PREDICTIVE ACCURACY OF CAPITATION RATE ADJUSTERS
PRIMARY CARE AND ENROLLMENT BASED PRACTICES

by

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The purpose of this research project was to identify and evaluate capitation rate adjusters that could be used to fund a family practice for the provision of primary care services for rostered adults. A cross-sectional research design that involved stratified sampling was used to explain variability in the amount of time that physicians spent providing medical services. A survey research method that involved stratified, random sampling was used to predict the incidence of a visit, the frequency of visits among participants who visited at least once, and the annual payments made by the provincial health insurance plan.

Participants were recruited from a large, academic, family practice in southwestern Toronto, Canada. Eleven physicians participated in both studies. Adults who participated in the Medical Minutes Study (n = 550; response rate: 80 percent) must have visited the practice on at least one prior occasion. Participants in the Visit/Payment Study (n = 659; response rate: 67 percent) must have met eligibility criteria to be considered rostered.

Linear and logistic regression were used to identify significant determinants of physician resource utilization. The R^2 value was used to evaluate predictive accuracy at the individual-level and thereby assess the potential for bias selection in enrollment-based markets. The

predictive ratio was used to evaluate accuracy at the group-level and thereby assess the potential financial impact of bias rosters.

Primary care capitation formulae should adjust for age and gender, but the use of this demographic information is insufficient as it provides financial incentives for bias selection. The sizes of financial benefits from bias selection of healthy individuals do not appear to be as detrimental as the costs associated with differential selection of unhealthy people. There are potential adjusters that improved the predictive accuracy of capitation rate formula including: (a) prior use of physician services, (b) self-rated health status, (c) hospital admission, or (d) the socioeconomic context of residence. Adjusting for prior use would substantially improve the predictive accuracy of a formula and thereby reduce the undesirable consequences of bias selection and bias rosters. The inclusion of any of the other potential adjusters - solely or in combination - would improve predictive accuracy but not to the same extent as the more parsimonious age-gender-prior visit formula.

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EXECUTIVE SUMMARY

Since the mid-1990s various professional associations, health policy organizations, interest groups and physicians in Canada have published position statements declaring their vision of primary care reform and the vast majority of these proposals endorsed the use of capitation financing. More recently, the Ontario Ministry of Health and the Ontario Medical Association have implemented a primary care reform pilot project that incorporates capitation. As many as 200 physicians and 450,000 people are expected to participate in this initiative. In fact, approximately 440,000 residents of the province already receive primary care from capitated Health Service Organizations. Capitation funding has been incorporated in primary care or integrated health system reform projects in Alberta, British Columbia, Nova Scotia, Ontario, Quebec and Saskatchewan.

Capitation refers to a method of payment whereby the amount of funds paid health care organizations is determined prospectively on the based of the characteristics of a defined or rostered population. Under this approach to payment, providers are obligated to render a specified range of services when and if they are deemed to be appropriate. Payment is made prospectively or retrospectively, and is dispersed on an annual or more frequent basis (e.g., per member per month). Capitation contracts between payers and health care organizations typically specify: the rate of payment, the scope of covered services, the term of the agreement, the criteria for enrolling and dis-enrolling individuals, what will occur when enrollees seek care from external providers, and the methods that will be used by payers to monitor utilization, quality of care, and/or satisfaction of rostered populations.

In the Canadian context, primary care capitation has been implemented on an enrollment basis where capitated and fee-for-service physicians and their organizations compete to roster and/or serve a selection of individuals from the community. As there is evidence to suggest that differential selection has occurred by providers and residents in enrollment-based markets, variability is likely to exist between providers in the case-mix of individuals for whom they serve. Therefore, an ideal capitation formula would adjust for these differences and account for bias rosters. This would contribute to policy efforts directed toward ensuring that financial resources are equitably distributed to Canadian residents on the basis of their need for intervention, demand for primary care and utilization of these services. The factors that would be appropriate to use as adjusters include the characteristics that reflect between-individual and/or between-roster differences in need, demand and/or utilization of covered services.

The purpose of this research project was to identify and evaluate capitation rate adjusters that could be used to fund a family practice for the provision of primary care services for rostered adults. The objective of this project was to evaluate the use of age, gender, other individual characteristics and community attributes as rate adjusters. Participants were recruited from a large, academic, family practice in southwestern Toronto. A cross-sectional research design that involved stratified sampling of patients was used to explain variability in the amount of time that physicians spent providing medical services for one encounter with a patient (i.e., Medical Minutes Study). A survey research method that involved stratified, random sampling of rostered adults and the use of administrative billing data was used to: (a) predict the incidence of a visit, (b) explain variability in the frequency of visits per annum among participants who visited at least once, and (c) explain variability in annual payments made to the practice by the Ontario Health Insurance Plan (OHIP) (i.e., Visit/Payment Study).

Eleven physicians participated in both studies as these practitioners held routine office hours and worked at the practice throughout the period of data collection. Patients who participated in the Medical Minutes Study (n = 550; response rate: 80 percent) must have visited the practice on at least one prior occasion. Patients who participated in the Visit/Payment Study (n = 659; response rate: 67 percent) must have met eligibility criteria to be considered rostered to the practice. Patient participants completed a social-demographic-health status questionnaire, and this information was linked with OHIP billing and 1996 Census data. As part of the Medical Minutes Study, physicians were required to record the amount of time they spent providing services for one encounter.

The most recent version of the Behavioural Model of Health Service Utilization was used to identify determinants of physician resource utilization. Linear and logistic regression were used to evaluate the relative contribution of potential rate adjusters to the explanatory and discriminatory power of the multivariable models. The R^2 value was used to evaluate the predictive accuracy of capitation formula at the individual-level and thereby assess the potential for bias selection. The predictive ratio was used to evaluate accuracy at the group-level and thereby assess the potential financial impact of bias rosters under conditions where the rate adjustment formula does not account for variability between individuals. By identifying and evaluating an array of potential adjusters, it was possible to estimate 'potentially explainable' variability in resource use and use this measure as a standard by which to compare different formulae. Payment schedules were constructed and compared to understand the distributive effects of different rate adjusters.

The formulae used to derive capitation rates paid to Health Service Organizations in Ontario and physician participants in primary care demonstration projects across Canada include age and gender adjusters.[1] The selection and utilization of this basic demographic information likely reflect the popularity, feasibility, face validity and lack of "game-ability" of these adjusters. The findings of this project suggest that the predictive accuracy of age and gender is low as these characteristics account for a small portion of variability in physician resource utilization between individuals and between bias rosters. These results are in accordance with evidence in the literature.

Although age and gender may provide an appropriate 'starting point' for an adjustment formula, the exclusive use of this type of demographic information is insufficient. The use of an age-gender formula will not account for different selection of enrollees or bias rosters. In fact, the findings of this project suggest that the amount of overpayment associated with relatively healthy rosters is greater than the amount of underpayment associated with relatively unhealthy rosters. Evidence derived from this project and the literature indicate that there are measures of individual attributes and community characteristics that improve the predictive accuracy of rate adjustment formula at the individual- and group-level, beyond the use of information on age and gender.

Need factors made the most significant improvement in the predictive accuracy of an age-gender formula, and the use of these measures to adjusting funding allocations is in accordance with policy objectives as defined in the *Canada Health Act*. The measure of need that made the largest contribution to the explanatory power of multivariable models and the discriminatory power of the logistic model was information on the frequency of prior visits. This variable was the strongest predictor of the incidence of a visit, the frequency of annual visits among participants who visited at least once, and total, annual OHIP payments. In fact, the age-gender-

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[1] The pilot study being conducted in British Columbia is the only primary care reform project using any other form of case-mix adjustment (i.e., Ambulatory Care Groupings).

prior visit formula accounted for 70 to 90 percent of variability in visits and payments (respectively) that could be explained by all independent variables. The predictive accuracy of a two-part (i.e., zero to five versus six or more visits) or four-part (i.e., zero to two, three to five, six to eight versus nine or more visits) prior utilization adjuster was comparable.

The use of information on prior utilization for rate adjustment is controversial for a number of important reasons. First, measures of prior use can be influenced by demand-side factors (e.g., inappropriate utilization by individuals) and supply-side factors (e.g., variability in availability, inappropriate supplier-induced demand) that may not reflect need. Therefore, some have argued that a utilization adjuster would result in funding allocations that are highly amenable to manipulation by opportunistic practitioners. Strategies that could be used to address this issue include the: (a) adoption of a utilization threshold (i.e., two-part adjuster) or numerous thresholds (e.g., four-part adjuster), and/or (b) use a blended payment system that combined capitation with a mechanism to monitor utilization (i.e., partial capitation). Second, some have argued that prior utilization adjusters over-compensate providers who care for individuals who have self-limiting conditions and under-compensate providers who care for people who have chronic diseases. One strategy that has been recommended to address this issue is to use retrospective adjusters - that is - the use of information from the year in which payment occurred rather than from the preceding year.

The second, third and fourth most powerful predictors of annual rates of physician resource utilization were self-rated health status, self-reported hospital admission, and the socioeconomic context of residence. The age-gender-health status formula was superior to the age-gender formula at the individual- and group-level, but the feasibility of collecting and maintaining self-rated health status data is low. Interestingly, the predictive accuracy of the age-gender-prior visit formula at the group-level was as good as or superior to the age-gender-health status formula. The age-gender-hospital admission and the age-gender-socioeconomic context of residence[2] formulae were superior (in terms of predictive accuracy) to the age-gender formula at the individual-level, and marginally superior at the group-level. Furthermore, the predictive

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[2] The use of information on the median income of all private households, unemployment rates <u>or</u> the incidence of low income in the community of residence significantly improved the predictive accuracy of the age and gender formula.

accuracy of the age-gender-prior visit-hospital admission formula at the group-level was similar to the more parsimonious age-gender-prior visit formula.

This project involved the evaluation of four measures of physician resource utilization and the findings support the theoretical proposition that the determinants of utilization depend somewhat on the indicator used to measure the use of these services. The determinants of whether or not a rostered participant visited a physician at the practice during one year included age, the frequency of primary care utilization in the preceding year and whether or not the individual lived alone. These results parallel those found by other researchers.

The determinants of the amount of time a physician spent providing medical services for one encounter included age, work status, the physician seen and the type of visit. The finding that the physician seen and the type of visit were the most powerful predictors of time spent concurs with the results of others. There was a strong, positive association between the amounts of time that physicians spent providing medical services and OHIP payments for the same encounter. This finding is in accordance with evidence derived elsewhere in Ontario and suggests that either physicians are able to use the current fee schedule to levy charges that reflect their perceptions of the value of their time or the fees on the OHIP Schedule account for time spent. These results do not enable a determination of whether the Schedule has been a driver of how physicians spend their time or whether the Schedule was designed to reflect how physicians spend or 'should be' spending their time

The determinants of visits per annum among participants who visited at least once included age, self-rated health status, the occurrence of a hospital admission, the frequency of utilization of physician services at the practice in the preceding year, and the incidence of low income. The finding that individual characteristics and community attributes were significant determinants of this measure of physician resource utilization is in accordance with the Behavioural Model and theories regarding the determinants of the health of populations. In addition, this evidence is in agreement with recent research documenting the contribution of socio-ecological context to an individual's utilization of health services.

The determinants of total, annual OHIP payments included the frequency of utilization of physician services at the practice and the occurrence of a hospital admission in the preceding year. Although other variables (e.g., self-rated health status) were identified as significant determinants after controlling for age, gender and provider-related factors, these characteristics did not remain significant in the full model. These findings are in accordance with evidence in the literature.

Only seven participants were identified as outlier cases in all multivariable models, and these individuals were extremely high users of physician services. These findings suggest that adults with multiple, psychiatric conditions or extremely high-use rates (e.g., more than 25 visits per annum) might be considered exempt from capitation funding, as well as high-volume, preventative interventions such as allergy shots. The identification of outlier cases should provide a point of departure for discussion between payers and providers regarding the types of individuals or services that should be excluded from coverage under a capitation contract.

Primary care has been identified as a key element in proposals to restructure health services, and capitation has been proposed as one funding alternative to stimulate primary care reform. Policy-makers in Canada have "stressed the need for research to identify additional adjusters beyond age and sex" (Hutchison et al., 1999, p. 8). The purpose of this research project was to identify and evaluate capitation rate adjusters that could be used to fund a family practice for the provision of primary care services for rostered adults. Predictive accuracy at the individual- and group-level was evaluated.

Although many of the findings of this project are in accordance with evidence in the literature, the external validity of the results to other physician organizations or patient populations in Toronto and Ontario remain unknown. Therefore, further research is warranted to evaluate the predictive accuracy of information on the frequency of prior visits, the use of inpatient resources, and the socioeconomic context of residence in other jurisdictions in Ontario. This type of investigation could be conducted using population-based administrative data.

Predictive accuracy is only one of the criteria by which capitation rate adjusters should be selected - consideration must also be given to policy objectives, face validity, feasibility, reliability, stability and 'game-ability'. The findings of this study, therefore, should stimulate and inform discussions regarding the utility of collecting and maintaining administrative and/or primary data to determine capitation rates for primary care services.

1.0.0. Introduction

Primary care has been identified as a key element in proposals to restructure health services, and capitation has been proposed as one funding alternative to stimulate primary care reform. There is evidence from across Canada that governments and providers have renewed interest in implementing and evaluating alternative methods of paying for medical and allied health services. Since the early 1990s various professional associations, health policy organizations, interest groups and physicians have published position statements declaring their vision of primary care reform and the vast majority of these proposals endorse the use of capitation financing. Full capitation or a blended funding mechanism that includes capitation has been endorsed in:

1. Reports commissioned by the Deputy Ministers of Health in Canada (Birch, Goldsmith & Makela, 1994; Stoddart & Barer, 1992).
2. A paper commissioned by the National Forum on Health (Marriott & Mable, 1999).
3. A position paper by the Federal/Provincial/Territorial Advisory Committee on Health Services (1995).
4. Reports funded by the Canadian Health Services Research Foundation and the Ontario Health Services Restructuring Commission (Hurley et al., 1999; Hutchison et al., 1999).
5. Position papers published by the five Chairs of Ontario's medical education programs (i.e., Forster et al., 1994), the Association of Ontario Health Centres (1995), the Provincial Co-ordinating Committee on Community and Academic Health Science Centre Relations (1996), the Ontario Medical Association (Graham, 1997) and the Ontario College of Family Physicians (1999a; 1999b).

The interest in implementing and evaluating alternative methods of paying for primary care physician services has its' roots in the political, economic, social and historical context of medical care. The *Canada Health Act* affirms the federal government's commitment to providing residents with access to publically administered health plans and the provincial government's role in remunerating physicians for medically necessary services. Over the last two decades, each provincial government has implemented administrative mechanisms to control the amount of money spent on physician services while respecting policy objectives directed toward health outcomes.

Provincial governments have sought budgetary control over expenditures on physician services by: (a) placing 'hard caps' on total expenditures, (b) managing growth in utilization by using 'soft caps', (c) limiting or reducing the prices listed on fee schedules, (d) enforcing income thresholds, (e) restraining growth in physician supply, (f) de-listing services that are not deemed to be 'medically necessary', and (g) introducing alternative forms of remuneration. When fiscal restraint has threatened the incomes of practitioners, physicians in the province have become more interested in changing the fee schedule, extra-billing, de-listing services, increasing service volume, unbundling services, enhancing the intensity of care provided/billed per patient, restricting physician supply, and/or alternative payment approaches. Section 2.3.0. provides more insight into the historic perspective of physician payment in Canada and Ontario.

More recently, capitation funding has been incorporated in primary care or integrated health system reform projects in Alberta, British Columbia, Nova Scotia, Ontario, Quebec and Saskatchewan. The Ontario Ministry of Health and the Ontario Medical Association have implemented a primary care reform pilot project that incorporates capitation. As many as 200 physicians and 450,000 people are expected to participate in this initiative. In fact, approximately 440,000 residents of the province already receive primary care from capitated Health Service Organizations. Section 2.4.0. describes these current developments.

Capitation refers to a method of payment whereby the amount of funds paid health care organizations is determined prospectively on the based of the characteristics of a defined or rostered population. Under this approach to payment, providers are obligated to render a specified range of services when and if they are deemed to be appropriate. Payment is made prospectively or retrospectively, and is dispersed on an annual or more frequent basis (e.g., per member per month). Capitation contracts between payers and health care organizations typically specify: the rate of payment, the scope of covered services, the term of the agreement, the criteria for enrolling and dis-enrolling individuals, what will occur when enrollees seek care from external providers, and the methods that will be used by payers to monitor utilization, quality of care, and/or satisfaction of rostered populations. Section 2.0.0. provides an overview of frameworks that have been used to conceptualize the types of financing mechanisms and describes incentives generated by different payment mechanisms from a theoretical perspective.

Evidence derived from randomized and/or quasi-experimental, controlled trials suggests that capitated and FFS providers differ in some respects and not in others. For example, capitated health organizations tend to use less in-patient resources in comparison to FFS providers - as measured by rates of discretionary admission, lengths of stay, and hospital days per enrollee. There does not appear to be consistent evidence that enrollees have higher or lower utilization of physicians than individuals served by FFS providers. Unfortunately, there have not been any studies evaluating the appropriateness of ambulatory visit rates to capitated and FFS providers. Research suggests that enrollees in prepaid plans receive comparable service quality and health outcomes. Lastly, there is no consistent evidence that prepaid arrangements reduce the cost of care. Section 2.2.0. reviews evidence from the literature regarding the impact of capitation and FFS on health service utilization, expenditures, quality of care, health outcomes and satisfaction of consumers.

There are two approaches to rostering that have been used in Canada. The population rostered to each capitated provider may include all of the people who reside in a specific, geographic location (i.e., geographic-based capitation or population-based funding). In this context, a health care organization assumes the responsibility for providing specific health services to all residents in a defined region and does not compete for enrollees. For example, Alberta and Saskatchewan now use a population-based funding formula to derive payments made to health regions for the provision of inpatient, ambulatory (e.g., day procedures, clinics and emergency care), long-term, and community-based care (Alberta Health, 1996; Saskatchewan Health, 1994). Although physician services are not yet included in the Alberta and Saskatchewan funding formula, Manitoba and a health region in Ontario have investigated the possibility of including physician services in a population-based funding formula to allocate financial resources to health regions (Eyles et al., 1991; Frohlich & Carriere, 1997; Mustard & Derksen, 1997).

Alternatively, the population rostered to each capitated provider may represent a sample of individuals from the community (i.e., enrollment-based capitation). In this context, health care organizations compete for enrollees. In the Canadian context, primary care capitation has been implemented on an enrollment basis where capitated and fee-for-service (FFS) physicians compete to roster and/or serve a selection of individuals from their community. As there is evidence to suggest that differential selection has occurred by providers and residents in enrollment-based markets, variability is likely to exist between providers in the case-mix of individuals for whom they serve.

An ideal capitation formula would adjust for differences between-individual and/or between-rosters. This will contribute to policy efforts directed toward ensuring that financial resources are equitably distributed to Canadian residents on the basis of their need for intervention, demand for primary care and utilization of these services. Section 2.1.0. outlines the rationale for adjusting payments to account for differences in need, demand and utilization and highlights important issues in the selection and weighting of capitation rate adjusters.

The purpose of this research project was to identify and evaluate capitation rate adjusters that could be used to fund a family practice for the provision of primary care services for rostered adults. The objective of this project was to evaluate the use of age, gender, other individual characteristics and community attributes as rate adjusters. The most recent version of the Behavioural Model of Health Service Utilization was used to identify determinants of physician resource utilization. Section 1.1.0. provides an overview of the Behavioural Model to highlight the contribution of this theoretical framework to research regarding the determinants of physician resource utilization, and Section 3.2.0. describes how the Behavioural Model was used to identify potential adjusters for inclusion in a capitation rate formula for primary care.

1.1.0. Theoretical Background: Physician Resource Utilization

While there are many theoretical models of health service utilization, the seminal work of Lu Ann Aday, Ronald Andersen and John Newman has provided the basis for much of the literature on the use of physician services over the last two decades (e.g., Anderson & Aday, 1978; Arling, 1985; McIsaac, Goel & Naylor, 1997; Mustard, Kozyrskyj, Barer & Sheps, 1998; and Wolinsky, 1978). Their Behavioural Model of Health Service Utilization (hereinafter referred to as the Behavioural Model) has undergone development and refinement since the 1960s, and the latest version provided the theoretical framework upon which this project was designed. This chapter provides an overview of the Behavioural Model to highlight the contribution of this theoretical framework to research regarding the determinants of physician resource utilization. Section 3.2.0. describes how the Behavioural Model was used to identify potential adjusters for inclusion in a capitation rate formula for primary care.

1.1.1. Behavioral Model of Health Service Utilization

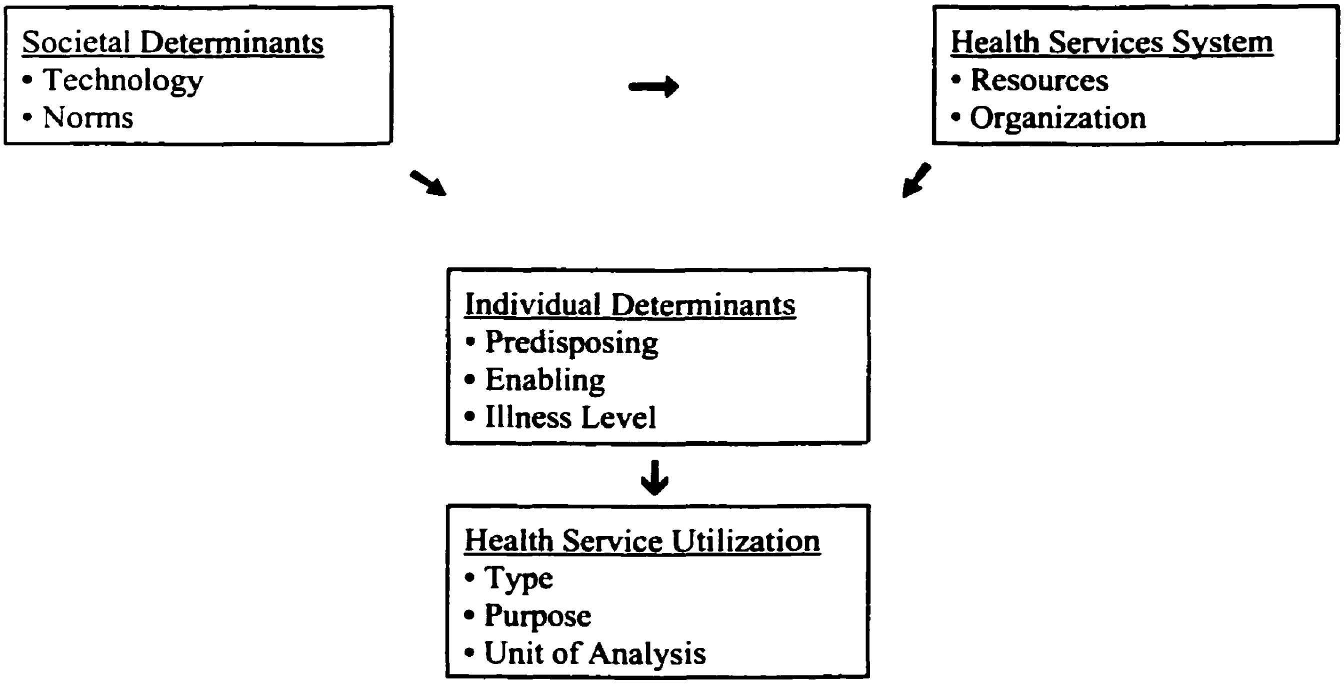
1.1.1.a. Historic Development of the Behavioural Model

In 1968, Ronald Andersen proposed a theoretical model of health service utilization in which individual-level determinants were conceptualized as having three types - predisposing factors, enabling resources and need characteristics. By 1970, Ronald Andersen, Bjorn Smedby and Odin Anderson expanded this framework to address contextual and systemic determinants of utilization. By 1973, what has become known as the Behavioural Model was introduced to peer-reviewed literature as a "framework for reviewing health service utilization which takes into account both societal and individual determinants" (Andersen & Newman, 1973, p. 96).

In 1973, Andersen and Newman suggested that health service utilization was a function of societal, systemic and individual determinants. Figure 1 illustrates this early conceptualization of the Behavioural Model. Societal determinants were seen as affecting individual determinants both indirectly through the health system and directly. The important societal characteristics identified by the theorists in 1973 included technology and norms. Technology referred to the 'principles and techniques' used to bring about change in health service use, while norms referred to the modes by which social systems induced behaviour or compliance.

Figure 1

A Framework for Viewing Health Services Utilization (1973)



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Health services system determinants were recognized as having an influence on utilization via the availability of resources and the organization of health care. Health service resources included such attributes as the total volume of labour and capital, and the geographical distribution of these assets. Organizational determinants included such characteristics as the manner in which personnel and facilities were coordinated and controlled in the process of providing health services. Andersen (1995) indicated that the health care system was explicitly included in the model in the 1970s to recognize the important contribution of health policy to a population's use of services. While policy was seen as having an influence on health service use, the impact or importance of provider payment was not explicitly identified as a determinant. The impact of personal income level and health insurance, however, was identified as an individual-level enabling resource that influenced a person's use of services.

Individual determinants included predisposing, enabling and illness-level characteristics. Predisposing characteristics included demographic (e.g., age, sex, marital status), social structure (e.g., education, race, occupation), and personal beliefs (e.g., values, attitudes and knowledge). Enabling determinants included familial attributes (e.g., income, insurance) and community characteristics (e.g., supply of providers, price of services, and region of country). Lastly, illness-level determinants included both perceived (e.g., disability, symptoms) and evaluated characteristics (i.e., diagnoses).

It was during this period in the development of the Behavioural Model that theorists recognized that the determinants of health services utilization may vary depending on the type of service (e.g., hospital, nursing home, physician, medication, etc.), the purpose of the service (i.e., primary, secondary, tertiary and custodial), and the unit of analysis (e.g., contact, volume or episode of care) (Andersen & Newman, 1973).

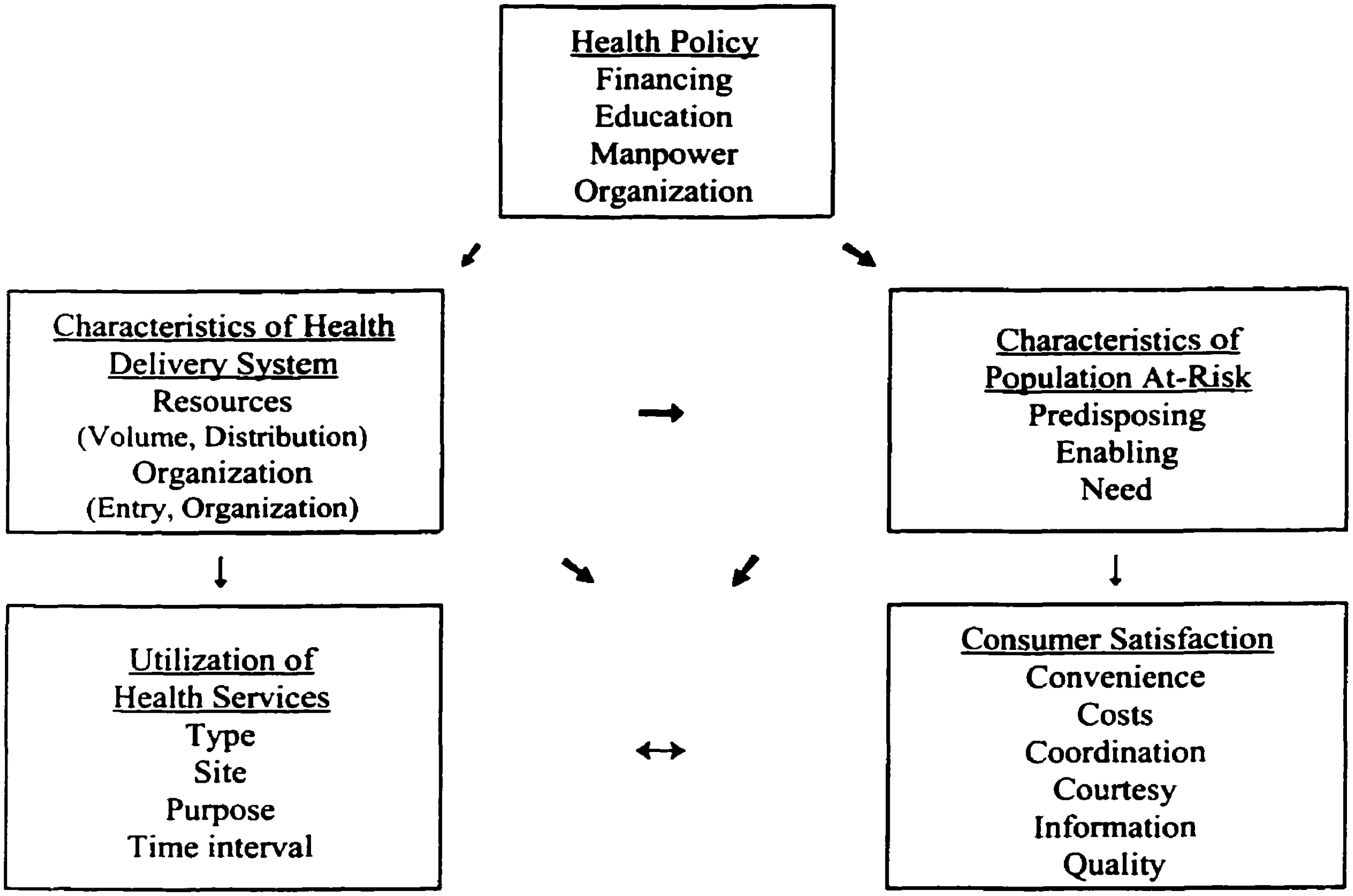
The essence of this early conceptualization of the Behavioural Model, in terms of individual, societal and systemic determinants of health service utilization, remains unchanged. The categorization of individual-level components into predisposing, enabling and need characteristics remain, but the specification and classification of societal and contextual influences have undergone considerable modification.

By 1974, Aday and Andersen revised the Behavioural Model and proposed a "framework for the study of access" (Aday & Andersen, 1974, p. 208). Access was conceptualized as entry into and flow through the health services system, and utilization was identified as one measure that could be used to gauge access. It was at this time in the refinement of the Behavioural Model that Aday and Andersen hypothesized that the determinants of access (i.e., use versus no use) may differ from the determinants of use among those who access care. In addition, these theorists proposed that any study of access proceed from health policy objectives to an understanding of the characteristics of the health care system, the population at-risk, the utilization of services, and consumer satisfaction with these services.

In 1974 health service utilization was seen as a function of health policy, characteristics of the delivery system and attributes of the population, and these determinants were conceptualized as interacting in ways that ultimately influence utilization. Figure 2 provides a summary of this framework - termed the "Expanded Behavioural Model".

Figure 2

A Framework for Access: The Expanded Behavioural Model (1974)



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The dimensions of health policy that were seen to impact access to care and use of these services included the financing, education, manpower and organization of programs. Aday and Andersen (1974) proposed that health policy may be seen as having a direct impact on service utilization and the satisfaction of consumers by influencing the characteristics of the delivery system. Funding policy was explicitly identified as a determinant of health service utilization. In addition, policy was seen as potentially having an indirect impact on health service utilization by affecting characteristics of the population at-risk. For example, it was hypothesized that policy could influence the beliefs, attitudes, knowledge and income of populations.

The characteristics of the health delivery system that were identified as important to understanding access and utilization included the availability of resources (e.g., volume and distribution of labor, capital and equipment) and the organization of care. Organizational determinants included such features as the manner in which personnel and resources were coordinated to influence entry to services and the process of receiving care once services were accessed.

The characteristics of populations that were identified as having a significant influence on entry and subsequent use of health services continued to be classified according to predisposing factors, enabling resources and need characteristics. Predisposing factors included those that influenced the propensity of individuals to use services - demographic characteristics, social structures, beliefs, values, attitudes and knowledge of health information. Enabling resources included those attributes that impacted the means and/or resources that individuals have available to them for the use of services (e.g., income, insurance coverage), as well as characteristics of the community or region in which these people reside (e.g., geographic proximity to services, local attitudes toward care). Need variables included perceived and evaluated symptoms or levels of illness. Predisposing, enabling and need characteristics were seen as either mutable by health policy or immutable (Aday, 1993).

During the mid-1980s to the early-1990s, the Behavioural Model was again revised in recognition of the proposition that health service utilization was supposed to contribute to maintaining and improving the health of the population (Anderson, 1995). In addition, the influence of political, physical and socioeconomic context on utilization was more thoroughly specified and the importance of these determinants began to be evaluated empirically. Lastly, the personal health practices of individuals such as diet, exercise and self care were identified as health behaviours that interacted with service utilization to influence health outcomes.[1]

In 1995 Andersen reviewed the development of the Behavioural Model and proposed a revised framework that incorporated research evidence and feedback from other scholars. Once again - utilization of health services was seen as a function of a person's predisposition to use services, factors which enabled or impeded use, and the need for care. Predisposing

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[1] Interestingly, Andersen (1995) cited two Canadian reports to provide evidence of this last linkage in the model - the Lalonde Report (1995) and Evans' and Stoddart's (1990) conceptual model "Producing Health, Consuming Health Care".

characteristics continued to include demographic factors[2], social structure and health beliefs. Social structure was seen to include individual characteristics (e.g., status in a community, ability to cope or deal with problems) and environmental influences (e.g., how the physical, social and cultural context may or may not promote health).

During this period in the refinement of the Behavioural Model, enabling resources began to include individual characteristics and contextual determinants. For example, the availability of health personnel and facilities to individuals at-risk and the organizational features of medical care (e.g., a regular source of care) were identified as contextual influences that enabled service utilization. In addition, the extent and quality of social relationships were identified as an enabling resource that could facilitate or impede the use of health services.[3]

The notable changes to the Behavioural Model in 1995 included an explicit recognition of the influence of environmental and community context on health service utilization. Also, it was during this time that feed-forward and feed-back loops were included in the model to emphasize the "dynamic and recursive" nature of the determinants and "the multiple influences on health service use and, subsequently, on health status" (Andersen, 1995, p. 7).

1.1.1.b. Current Version of the Behavioral Model

In 1998 Phillips, Morrison, Andersen and Aday reviewed the literature to determine how researchers had incorporated contextual determinants into studies on health service utilization, and to understand the relative contribution of patient, provider and the community on health service utilization. The Behavioural Model was revised to recognize the importance of the political and socioeconomic context in which populations live. Figure 3 provides a summary of this most recent conceptualization of health service utilization.

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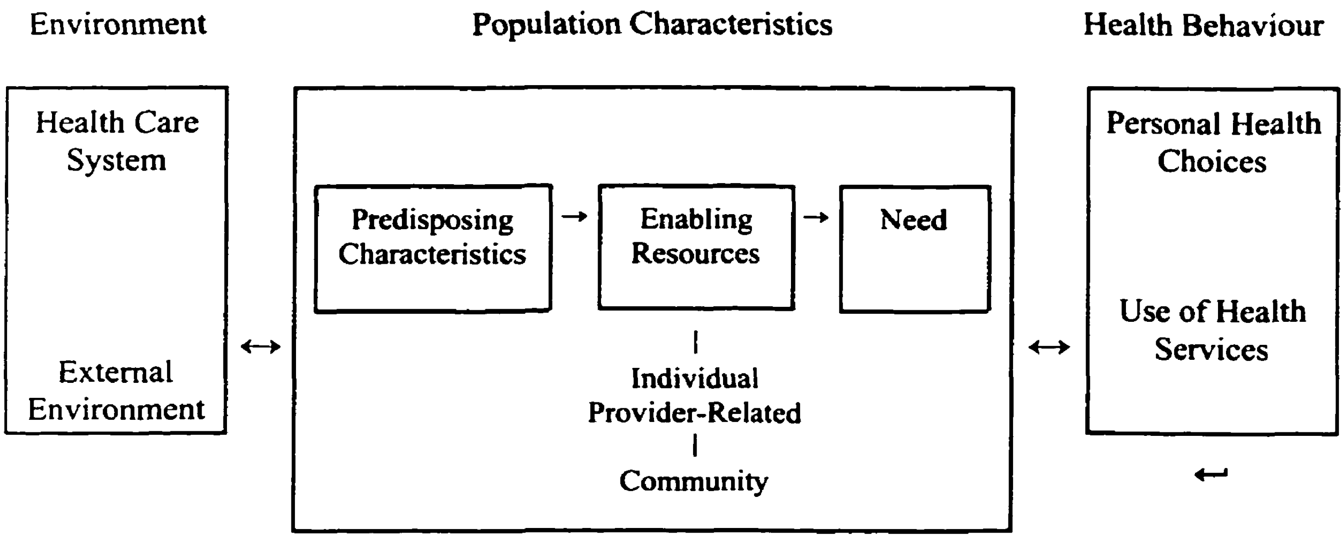
[2] Andersen (1995) discussed the possible inclusion of genetic factors and psychological features (e.g., mental status) characteristics as predisposing characteristics.

[3] Andersen (1995) did not describe how this differed from predisposing social structures.

Figure 3

The Behavioural Model of Utilization



Reproduced from K.A. Phillips, K.R. Morrison, R. Anderson & L.A. Aday, "Understanding the context of healthcare utilization: Assessing environmental and provider-related variables in the Behavioural Model of Utilization" *Health Services Research Journal, 1998*, pg. 575. Reprinted with permission of the Health Research and Educational Trust, copyright 1980, 1998.

The most notable changes to the Behavioural Model included the conceptualization and specification of the following contextual influences:

A. Health system characteristics were seen as including the "policies, resources, organization, and financial arrangements influencing accessibility, availability, and acceptability of medical care services" (Phillips et al., 1998, p. 574).

B. External environmental factors were seen as including the "economic climate, relative wealth, politics, level of stress and violence, and prevailing norms of society" (p. 576).

C. Community-level enabling variables included "attributes of the community where the individual lives that enable the individual to obtain services" (p. 576). "Community-level enabling variables could be the same as [health] delivery system characteristics or external environmental variables with the distinction being that the level of measurement is the community" (p. 592). "These variables are often measured at the aggregate level ... However, they can also be measured at the individual-level when they identify the context in which the individual 'lodges'" (p. 576). "The variables *measured* at the aggregate level may be *analyzed* at either the individual or aggregate level, or both" (p. 592, italics in the original source).

D. Provider-related variables were included to recognize the context in which utilization occurred to reflect: (a) patient factors that may be influenced by providers (e.g., convenience), and (b) provider characteristics that interact with patient characteristics to influence utilization (e.g., gender or specialty of physician). "We defined provider-related variables as those measured at the individual-level in order to be able to categorize variables in our analysis as either environmental or provider-related" (p. 592).

This version of the Behavioural Model provided the theoretical foundation upon which this research project was designed. As the theorists who developed the Behavioural Model proposed that research on utilization proceed from health policy objectives to an understanding of the characteristics of the health system, Section Two of this dissertation provides a descriptive overview of the environmental context of this research project. Section 2.0.0. previews different frameworks that have been used to conceptualize approaches to funding providers and their organizations for the provision of health services, and Section 2.1.0. highlights important issues in the development of capitation formulae. Section 2.2.0. summarizes evidence derived from the literature regarding the impact of fee-for-service and capitation funding on health service utilization, aggregate expenditures, quality of care, health status and satisfaction of consumers. Sections 2.3.0. and 2.4.0. provide an overview of health policy objectives in Ontario, describe payment of primary care physicians in Ontario and Canada, and outline payment reform initiatives in Ontario and nationally. Lastly, Section 3.2.0. describes how the Behavioural Model was used to identify potential rate adjusters for inclusion in a capitation rate formula for primary care.

Section 2.0.0. Financing Physician Services

2.0.1. Conceptual Frameworks

There are a number of different approaches to funding physician services, therefore this section provides an overview of frameworks that have been used to conceptualize the types of financing mechanisms. As approaches to funding differ in the 'signals' they send to providers, and insofar as these incentives influence behaviour, financing schemes may impact the delivery of health services. Subsequent sections will describe incentives generated by different payment mechanisms from a theoretical (Section 2.0.2.) and evidence-based perspective (Section 2.2.0.).

Five different conceptual frameworks are presented here. The first framework was proposed by scholars from the World Health Organization (Barnum, Kutzin & Saxenian, 1995) to: (a) review methods of payment used throughout the world, and (b) explain alternatives that might be considered by countries reforming their health funding policies. The remaining four frameworks have been developed by researchers and policy analysts in Ontario. The conceptual model prepared by Birch, Goldsmith and Makela (1994) was developed for a report submitted to Deputy Ministers of Health. The purpose of this work was to "identify and analyse policy options for changing physician payment and delivery systems in the current Canadian health care environment, paying particular attention to approaches to physician remuneration other than FFS" (p. 7). The next framework described in this section was prepared by another group of researchers who reviewed "policies to control medical care spending in Canada's provinces and territories" (Barer, Lomas & Sanmartin, 1996). This model focuses primarily on the policy levers available to single payers in a FFS market. The final two frameworks were proposed by researchers and policy analysts at the University of Toronto. The first was used in a report prepared for the Ontario Medical Association's Subcommittee on Health-Care Financing (Coyte, 1995), while the second was used in a report prepared for the Ontario Ministry of Health (Hollander & Deber, 1997).

Barnum et al. (1995) proposed a conceptual model of provider payment to review the different payment schemes used throughout the world, and to explain alternatives that might be considered by countries undergoing health finance reform. These scholars indicated that there are basically two approaches to provider payment: (1) prospective payment where finances are transferred or committed to providers before services are rendered, and (2) retrospective reimbursement where payments are made based on the quantity and type of service rendered.

Budgets, capitation and salary are examples of prospective payment, while FFS and case-based payment are examples of retrospective reimbursement.

Birch et al. (1994) proposed a conceptual model, as illustrated in Figure 4, that assumes the perspective of the payer and focussed on the determinants of total physician expenditures. From this viewpoint, physicians or their organizations could be remunerated on the basis of through-put (e.g., services rendered) or input (e.g., physician time). In addition, a third option was to base payment on the profiles of clients seen (i.e., population-based). FFS reimbursement was identified as an example of payment based on through-put. In this context, total expenditures were seen as a function of the fee charged per service, the number of physicians with billing privileges, and the services provided per physician. Salary was cited as an example of an input-based remuneration scheme; total expenditures under this payment mechanism were seen as a function of the salaries of physicians and the number of practitioners. Capitation was identified as an example of a population-based scheme; total expenditures under this approach to financing were seen as a function of the number of residents and the capitation rate per resident.

Barer et al. (1996) proposed a conceptual framework to aide payers in understanding and evaluating the impact of different payment approaches on the cost of physician services. Figure 5 illustrates this framework. Expenditures per capita are conceptualized as a function of three sets of variables: (1) average income per physician multiplied by the number of physicians per capita, (2) average services per physician multiplied by the average price payed per service multiplied by physicians per capita, or (3) services per capita multiplied by the average price per service.

Figure 4

Determinants of Physician Expenditures/Incomes Under Alternative Payment Methods

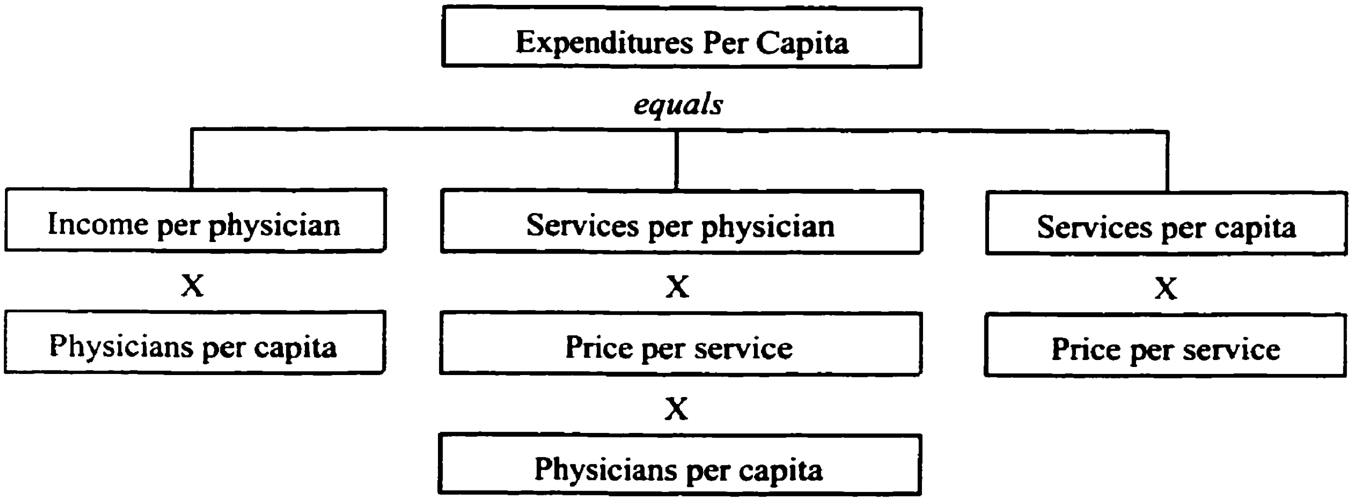
Payment Method	**Expenditures Determined By:**				
Throughput-Based	Fee per service	X	Services per physician	X	Number of physicians
Input-Based	Salary per physician	X	Number of physicians		
Population-Based	Capitation fee per resident/client	X	Number of residents/clients		

Note. X = 'multiplied by'. Reprinted from S. Birch, L. Goldsmith & M. Makela, 1994. "Paying the piper and calling the tune: Principles and prospects for reforming physician payment methods in Canada" McMaster University Centre for Health Economics and Policy Analysis Working Paper Series 94-16. Reproduced with permission.

For example, in the first instance expenditures per capita would be a function of the average salary of physicians and the number of these practitioners per person in the population. This is similar conceptually to Birch et al.'s (1994) in-put approach to financing. In the second scenario, Barer et al. (1996) considered expenditures per capita to be a product of the average volume of services per physician, the average price of each service rendered, and the number of physicians per capita. This is similar to the throughput-based or FFS approach described by Birch et al.(1994). In the third scenario, expenditures per capita are considered to be a function of the services per capita and the average price per service.

Figure 5

Determinants of Per Capita Expenditures on Physician Services and Cost Control Options



Note. X = 'multiplied by'. Reprinted from M.L. Barer, J. Lomas & C. Sanmartin. "Re-minding our Ps and Qs: Medical costs controls in Canada" Health Affairs, p. 216-234. Published by *Health Affairs*. Copyright 1996. 'The People-to-People Health Foundation, Inc., Project HOPE'. http://www.projhope.org/ha Reprinted with permission.

Coyte (1995) proposed a conceptual framework that considered the perspectives of providers and consumers. Figure 6 illustrates this framework. From the physician's viewpoint, payment could be seen as being tied to inputs, processes or outcomes. From the consumer or client's perspective, payments could be seen as being responsive to their choices or invariant to these decisions. Coyte proposed that payment schemes that were responsive to the choices of consumers resulted in services that satisfied the perceived needs of patients. Therefore, "money-follows-the-client". Payment schemes that are invariant to the decisions of consumers would result in patterns of practice that do not meet the perceived needs of these individuals. Under these payment mechanisms, "clients-follow-the-money" (Coyte, 1995, p. 25).

According to Coyte's framework, capitation represents a method of payment where physicians are compensated based on the clientele serviced (i.e., input-based). The number and type of clientele served, however, was seen as a function of the choices that consumers made regarding from whom they would like to receive care. By comparison, traditional FFS financing was seen as an example of a process-based approach where payments would be made to the practitioners who consumers chose to render care. The use of salaries, from the physician perspective, is an input-based approach where the primary resource being compensated is time. This type of payment was seen as not responsive to the choices made by consumers. For example, when individuals chose not to be seen by particular physicians for services, these practitioners would continue to be paid. Two alternative approaches to payment included outcome-based remuneration schemes such as client-specific and practice-specific performance payments. In these situations, financing could be tied to 'intermediate' (e.g., ease the adverse consequences of an illness) or 'final' outcomes (e.g., health status or satisfaction) attained by specific individual. Alternatively, physicians could be compensated for attaining a target level of preventative activities (e.g., bonuses for achieving target immunization rates). In this context, financing would be tied to outcomes.

Figure 6

Classification of Physician Reimbursement Schemes

		Physician's Perspective		
		Input-based	Process-based	Outcome-based
Client's Perspective	Physician's payment responsive to client choice	Capitation	Fee-for-service	Client-specific performance payment
	Physician's payment invariant to client choice	Salaries or sessional fees	-	Practice-specific performance payment

Note. Reprinted from Coyte (1995). The article "Review of physician payment and service delivery mechanisms" first appeared in the April 1995 issue of the Ontario Medical Review and is reproduced with the permission of the Ontario Medical Association.

Hollander and Deber (1997) proposed a conceptual framework that considered the perspectives of individual practitioners, provider organizations, and payers. Figure 7 illustrates this framework. From these viewpoints provider payment could be based on costs, time spent, services delivered, the population served or outcomes. For example, cost-plus reimbursement or line-by-line budgets were seen as payment based on costs. Salary, sessional or per diem disbursements were seen as payments based on time spent, and FFS and case-based funding were categorized as payments based on services delivered. Capitation and the allocation of budgets to specific health regions or catchment areas were classified as payment based on the characteristics of populations serviced. Lastly, performance contracting was seen as payment based on outcomes.

Figure 7

Classification of Resource Allocation Models

Scope	Basis of Payment				
	Cost	**Time Spent**	**Services Delivered**	**Population Service**	**Outcomes**
Individual	• Cost plus	• Salary • Sessional • Per hour	• Fee-for-service → per task → per visit		
Organization	• Line-by-line • Average cost models	• Per diem • Per hour	• Fee-for-service • DRG/CMG • Other rate based models	• Capitation • Budget per catchment area	• Performance contracting

Note. DRG: Diagnostic related group. CMG: Case mix group. Reprinted from M.J. Hollander & R. Deber, 1997. "A typology of models of resource allocation" In M.J. Hollander, R. Deber & P. Jacobs (Eds.), A critical review and analysis of health care related models of resource allocation and reimbursement in an Ontario context (pp. 25-28). Victoria, British Columbia. Reproduced with permission.

In summary, there are a number of conceptual models that can be used to understand the determinants of expenditures on medical services and alternative methods of remunerating physicians. While these frameworks vary in how they classify provider payment mechanisms, many of the approaches to financing represented in each model are the same.

2.0.2. Methods of Payment, Incentives and Practice Patterns

As approaches to financing differ in the signals they send to providers, this section describes different methods of payment, the incentives that may be generated by different approaches to physician remuneration, and how these inducements might directly or indirectly influence the behaviour of doctors. This discussion builds on the conceptual frameworks described previously and assumes a theoretical or hypothesized perspective on the impact of different approaches. Evidence regarding the impact of FFS and capitation is provided in Section 2.2.0. Five different methods of payment are reviewed as these approaches are currently used in various provinces in Canada. These methods include budgets, case-based funding, FFS, salary and capitation. The relevance and applicability of these incentives in the Ontario and Canadian context are highlighted, but a more detailed discussion is provided in Section 2.3.0. and 2.4.0.

Although each method of payment is compatible with any level of expenditure that society deems appropriate to spend on physician services, the methods used to distribute these funds can send explicit and implicit messages to physicians about how the use of their time and skill will be financially rewarded (Birch, Goldsmith & Makela, 1994). While funding policies establish the method by which physicians will be remunerated, they also communicate who will be paid and what behaviour will be rewarded. While there are different methods of payment, the regulations that accompany a payment policy also send messages and may influence the behavioural responses of practitioners (Giacomini et al., 1996). For example, when providers are remunerated on the basis of capitation the terms of the contract, such as the ability of providers to de-roster enrollees or the time period of enrollment, might also influence incentives and behaviour. In addition, the size and timing of payments, the type of rate adjusters used to determine the payment per enrollee, and the level of the penalty imposed when enrollees obtain care from 'out of plan' or 'alternative' providers influence behaviour.

The ways in which messages are interpreted by physicians are not straightforward. Providers are not simply 'black boxes' whose responses to fiscal stimuli can be predicted. Indeed, the social and institutional environments in which provider organizations operate also affect how they interpret and respond to funding (Giacomini et al., 1996). Physicians are both social and economic beings and their practice behaviour is a function of financial and non-financial incentives (Gabel & Redisch, 1979). Financial gain is only one of the many sources of human motivation for action.

The practice behaviours of physicians, however, have been conceptualized from two perspectives or points on a continuum - the physician as a self-interested practitioner and/or as an agent who acts on behalf of the patient. Factors that influence the behaviour of self-interested practitioners primarily include a desire for income and a preferred practice and life style. This type of individual may also be influenced by personal characteristics (e.g. age, experience) as well as the practice context (e.g. peer pressure, organizational setting, professional standards etc.) The factors that influence the behaviour of the physician-as-agent include the patient's clinical and personal characteristics, economic well-being, and demand for services (Eisenberg, 1985). It is hypothesized that these physicians are less responsive to the financial incentives of payment mechanisms than the self-interested practitioner.

Although the behaviour of physicians may be influenced by a number of things, this section focuses on how financial incentives, all other things equal, influence the practice patterns of physicians. It is acknowledged that other non-financial mechanisms such as physician specialty and organizational structure, can have an independent and interaction effect on behaviour (Greenfield et al.,1992). The focus here will also be on 'how' physicians are funded rather than 'how much' is spent, as both factors may affect behaviour. Lastly, the degree to which physician payment methods create financial incentives is also dependent on the opportunity for these practitioners to seek alternative sources of income from other payers. Therefore, this discussion focuses on the incentives and behaviours of practitioners who practice in environments with only one source of payment.

2.0.2.a. Budgets

Budgets are the most common form of provider payment used in countries throughout the world (Barnum et al., 1995). This approach to prospective payment is commonplace in Canada, particularly in the areas of in-patient and ambulatory care that is provided in hospitals. This approach is probably popular because budgets enable governments to limit aggregate expenditures.

Although budgets are easy to understand and relatively inexpensive to implement, relative to other forms of provider payment, they are not flexible or adaptable to change and do not foster equitable and cost-effective delivery (Eliasoph, 1993). Budgets do not inherently contain financial incentives for providers to render appropriate[1] services or to supply high quality care. The size of the budgets allocated toward providers or regional health authorities is determined administratively, and may or may not be tied to provider performance, market characteristics, the

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[1] In the context of this paper the term 'appropriate' refers to services or procedures that are expected to produce health benefits that exceed the expected negative consequences by a sufficiently wide margin such that the activity is worth doing (Lavis & Anderson, 1996).

characteristics of the population being served, or fluctuations in demand. In general, providers who receive budgets have the incentive to maximize the size of the allocation. This approach to financing may even result in undesirable behaviours such as spending funds without regard to necessity or efficiency in order to maximize future allocations.

There are a number of different mechanisms that have been used to determine the size of funds allocated to different recipients. The incentives associated with each approach are dependent on the implicit or explicit formula used to calculate and adjust these allocations. Budgets that are adjusted based on prior utilization tend: (a) to perpetuate historic patterns of efficiency and/or inefficiency, (b) to reinforce the current distribution of providers and health organizations, and (c) not to respond to variability in the supply or demand for resources. To the degree that historic budgets generated equities or inequities in access and/or utilization, these too are perpetuated (Department of Health and Social Security, 1976; Pink & Bolley, 1994).

An alternative approach is to case-mix adjust global budgets to account for the volume and mix of services rendered and thereby provide more rational and equitable funding among hospitals. "The principle underlying equitable funding is that hospitals providing comparable acute inpatient services have similar resource needs and are, therefore, entitled to equitable funding" (Pink & Bolley, 1994, p. 1257). This approach has been used to allocate budgets to hospitals for the provision of inpatient care (e.g., Ontario and Alberta), day surgery (e.g., Ontario), and hospital-based ambulatory services (e.g., Alberta) (Eliasoph, 1993; Joint Policy and Planning Committee [JPPC], 1998; Pink & Bolley, 1994). It has been recommended that the Ontario Ministry of Health use the National Ambulatory Care Reporting System to case-mix adjust funding for ambulatory care rendered in Ontario hospitals by 2001 (JPPC, 1998).

Once the size of a budget is ascertained, it is disbursed to provider organizations on a line-item or global basis. Line-item budgets are commonly used when funds are distributed by governments in highly centralized economies (Barnum et al., 1995). Laws, rules and regulations limit managers from switching funds across line items, and the intention of this approach is to control spending and to "limit the consequences of weak local management" (Barnum et al, 1995, p. 26). Global budgets, by comparison, distribute funds on a periodic basis and health administrators are free to allocate this money as they deem appropriate. The purposes of global allocations are to: (a) enable payers to prospectively determine and control expenditures, (b) decentralize decision-making, (c) increase flexibility in resource allocation, and (d) hold financial managers accountable for performance (Barnum et al., 1995).

2.0.2.b. Case-Based Funding

Case-based funding is another form of prospective financing where the amount of funds paid to providers is pre-determined and is intended to cover all of the services per admission, case or episode of illness. Actual dispursement of funds may occur prospectively or retrospectively. The objective of this approach is to fix the amount of revenue that providers receive per case and thereby give these practitioners the incentive to reduce their costs by rendering care more efficiently (Barnum et al., 1995).

This form of payment requires that cases be grouped into distinct categories that are reasonably homogeneous with respect to resource use, as payment is based on a fixed amount per category. As patients within a case-mix group are not identical and therefore vary in their resource requirements, it is in the financial interest of providers to refuse or avoid serving cases that might result in low or negative net income. In addition, case-based financing may encourage providers to diagnose patients into case groupings that are associated with higher margins or code cases in such a way that payment is maximized (Simborg, 1981). Alternatively, providers may fiercely compete for cases that are traditionally associated with higher margins. Case-based funding does not financially reward providers who render appropriate services, nor is it sensitive to variability in quality or service satisfaction.

Barnum et al. (1995) identified pre-conditions for the implementation of case-based remuneration schemes to minimize the potential for beneficiaries to be subjected to discrimination and/or inadequate care. Case categories must be sufficiently well designed so that incentives for bias selection are minimized, therefore variation in resource use for different cases within a category should be small. Information systems are required to: (a) develop and update the grouping methodology, and (b) monitor and audit the coding practices of provider organizations. Lastly, there should be quality-based competition among providers and well-informed consumers to ensure that the financial incentives for efficient care do not compromise the appropriateness of services. Therefore, the costs of administering a complex, case-based funding scheme are high due to the expenditures associated with developing and refining a grouping strategy, determining remuneration rates, processing claims, and auditing remittances.

While there are a number of different case-based remuneration schemes that have been proposed and/or implemented in Canada and the United Status, this approach to financing has historically been targeted toward inpatient services. For example, in America diagnosis-related groups (DRG) are used by the federal government in the United States to prospectively pay for inpatient services received by Medicare beneficiaries. Resource utilization groups (RUG) have been designed to classify nursing home residents on the basis of their service intensity (Fries et al., 1994), and this case-mix measure is now used to adjust prospective payments to skilled nursing facilities in the United States (Balanced Budget Act, 1997).

Over the last few decades there have been a number of ambulatory case-mix classification systems developed and/or used in the United States to reimburse providers who render care for individuals under the Medicare and/or Medicaid programs (Averill et al., 1990; Tenan et al., 1988; Weiner, Starfield, Steinwachs & Mumford, 1991). After the year 2000 the Health Care Financing Administration (HCFA) will be using ambulatory payment classes (APC) to adjust hospital outpatient payments for Medicare beneficiaries (Balanced Budget Act, 1997; HCFA, 1999). Functional related groups (FRG) and ambulatory care groupings (ACG) have been also been developed in the United States for use when case-mix adjusting prospective payments for inpatient rehabilitation and outpatient services, respectively (Harada, Kominski & Sofaer, 1993; Stineman et al, 1994; 1997).

2.0.2.c. Salary

The salary approach pays the physician for a specified period of time, regardless of the number of units of service rendered or the number of people serviced. Payments could be based on full-time, part-time, or sessional basis. The size of payments made to physicians are usually determined prospectively and may be based on individual provider characteristics such as training, experience, seniority, scope of responsibility, the financial performance of an institution, etc. (Gabel & Redisch, 1979). This method of payment is used to compensate some physicians in Ontario who work in laboratories, educational facilities, and community health centres.

Under salary reimbursement practitioners focus their attention on those individuals who come for services or those in the community that they think need their service. The volume of services offered would be determined by the work habits of practitioners. The types of services rendered and mix of intervention or preventative services provided are those that are deemed appropriate by providers. Salaried practitioners likely practice in their field of interest rather than in a specialty area that was in high demand. In addition, medical practices would be located in the communities within which doctors would like to live. There would be no financial signals prompting physicians to allocate their time between clinical, administrative, continuing education, research and teaching activities. In addition, there would be little incentives for group practice models or other organizational structures. Lastly, salary payments tend to be insensitive to variability in service quality and satisfaction.

A systematic review of the impact of salary remuneration on the behaviour of physicians was conducted by Gosden, Pedersen and Torgerson (1999). These researchers concluded that physicians who were paid a salary tended to use fewer tests and procedures per patient, have lower throughput and longer consultations in comparison to FFS or capitated practitioners. They also provided more preventive care and used different patterns of consultation compared to FFS providers.

2.0.2.d. Fee-For-Service

Fee-for-service financing requires that physicians charge and payers remit a fee for each service rendered. Services can be counted on a per task or per visit basis (Hollander & Deber, 1997), and the price attached to each fee can be determined on the basis of cost or by using a fee schedule. For example, a system which has been popularized in the United States called 'customary, prevailing and reasonable' was used prior to 1992 to reimburse providers on the basis of cost. This approach to price determination was used to remunerate physicians who rendered services to Medicare beneficiaries. Under this system payers maintained a separate fee schedule for each physician and reimbursed these providers for each unit of service based "on the basis of the lowest of his actual charge, his customary charge, and the area's prevailing charge" (Gabel & Redisch, 1979, p. 40). The customary charge is equal to the median billed charge for a particular service during the prior calendar year, while the prevailing rate is equal to the 75th percentile of the distribution of all customary charges for similar providers within a market area. Payers operationally define 'similar providers' and 'market areas' (Gabel & Redisch, 1979).

An alternative to remuneration on the basis of cost is the use of fee schedules such as the Ontario Health Insurance Plan's Schedule of Benefits. Fee schedules are negotiated contracts that are developed prospectively. The actual size of the payments made to a physician are typically the lesser of the billed charge or the fee specified in the schedule. The services rendered in a FFS environment are the activities and procedures: (a) that are listed on the fee schedule, and (b) whose marginal benefits (i.e., fee) exceed marginal costs (i.e. provider's production costs). For example, if the fee schedule focuses on medical care, physicians provide services to people who are sick when the fee they receive for providing this care exceeds the costs of rendering it. If the schedule provides incentive for preventative care, these services will be offered. If there are no financial rewards for educational, research and/or teaching, physicians will not be compensated for the time and effort they devote to these activities. If the fee schedule lists cost-effective activities and procedures, physicians would be rewarded for practicing this type of medicine. If cost-effective activities are not listed on the schedule, these interventions will not be provided. Alternatively, if the fee schedule were established according to the needs of the population, service provision could be aligned with the health objectives of communities (Coyte, 1995; Vayda, 1994).

The volume and type of services rendered are determined by FFS physicians and those who receive care, and practitioners who do not render the services demanded by consumers can lose this 'customer' to other providers. Therefore, FFS financing ensures that payment is responsive to client choices (Coyte, 1995). Alternatively, the services that are provided by FFS practitioners may not be effective or appropriate. There are no financial penalties for delivering unnecessary or potentially harmful services or not rendering necessary care.

FFS providers are those who are authorized to bill for services. Activities that may be effective but are not within the skill set of these eligible 'billers' may not be rendered. In addition, services may not be provided by the least-costly practitioner. There are little if any incentives in a FFS environment to promote efficiency in the provision of care, and this approach to remuneration promotes the delivery of care in discrete pieces (Stoddart & Barer, 1991).

FFS physicians and their organizations tend to be located in areas where they will be able to generate income based on local supply and demand. Therefore, there are few financial rewards for physicians who practice in regions where the population is dispersed, during times of the day or year when 'business' is slow, or in environments where the supply of practitioners is high. Therefore, access to care may be compromised in certain geographic areas and at certain times of the day or year.

In 1992 the HCFA implemented a Resource Based Relative Value Scale (RBRVS) to remunerate physicians who served Medicare beneficiaries (Hsiao et al., 1992). Under this approach to determining prices, medical services were assigned 'values' according to the relative amount of physician work, practice expenses and malpractice insurance required to render the care. The final fee represents a geographically weighted sum of the value of these three service components times a conversion factor. This conversion factor is a single value that is used national and updated periodically (Grimaldi, 1991). In France and Germany, prices for physician services are also based on 'value points' and the price attached to these points is negotiated periodically (Barnum et al., 1995)

Apparently, provincial medical associations in Alberta and British Columbia have unsuccessfully tried to develop an RBRVS fee schedule in the past (Serediak, 1993; Wade, 1998). Despite this history, a 1997 agreement between the Ontario Ministry of Health and the Ontario Medical Association mandated the establishment of a commission to develop a Relative Value Schedule to replace the current provincial Schedule of Benefits. This Relative Value Schedule "ranks and rates insured physician services according to the resource inputs required to perform those services ... to correct any distortion in the relativity of fees that may have occurred over time" (Wade, 1998, p. 13). For a more detailed description of this joint RBRVS initiative, refer to Section 2.3.0. and 2.4.0.

In a fee-for-service context, expenditures on physician services are a function of the price per service, services per practitioner, and the number of doctors (Birch et al., 1994). When the volume and mix of services are not fixed, the total amount of money spent on medical care is unpredictable and may exceed budgetary targets (Vayda, 1994; Lomas et al, 1989).

2.0.2.e. Capitation

Capitation refers to a method of payment whereby the amount of funds paid health care organizations is determined prospectively on the based of the characteristics of a defined or rostered population. Under this approach to payment, providers are obligated to render a specified range of services when and if they are deemed to be appropriate. Payment is made prospectively or retrospectively, and is dispersed on an annual or more frequent basis (e.g., per member per month).

This method of payment differs from case-based funding, as capitation requires providers to assume the responsibility for an individual rather than an admission or episode of care. Rostering, which is also known as enrollment, requires that beneficiaries register with a provider or provider organization. From the payer perspective, this approach to financing enhances the predictability of expenditures, transfers treatment obligations and the associated financial risk to providers, and potentially links payments to the characteristics of service recipients. Total expenditures depend on the capitation formula and the size of the population. Although the formula may be changed periodically, volatility in expenditures is simply tied to the size of the population.

The revenue stream of capitated providers is dependent on the capitation fee per enrollee and the size of the roster (Birch, Goldsmith & Makela, 1994). Capitated providers, therefore, face financial incentives to maximize the difference between revenue and expenses by: (a) rostering enrollees whose capitation rate is expected to exceed the costs associated with their care, (b) introducing cost-reducing technologies and cost-minimizing practices, and/or (c) limiting the quantity and/or quality of services provided (Barnum, Kutzin & Saxenian, 1995; Newhouse, 1998). These practices have direct implications for who receives services and what type of care is offered by capitated providers.

Capitation implies a strong commitment to equity by providing equal funding for health care per person, with adjustments to premiums to reflect differential needs (Raftery, 1993). Therefore, the capitation rate paid to providers compensates these organizations for between-individual variability in needs or financial risk. While it is feasible to have one rate (e.g., total planned expenditures/number of enrollees), this assumes that all individuals consume the same financial resources. Not unexpectedly, there is strong evidence to suggest that individuals vary in their need for and utilization of health care services.

Rostered ‘populations’ may include a sample of individuals from a catchment area. In this context, capitated providers compete for enrollees and roster a sample of individuals in their community. Alternatively, a rostered ‘population’ may include all of the people who reside in a specific, geographic location. For practical purposes, this approach to rostering can only be used in publically-funded systems where the payer (i.e., government) is responsible for financing services for all residents.

The variability in need for and utilization of health services among beneficiaries can create an environment for risk selection and financial uncertainty when providers compete for enrollees and capitation rates do no adequately adjust for case-mix (Eggers, 1980; Newhouse, 1986; 1998; Morgan et al., 1997). Capitation financially rewards providers for rostering individuals who would use fewer services than expected based on the capitation rate and avoiding those who would use more services than anticipated. Therefore, capitated providers will be located in areas where they are able to recruit and retain individuals who are expected to provide the highest net income. Because capitated providers are financially at-risk for rendering a defined set of services to individuals on their roster and rate formulae cannot account for all of the variability in future health service utilization, capitation is usually associated with group practices that enroll large numbers of people as a risk management strategy.

The degree of financial risk capitated providers have for service utilization in other health service sectors is important, as this will determine the referral patterns and ultimately the types of services received by rostered populations. For example, when general or family physicians are responsible solely for providing primary care, practitioners have the incentive to minimize their costs by referring patients to more specialized providers whenever possible. Conversely, when capitated, primary care providers are responsible for utilization of specialty and inpatient services they tend to make more cross-referrals to other general and family practitioners (Stearns, Wolfe & Kindig, 1992).

The types of medical care rendered and the mix of intervention or preventative services provided are those specified in the contract or those deemed 'worthwhile' by capitated providers. To determine whether a service is worthwhile, cost-benefit analyses would be conducted by these providers using their investment horizon. The longer the duration of the contract or the higher the likelihood of contract renewal, the longer the investment horizon of the provider. Benefits that would accrue to other providers or sectors of the economy would not be considered in cost-benefit analyses. Lohr (1997) and Newhouse (1998) warn that prospective payment schemes such as capitation fosters under-utilization of appropriate and necessary care.

Under 'full' capitation, providers that reduce their cost by one dollar profit by one dollar because revenue is unchanged. For these reasons, Newhouse (1998, p.126 & 129) argued that "if there are worries about supplier-induced demand under the traditional [fee-for-service] system, one probably should worry about stinting if nothing is paid for additional services ... Stinting refers to not performing services or procedures in which the benefit to the patient exceeds the cost". While evidence of stinting in capitated environments is ambiguous, research methods for detecting under-serving are far less developed than those for over-servicing (Kerr et al., 1996; Newhouse, 1998). A variant of capitation - 'partial capitation' - has been proposed as a mechanism to limit stinting and differential selection of enrollees. Partial capitation involves payment on the basis of a rate adjustment formula and on the basis of actual services used.

2.0.2.f. Conclusion

Clearly, there is no ideal approach to financing physician services. Each mechanism has the power to generate incentives that align with health policy and the potential to reinforce undesirable practice patterns. While the methods of payment described in this chapter represent more "pure" approaches to financing, these approaches are often adapted in practice to generate 'modified' or 'blended' forms of payment. For example, the 'modified' fee-for-service approach used in Canada and Ontario will be described in more detail in Section 2.3.0. and 'blended' capitation approach recommended for use in Canada and Ontario will be described in more detail in Section 2.4.0. The next two sections of this document, however, provide more detailed information on the technical aspects behind the derivation of capitation rate formula and evidence from the literature regarding the impact of fee-for-service and capitation financing in other jurisdictions.

2.1.0. Capitation and Rate-Adjustment

Capitation refers to a method of payment whereby the amount of funds paid health care organizations is determined prospectively on the based of the characteristics of a defined or rostered population. Under this approach to payment, providers are obligated to render a specified range of services when and if they are deemed to be appropriate. Payment is made prospectively or retrospectively, and is dispersed on an annual or more frequent basis (e.g., per member per month). Capitation contracts between payers and health care organizations specify the rate of payment and the scope of services covered by the contract (e.g., primary, secondary, tertiary and/or quaternary care) These documents may include clauses that indicate the duration or term of the agreement, the criteria for enrolling and dis-enrolling individuals, what will occur when enrollees seek care from external providers (e.g., reduced payments - also known as negation), and the methods that will be used by payers to monitor utilization, quality of care, and/or satisfaction of rostered populations (e.g., withholding a portion of payment until certain conditions are met)[1].

The population rostered to each capitated provider may represent a sample of individuals from the community. In this context, health care organizations compete for enrollees and individuals (and/or their employers) are able to select from a number of health plans or service providers. Health service organizations (HSOs) in Ontario and health maintenance organizations (HMOs) in the United States operate under this approach to rostering. Both HSOs and HMOs receive capitated payments and compete with other providers to assume and retain the responsibility for providing specific health services to individuals in a community.

Alternatively, the population rostered to each capitated provider may include all of the people who reside in a specific, geographic location. In this context, a health care organization assumes the responsibility for providing specific health services to all residents and does not compete for enrollees. Individuals who reside in the specified community receive care from the designated, health care organization. Care that is sought outside of the region may or may not be the financial responsibility of the designated provider - this too is specified in the capitation contract. Capitation that involves rostering on the basis of geographically-defined populations

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[1] A capitation 'withhold' is a risk-sharing strategy where a modest portion of all payments are withheld from providers to create a reserve fund which is dispersed at the end of a fiscal year according to the terms and conditions set forth in the contract (Taylor & Taylor, 1994).

can only be used in publically-funded systems where a single payer is responsible for financing health services for all residents. For example, regional health authorities in Alberta and district health boards in Saskatchewan both receive capitated payments for assuming the responsibility for providing specific health services to all of the people who reside in a defined, geographic location (Alberta Health, 1996, Saskatchewan Health, 1994; 1995).[2]

As individuals and rostered populations vary in their need for physicians, demand for medical care and utilization of these services, capitated payments must be adjusted to account for these differences. The purpose of this section, therefore, is to outline the rationale for adjusting payments to account for differences in need, demand, and utilization and to identify important issues in the selection and weighting of capitation rate adjusters.

2.1.1. Rationale for Adjusting Payments Based on Relative Risk or Need

While it is feasible to have one rate (e.g., total planned expenditures divided by the number of enrollees), this approach to the determination of rates (referred to a community rating) assumes that need for physicians, demand for medical care and utilization of these services are the same for all enrollees and the costs associated with rendering care are the same for all providers. Not unexpectedly, there is strong evidence to suggest that individuals and populations vary in their demand for medical care and utilization of physician services and there is growing interest in Canada in allocating resources on the basis of relative need (Alberta Health, 1999; Eyles & Birch, 1993; Hutchison et al., 1999; Mustard & Derksen, 1997; Roos et al., 1997; Saskatchewan Health, 1994; 1995). Therefore, a capitation formula should adjust payments to account for variability between individuals and/or rostered populations. An equitable, adjustment formula would account for differences in the need, demand and/or utilization between populations that are rostered to physicians (e.g., solo-practice), health care organizations that

[2] Population-based funding (i.e., rostering on the basis of geographically-defined regions where all residents are enrollees) has been used since the mid-1990s to allocate funds to regional health authorities and district health boards in Alberta and Saskatchewan. One could argue, however, that capitation has been used in these provinces simply as a mechanism to establish global budgets. Although the formula used to allocate financial resources considers the number of residents in each geographic area and any differences in the relative need of different populations (i.e., case-mix), adjustments are also made for regional differences in factor input costs, cross-boundary utilization, and historic financial allocations. Apparently, these last adjustments [historic spending] significantly alter the allocations made on the basis of case-mix (Alberta Health, 1999; Saskatchewan Health, 1994).

compete for enrollees (e.g., HMOs), or health care organizations that are responsible for all individuals in a geographic region (e.g., regional authorities).

Capitation rates that do not adequately adjust payments may create an environment for selection bias. [3] For example, capitated providers may intentionally or unintentionally roster enrollees who need, demand or use health services more or less frequently and/or more or less intensely. Health care organizations who deliberately seek to enroll individuals that are relatively healthy have been referred to in the literature as 'cream-skimmers' or 'cherry-pickers' (Lichtenstein, Thomas & Watkins, 1992). Alternatively, individuals who need, demand or use physician services more or less than others may be bias in their selection of capitated organizations (Bailey et al., 1999). Results of quasi-experimental, controlled studies suggest that differential selection of enrollees has occurred by either providers or patients in markets where capitated health care organizations compete for enrollees (Bailey et al., 1999; Kravitz et al., 1992; Lichenstein, Thomas, Adams-Watson, Lepkowski & Simone, 1991; Morgan, Virnig, DeVito & Persily, 1997). Selection bias has also been documented in randomized trials that seek to compare capitated and fee-for-service health care organizations - due to the tendency for unhealthy people to withdraw from their assignment to capitated providers in favour of seeking fee-for-service care (Buchanan, et al., 1996; Leibowitz et al., 1992; Mauldon et al., 1994).

The opportunity for differential selection of enrollees is not a concern when capitated health care organizations assume the responsibility for rendering a specified range of health services to all of the residents in geographically-defined regions. However, unless need, demand and/or utilization is distributed equally among geographic regions, capitation payments should be adjusted to reflect inter-regional differences - if the goal of payers is to equitably distribute financial resources (Eyles & Birch, 1993; Mustard & Derksen, 1997). For example, recent evidence from a quasi-experimental, controlled study suggests that individuals with arthritis who would benefit from a hip or knee replacements vary in their willingness to receive this surgery despite high, quality evidence on the effectiveness of this intervention. Interestingly, communities varied in their need for care (as measured by the incidence of arthritis), demands for

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[3] The extent to which this occurs, however, depends on a number of factors such as the absolute level of funding, terms of the funding agreement, the use of quality assurance initiatives, implementation of performance monitoring programs and the ethical culture of capitated providers (Hutchison et al., 1999).

intervention (as measured by regional differences in willingness) and utilization of services (as measured by surgical rates) (Hawker, 1999).

Capitation formulas that do not adequately account for variability in need, demand and/or utilization can have unfortunate consequences for providers, consumers and payers. For example, if health care organizations are not adequately compensated when they enroll very sick individuals, these providers will face financial difficulty and may elect to dis-enroll high-use patients from their rosters. In addition, high-use patients may have difficulty finding a provider that will assume the responsibility for their care. This situation would eventually impact payers by not enabling them to find organizations that are willing to assume the responsibility for providing health services to certain individuals. Alternatively, capitation rates that over-compensate providers represent an opportunity for reducing payments and thereby represent a potential source of cost-savings to payers, consumers and society. Ultimately, it is in the mutual interests of all stakeholders to adjust rates.

An ideal adjustment capitation formula, therefore, would promote the equitable distribution of financial resources between rostered populations and limit differential selection. The factors that would be appropriate to use as adjusters include the characteristics that reflect between-individual and/or between-roster differences in need, demand and/or utilization of covered services. Differences between individuals are important if the adjustment formula will be used to limit or account for differential selection in markets where providers compete for enrollees (enrollment-based capitation), and differences between rosters (enrollment-based or geographically-defined) are important if the adjustment formula will distribute funds equitably. Adjusting capitation rates to reflect variability between individuals and rosters, however, does not guarantee that funding levels are sufficient to meet all existing needs. "It follows that if the resources available to finance health care services are insufficient to meet all needs for health care, the [rate-adjustment] funding methodology should distribute unmet need equitably across ... populations" (Mustard & Derksen, 1997, p. 5).

2.1.2. Issues in the Selection, Measurement and Weighting of Capitation Rate Adjusters

The development of a rate-adjustment formula requires the selection, measurement, and weighting of risk factors and the delineation of the scope of covered services and/or responsibilities. Once risk factors have been identified conceptually, they must be operationally defined in a way that permits valid and reliable measurement. Lastly, these adjusters "must be combined in either an empirical or normative fashion to produce a risk score or rating for each patient" (Iezzoni, 1995, p. 139).

2.1.2.a. Selection of Rate Adjusters

The first step in designing an adjustment strategy is to identify the factors that reflect the likelihood that an individual or group of people will experience an outcome of interest (Iezzoni, 1995). Although this appears straightforward, there is controversy regarding the approach that should be used to select adjusters (Carr-Hill & Jamison, 1998; Mays, 1995; Sheldon, Smith & Bevan, 1993). In addition, there is disagreement regarding what 'outcomes' are of 'interest' - the need for physicians, demand for medical care and/or utilization of these services (Carr-Hill & Sheldon, 1992; Eyles & Birch, 1993). Irrespective of this debate, there appears to be three approaches that have been used to develop a capitation rate adjustment formula: (1) the of use of empirical models to identify significant determinants of utilization, (2) the use of research evidence to select variable(s) that reflect the underlying needs of different populations, and (3) a combination of these strategies.

Payers, policy-makers and researchers in a number of countries[4] have selected and/or evaluated factors for inclusion in a risk-adjustment formula by using empirical models to identifying significant predictors of utilization. For example, an empirically-based, funding formula was developed by researchers at the University of York and used by the National Health Service in the United Kingdom to allocate funds among regional authorities between 1995 and 1999. The York model was developed by using multilevel modelling techniques to regress measures of inpatient utilization on various measures of demographic, socioeconomic indicators and health. In order to address the issue of supply-side influences on demand, a two-stage least squares regression model was used. These researchers conceptualized in-patient utilization as a function of supply-side and demand-side influences, although they recognized that supply might reflect relative need to some extent (Smith et al., 1994).[5] In this situation, the risk-adjustment formula was used to allocate funds for acute and general hospital services - the outcome of

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[4] For example, the United Kingdom, Netherlands, and the United States.

[5] For example, during times when there is insufficient supply to meet demand there is unmet need. When there is insufficient demand, suppliers (e.g., doctors) can induce demand.

interest was inpatient utilization as measured by episodes, bed days, and estimated and standard costs.

The objective of the utilization-based approach is to compensate provider organizations[6] for assuming the responsibility for providing specific health services over the term of the contract. This approach assumes that the future costs of delivering care can be empirically modelled and predicted on the basis of historic patterns of use.[7] The use of empirical models to identify determinants of utilization has come under scrutiny (Carr-Hill & Sheldon, 1992; Sheldon, 1997; Sheldon, Smith & Bevan, 1993). It has been argued that the utilization-based approach:

1. Does not recognize the selection-bias inherent in studying a sample of individuals who access care (Birch, Eyles & Newbold, 1993; Sheldon et al., 1993; Sheldon, 1997).
2. Fails to recognise the process by which illness or need is transformed into or relates to utilization behaviour (Birch, Eyles & Newbold, 1993; Mechanic, 1979).
3. Assumes that historic patterns of utilization are appropriate (Mustard & Derksen, 1997). There is substantial evidence, however, that health services may be rendered inappropriately and appropriate services may not be provided to those who would benefit from care (e.g., Horton, Romans & Cruess, 1992; Park, 1993).
4. Results in the selection of risk-adjusters that reflect satisfied demand rather than unmet demand or underlying need (Mays, 1995; Mustard & Derksen, 1997).
5. Reinforces and perpetuate prior resource allocation decisions (Saskatchewan Health, 1994; Birch et al., 1996).

Several authors have criticized how empirical models have been used by researchers to identify determinants of physician use. Some have argued that investigators have disregarded the influence of supply on utilization (Dunlop, 1998; Smith et al., 1994). Others indicate that the

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[6] Capitated payments are usually made to health service organizations, as one of the most popular strategies to diversify risk is to establish a corporate entity that is able to maintain a large roster of individuals in order to reduce random variation in income (Bachmann & Bevan, 1996).

[7] In practice, jurisdictions that use a utilization-based approach to rate adjustment compensated providers based on cost estimates of expected utilization. Providers don't seem to be compensated for risk regarding these expectations (Woodward & Schnitzler, 1996).

typical hierarchical, additive approach of regressing measures of physician utilization on predictors does not consider the interaction effect of causal variables (Arling, 1985, Rundall, 1980). However, while interaction terms may reach statistical significance they have failed to make substantial improvements in the explanatory power of multivariate models (Arling, 1985; Birch et al., 1993; Ronis & Harrison, 1988). For these and possibly many other reasons, multivariate empirical models have failed to explain much of the variability in health service use.[8] While the amount of variability in physician resource utilization explained by an empirical model is customarily used as a 'goodness-of-fit' measure, rostered populations provide financial risk diversification as net income is a function of the difference between actual payments and predicted costs for a group of individuals. To respond to this observation, investigators have used the predictive ratio to evaluate the impact of a formula on selected groups. This ratio is calculated by dividing the payments predicted by the model for individuals in a predefined group by the actual costs incurred by this cohort (Ash, Porell, Gruenberg, Sawitz & Beiser, 1989).[9]

An alternative approach to the selection of factors for inclusion in an adjustment formula is the use of measures that are associated with the underlying needs of different populations. Birch and Chambers (1993) argued that the needs-based approach allocates resources efficiently and equitably. "Efficiently in this context means maximizing the expected improvement in health status produced from a given amount of health care resources, and, hence, populations with greater potential for improvement are allocated more resources. Equity introduces notions of fairness into the allocation of resources. The needs-based approach provides equal resources for populations with equal needs (horizontal equity) but unequal resources for populations with unequal needs (vertical equity)" (p. 608).

The difficulty with the needs-based approach to the selection of adjusters is the identification and weighting of measures that account for the dimensions of need and/or medical necessity (Carr-Hill & Sheldon, 1992; Birch, Eyles & Newbold, 1996). In response to this

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[8] For example, Phillips et al. (1998) reviewed articles ($N = 136$) that used the Behavioural Model of Health Service Utilization to identify determinants of use and found that the median R^2 value of studies that cited this goodness-of-fit measure ($n = 65$) was 19 percent.

[9] Some investigators use a cost ratio (CR) which is determined by dividing the actual costs incurred by the predicted costs (i.e. CR - actual costs/predicted costs) (van Vliet & van de Ven, 1992).

challenge, researchers have attempted to identify measures that have demonstrated utility as proxies for the health status and/or the need for health services.[10] For example, Hutchison et al. (1997) evaluated the impact of using various need-adjusters (community-level measures of health status, socioeconomic circumstance and mortality) on capitated payments made to Health Service Organizations in Ontario.

Between 1977 and 1990 the National Health Service in the United Kingdom incorporated standardized mortality ratios into a resource allocation formula in an attempt to adjust for variability in need (Department of Health and Social Security, 1976). "When including standardized mortality ratios in the formula the [developers of the funding formula] argued that since 'need' was only measurable using proxies and since its effects on utilization were contaminated by supply-induced demand and were incomplete in the case of unmet need, the relation between 'need' and mortality could only be assumed" (Mays, 1995, p. S97). Standardized mortality rates have been used in other jurisdictions. For example, Saskatchewan Health incorporated measures of need (e.g., standardized mortality, fertility and low birth weight) into a funding formula used to allocate funds among district health boards for the provision of long-term care, inpatient care, outpatient non-primary care, home-based services, and rural health initiatives (Saskatchewan Health, 1994; 1995). Eyles et al. (1991) recommended the use of standardized mortality ratios in Ontario for payment adjustment purposes after they conducted a review of the literature to evaluate the validity, reliability, administrative feasibility and 'gameability' of different measures of need.

Another approach that has been used to develop adjustment formulas is the combined use of empirical techniques and measures of need. For example, Frohlich and Carriere (1997) used a two-staged approach to derive a formula to risk-adjust payments directed toward regional health authorities in Manitoba for the provision of physician services. The first stage used empirical modelling to examine utilization patterns and select factors that could be used in a formula to "smoothen out" discrepancies in allocations among regions. The best model combined age, gender, and socio-economic status; and included interaction terms to account for the fact that need in each age and gender stratum appeared to vary among different levels of socio-economic

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[10] "Need for medical care [is] conceptually defined as the ability or capacity to benefit from health care intervention", and it is this capacity to benefit from care that distinguishes need from health status (Birch & Chambers, 1993; Mustard & Derksen, 1997, p. 1).

status. Socioeconomic status was measured using an index developed by regressing area-based indices of health (i.e., inpatient utilization) on socioeconomic data (Mustard & Frohlich, 1995). As current utilization did not appear to account for a measure of need (i.e., premature mortality), a second stage reallocation was performed to account for regional differences in standardized mortality ratios. The weight assigned to standardized mortality ratios was based on coefficients derived from empirical modelling in the first stage.

A number of researchers in the United States have proposed and used information from administrative and clinical databases to derive measures of need to improve capitation rate adjustment for Medicare beneficiaries who enroll in HMOs. These individuals have regressed measures of resource utilization on information measuring relative need to evaluate the predictive validity of different formulae. Measures of need include indicators of physiological health, information on the type and severity of medical conditions, and measures of functional status (Ash et al., 1989; Ellis &Ash, 1995; Newhouse, Manning, Keeler & Sloss, 1989; Manton, Newcomber, Vertrees, Lowrimore & Harrington, 1994; Smith & Weiner, 1994; Thomas & Lichenstein, 1986; Weiner et al., 1996). In most instances, the identification and weighting of indices of need were derived using empirical models (e.g., Ash et al. 1989).

The selection of rate adjusters also requires sensitivity to administrative and political issues. Capitation rate adjusters that are eventually selected for inclusion in a formula should be administratively feasible and lack adverse incentives. The information upon which adjusters are derived should be collected on a regular basis and be easy and inexpensive to aggregate. Ideally, the costs associated with data collection should not exceed the benefits that accrue due to inclusion of this information in the adjustment formula. The data required for rate adjustment should be difficult to manipulate for the purpose of seeking higher remuneration, and should not provide incentives for inefficient care. In fact, the potential impact of provider surveillance to identify and counter gaming must also be weighted. Lastly, the methods by which adjusters are selected should be acceptable and make sense to all stakeholders, and the process by which payment is derived should be relatively simple and transparent (Alberta Health, 1999; Epstein & Cumella, 1988; Frohlich & Carriere, 1997; Holland, 1998; Hutchison et al., 1999; Miller & Sage, 1999; Mustard & Derksen, 1997).

The external validity of adjusters will depend on the extent to which the jurisdictions: (a) use the same approach to rostering - competitive versus geographic-based, (b) have similar roster sizes as smaller groups of enrollees will show stronger variation at the group-level than larger populations, (c) represent populations that have similar characteristics,[11] (d) adopt the same goals of adjustment (e.g., limit differential selection and/or promote equity), and (e) capitate the same type (e.g., primary and/or specialty physician services) and scope of services (e.g., all primary care intervention, except prenatal care).[12]

2.1.2.b. Measurement

Once adjusters have been identified conceptually, they must be defined in a way that permits unbiased identification and measurement (Iezzoni, 1995). The measures that are used to operationalize these constructs should have face validity, as well as demonstrate reliability, stability, and sensitivity to change (Epstein & Cumella, 1988; Holland, 1998; Hutchison et al., 1999; Mustard & Derksen, 1997). If a utilization-based approach is used, predictive validity is also important.

One adjuster that has face validity from the perspectives of a range of stakeholders is the level of 'need' of the individual. Although there is "growing consensus across [Canada] that funding allocations should be based on an appropriate measure of need for health care resources ... there is, however, no consensus on what constitutes need or how it might be measured, let alone how it might be implemented as a basis for allocating funding" (Frohlich & Carriere, 1997, p. 6). In addition, although an individual could be identified as 'high need' they may not be interested in receiving or willing to accept services (Hawker, 1999). Alternatively, the medical profession may not have an intervention that is appropriate - the estimated health benefit derived from receiving the intervention may not exceed the estimate negative consequences by a significantly wide margin that the services is worth providing (Lavis & Anderson, 1996).

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[11] Bice and White (1969) found that the determinants of whether individuals visit a physician or not vary between geographic locations. In addition, Birch, Eyles & Newbold (1993) found significant interactions between region of residence in Canada and level of need when they conducted an analysis to identify determinants of the frequency of physician visits. Research conducted by others supports the hypothesis that health-related behavior varies between regions (Duncan, Jones & Moon, 1993).

[12] To illustrate the relevance of this last point, the National Health Service in England commissioned three projects to develop separate capitation formula to allocate financial resources toward inpatient services (Smith et al., 1994), community health services (Buckingham & Freeman, 1997), and psychiatric services (Smith, Sheldon & Martin, 1996).

Indicators of need that have been recommended by researchers or used by funding bodies are measured directly or indirectly. The direct approach requires the measurement of specific impairments, disabilities or handicaps or the use of generic health status instruments. These indicators could be measured using individual-level or group-level data. For example, the incorporation of objective indicators of physiological health and subjective measures of self-rated health in a risk-adjustment formula have been evaluated (Fowles et al., 1996; Newhouse, Manning, Keller & Sloss, 1989). Alternatively, the use of survey data regarding health status has also been investigated (Gruenberg, Kaganova & Hornbrook, 1996; Hutchison et al., 1997). The indirect approach to measuring need requires the use of indicators that are associated with morbidity, disability, and/or health status such as age, standardized mortality rates, and socioeconomic characteristics. These indicators can also be measured using individual-level data or from the aggregate attributes of groups. The face validity of some of these measures of need, however, remains controversial (e.g., standardized mortality).

Measures should demonstrate reliability to ensure that allocations derived from any formula should be relatively stable over time (Yamey, 1999). Wide variations in payments due simply to measurement error are not appropriate. Reliability assesses the repeatability, consistency and dependability of a measure. There are two types of reliability and both are important to measurement of adjusters.[13] For instance, consider the case where the socioeconomic context within which enrollees live has been identified as a potential rate adjuster. Frohlich and Carriere (1997) recognized that social and economic variables from census data were subject to error and assessed the reliability of these measures to evaluate the stability of a risk-adjusted formula. Lastly, adjusters should be responsive to change in health if they are to continue to adjust rates based on the evolving characteristics of populations.[14]

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[13] Test-retest reliability refers to the stability of a measurement over time, while inter-rater reliability estimates the amount of error associated with the measurement process or individuals who are doing the measuring and/or coding (Ferris & Norton, 1992; Green & Lewis, 1986).

[14] There exists an inherent tradeoff with the use of health status as an adjuster. Providers that improve health of their population at a faster rate than other providers are financial penalized by a formulae that would allocate less funds to their enrollees in the future.

2.1.2.c. Weighting

Once adjusters have been identified conceptually and operationalized in a way that permits valid and reliable measurement, these adjusters "must be combined in either an empirical or normative fashion to produce a rating or risk score for each patient" (Iezzoni, 1995, p. 139). Weighting the factors that are included in a formula requires: (a) the use of empirical modelling to determine the relative contribution of each adjuster to variability in need for physicians, demand for care and/or utilization of these services; (b) the use of theoretical rationale; and/or (c) political choices (Sheldon et al., 1993). The process of developing a resource allocation formula in the United Kingdom over the last few decades serves to illustrate the contribution of statistical modelling, theory, and the political process behind the selection of adjusters and derivation of weights.

In the late 1970's the Resource Allocation Working Party (RAWP) was established by the National Health Service to develop a formula whereby financial resources could be allocated to regional health authorities to pay for hospital and community health services. The funding formula developed by the committee incorporated age and gender adjustments and used condition-specific, standardized mortality ratios as a proxy measure for need and morbidity. Standardized fertility ratios were used to calculate allocations for maternity services (Department of Health and Social Security, 1976; Sheldon et al., 1993). In the absence of evidence regarding the explanatory power of standardized mortality ratios, the RAWP argued that the most reasonable assumption was to assign standardized morality ratios a weight of one. Therefore, under this formula an area with a standardized mortality ratio of 110 would receive 10 percent more resources than an area with a ratio of 100 - all other things being equal (Mays, 1995). The RAWP apparently avoided using non-health adjusters (e.g., social deprivation indices) and statistical modelling to avoid having to provide excuses for not remedying the cause (e.g., social disadvantage) and to produce a model that was relatively simple and transparent (Holland, 1998). The RAWP formula was used to allocate financial resources between 1977 and 1990 (Mays, 1995; Sheldon et al., 1993).

A review of the RAWP formula was conducted in the early 1990's using an empirically-based approach. A statistical model was derived by estimating the influence of health and socioeconomic factors on inpatient utilization. The final model included the use of all cause, premature mortality for those less than 75 years with a weighting of 0.44. Various social deprivation indices were also statistically significant and their use was recommended by the allocation review committee. The capitation formula selected by policy-makers to allocate financial resources between 1990 and 1995 assigned a weight of 0.50 to mortality data and did not use a social deprivation index (Mays, 1995). Sheldon et al. (1993) argue that the political decision to weight mortality data (at 0.50 rather than 1.00) and not include a social deprivation index diluted the redistributive effects of the RAWP formula.

2.1.2.d. Conclusion

In summary, individuals and rosters vary in their need for physicians, demand for medical care and use of these services and capitation formulas that do not adequately account for this variability will not distribute financial resources equitably and may create an environment for bias selection. The development of an adjustment formula, therefore, requires the selection, measurement and weighting of adjusters and the delineation of the scope of covered services and/or responsibilities. There appears to be three approaches to the development of rate adjustment formulas each of which has strengths and weaknesses - the use of empirical modelling, the selection of adjusters that reflect relative needs, and a combination of these strategies. Irrespective of the approach, the selection, measurement and weighting of adjusters is driven by theoretical rationale, research evidence and the political process. Ultimately, the internal validity of a formula depends on whether it promotes an environment that parallels the goals of health policy. The external validity of a formula depends on the extent to which jurisdictions, enrollees and covered services are similar.

2.2.0. Impact of Provider Payment Mechanisms

The purpose of this section is to review evidence from the literature regarding the impact of capitation and FFS on health service utilization, expenditures and quality of care, as well as the health status and satisfaction of consumers. The methodological approaches that have been used by investigators to conduct this type of research are first reviewed and threats to internal and external validity are discussed. As there is a large body of knowledge evaluating the impact of financial incentives on these outcomes, this analysis focuses on summarizing the results of Level I evidence (i.e., results/evidence derived from randomized, controlled trials [RCT] that use large samples) and Level 2 evidence (i.e., RCT that use small samples) and Level III evidence (i.e., non-randomized, controlled research designs) where investigators have made reasonable attempts to account for variables that could confound the results (Canadian Task Force on the Periodic Health Examination, 1979; Centre for Evidence-Based Medicine, 1998).

2.2.1. Methodological Approaches and Threats to Validity

Over the past two decades, there have been a few RCT and a number of quasi-experimental, controlled studies that have evaluated the impact of different provider payment mechanisms. The primary threats to the internal validity of quasi-experimental studies include bias selection, historic effects, differential attrition, and measurement bias, as well as selection-maturation and selection-history interactions. The primary threats to the external validity of experimental and quasi-experimental research designs include: (a) the representativeness of participants, and (b) the degree to which others can replicate the conditions under which individuals in the treatment group were exposed (Shortell & Richardson, 1978). The remainder of this Section addresses these threats.

2.2.1.a. Bias Selection

Investigators that test hypotheses regarding the impact of provider payment must ensure that the groups being compared are equivalent in other ways so that alternative explanations for differences in outcomes can be ruled out. Bias can be introduced due to between-group differences in plan benefits, providers and patients. Miller and Luft (1994) observed that few investigators who conduct research in the United States describe or account for differences in benefit packages. For example, capitated HMO plans tend to offer more comprehensive coverage in comparison to indemnity insurance. Even providers that render services to beneficiaries of government programs such as Medicare and Medicaid may differ in how much they 'top-up' entitlements. When investigators do not account for differences in plan benefits, this alternative explanation for differences in outcomes cannot be ruled out. In the Canadian context, however, the range of health benefits available to individuals who reside within a province is the generally the same irrespective of the financial arrangements between providers and the government.

There is some evidence in the literature that doctors, who practice in capitated and FFS settings, may differ in important ways (Fruend & Allen, 1985; Hutchison, Birch & Gillett, 1996). Between group-differences in physicians, or 'provider selection', is a potential source of bias if these differences impact the outcome of interest. For example, it appears that physicians in one HMO were more likely than FFS providers to assign non-diagnostic labels rather than specific psychiatric diagnoses (Wells, Manning & Benjamin, 1986). These findings suggest that between-group differences in the diagnostic patterns of physicians may bias unadjusted results and limit the ability of researchers to adjust for differences in the case-mix of patients. In the Canadian context, it has been suggested that physicians who chose to enter Health Service Organization agreements with the Ontario Ministry of Health were low-billers (Federal, Provincial, Territorial Advisory Committee on Health Services, 1995). This type of provider selection creates a source of bias when evaluators compare the behaviour of these capitated physicians with doctors in the FFS sector.

Capitated organizations may also receive alternative forms of remuneration and may use various approaches to paying individual practitioners to influence the process and outcomes of care. For example, physician group practices may render services to individuals who are enrolled in capitated plans and to patients who receive care from indemnity plans. In this context, doctors may simultaneously face different financial incentives and may not even know the source of payment when rendering care. Alternatively, provider organizations might receive capitated payments for all of the individuals they serve, but pay doctors on a salary basis and/or purchase physician services on a capitated basis. Therefore, when health care organizations participate in a research project, investigators must provide but often do not offer, details regarding the financial arrangements used by these providers (Miller & Luft, 1994).

Evidence from the literature suggests that it is difficult to distinguish the effects of organizational structure (e.g., solo versus group practice, single versus multi-specialty groups) and method of payment on outcomes and that there may be significant interaction effects

(Greenfield et al., 1992). Therefore, the complexity of organizational relationships and payment mechanisms used by providers who participate in research must be described as these arrangements may limit the external validity of findings. Although capitation is associated with group practices due to the number of enrollees required to diversify risk, physicians who receive FFS remuneration may work in solo or group practices. Most comparative studies do not even describe whether FFS providers work in solo or group settings.

Most quasi-experimental, comparative studies have documented baseline differences in the characteristics of patients who receive care from capitated and FFS providers. For example, FFS recipients tend to be older, sicker, more disabled, and have a higher number of chronic diagnoses (e.g., Brown et al., 1993; Kravitz, et al., 1992; Retchin et al., 1992). Evidence suggests that these between-group differences may be due to self-selection by beneficiaries and/or differential selection by providers (Brown et al., 1993; Buchanan et al., 1996; Lichtenstein et al., 1992; Wilensky & Rossiter, 1986). Whatever the source of bias, statistical adjustments must be made to control for case-mix differences between groups when the characteristics by which research groups differ may influence variability in outcomes (Iezzoni, 1995). Unfortunately, the more heterogeneous the baseline differences, the larger the sample size required for multivariate analysis. To minimize the need for case-mix adjustment, researchers often recruit subjects who have prevalent, definable and/or expensive diagnoses such as hypertension or diabetes (e.g., Greenfield et al., 1992). The external validity of studies that use tracer conditions, however, may be limited.

Some investigators have used novel research designs in an attempt to minimize provider and/or patient selection bias. For example, Murray, Greenfield, Kaplan and Yano (1992) and Udvarhelyi et al. (1991) conducted retrospective studies at medical practices where physicians simultaneously provided care to patients who were enrolled in capitated and indemnity plans in an attempt to control for provider selection. Investigators have also attempted to control for provider selection bias by observing the practice patterns of physicians who changed from FFS reimbursement to capitation or vice versa (Flierman & Groenewegen, 1992; Krasnick et al., 1990; Stearns et al., 1992). Other investigators have eliminated the need for case-mix adjustment by asking physicians who work under different payment mechanisms how they would diagnose and/or treat hypothetical patients (Bredfeldt, Brewer & Junker, 1990; Cummings et al., 1989;

Hlatky et al., 1983). Researchers at RAND[1] used a unique, randomized, controlled design in the early and mid-1990s that enabled them to attribute differences in utilization between capitated and FFS providers to either the operational efficiency of an HMO or differential selection of a healthier population (Buchanan, et al., 1996; Leibowitz et al., 1992; Mauldon et al., 1994).[2]

2.2.1.b. Historical Effects

Many investigators use a longitudinal approach to evaluate the short- and long-term impact of payment methods or compare the practice styles of practitioners before and after a change in financing. The primary threat to longitudinal designs that do not incorporate control groups is that differences between 'before' and 'after' groups may be due to other events (i.e., history effect). For example, Stearns et al. (1992) evaluated the utilization patterns of physicians in one medical practice who changed from FFS to capitated payment and determined that prepayment was associated with reductions in hospital admission rates. The authors acknowledge, however, that the decrease in admissions may be due to a decline in hospitalization rates in the local community over the same period of time.

Interestingly, longitudinal designs that measure utilization over the short-term may result in different conclusions than studies that take a long-term perspective. Buchanan et al. (1996) found that individuals randomized to HMO providers are less likely to use services during the first six months after enrollment than after this period of time. These investigators speculated that these enrollees required time to learn how to use the HMO system. In addition, Ware et al. (1996) found that between-group differences in health outcomes may depend on the duration of time that has elapsed since individuals started to receive care from capitated or FFS providers.

2.2.1.c. Differential Attrition

Longitudinal studies must address the possibility of bias attrition by monitoring enrollment, dis-enrollment, and/or death. There is evidence to suggest that individuals are more likely to switch from an HMO than from a FFS plan and death is more likely in FFS plans (Ware et al., 1996). Leibowitz et al. (1992) found evidence of significant selection and attrition bias resulting from individuals who were assigned to an HMO but didn't enroll and those that initially enrolled but quickly dis-enrolled. These people used more medical care than average HMO

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[1] The Rand Corporation, Santa Monica, California.

[2] This research design is described in Section 2.2.2.a.

enrollees or FFS recipients. Researchers must address these issues by conducting data analysis using an intention to treat approach[3], while using information regarding the rate and time at which individuals switch systems to conduct sensitivity analysis (e.g., Buchanan et al., 1996; Leibowitz et al., 1992; Ware et al., 1996).

2.2.1.d. Measurement Bias

Measurement issues may pose a source of bias, when investigators use different data collection methods to obtain information from capitated and FFS providers. For example, when testing hypotheses regarding differences in utilization, claims data may be used to evaluate FFS physicians while medical records may be used to assess capitated providers. Detecting or assessing the extent of measurement bias becomes more complex when testing hypotheses regarding differences in provider costs. Investigators often estimate what capitated providers 'would have' billed if they had rendered care under FFS conditions. These 'imputed charges' are then compared to actual billings rendered by FFS providers (Wells et al., 1986). In the American context the amount of money that a provider bills for a particular service may not resemble the money that is actually paid to these practitioners or healthcare organizations because not all payers reimburse the full price of provider charges (Finkler, 1982).

2.2.1.e. Representative

The demographic, health and geographic profiles of individual participants (i.e., physicians and patients) and/or the characteristics of provider organizations included in a research project may/may not be representative of other populations. For example, when investigators use tracer conditions to enhance baseline homogeneity between comparison research groups the results they obtain may not be reflective of outcomes for individuals with other diagnostic conditions.

Most of the evaluative research that has been done to assess the relative performance of providers who received capitated versus FFS payment was conducted in the United States, as this market allows for the simultaneous existence of multiple payers and methods of payment. The validity of these studies to environments without similar regulatory and/or competitive

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[3] The 'intention to treat' approach requires that investigators attribute all subjects to the research group to which they were initially assigned to preserve the value of randomization, as those who are non-compliant or dis-enroll may represent a bias selection of participants (Guyatt, Sackett & Cook, 1993).

environments is unknown. Interestingly, even when American providers and patients have been sampled to represent their national population, investigators have found that differences between capitated and FFS providers in outcomes vary by geographic location (Ware et al., 1996). Hutchison et al. (1997) argued that the American literature on capitation has little relevance to payment of general practitioners in Canada as: (a) the enrolled populations in the United States tend to be larger, and (b) the scope of services provided by capitated organizations in the United States go beyond primary care.

The external validity of research findings and the degree to which results can be generalized across studies is also limited by the ability of others to replicate the conditions under which individuals in the treatment group were exposed (Shortell & Richardson, 1978). Unfortunately, many studies do not specify the organizational or market context within which providers work and different HMOs use various organizational structures to influence the process and outcomes of care. For example, staff-model HMOs pay primary care physicians a salary while group-model HMOs contract for physician services from other corporate entities (e.g., group practices, Independent Practice Associations) and pay for these services on a FFS or capitated basis. Miller and Luft (1994) conducted a systematic review of the literature and concluded that there are too few observations to make any conclusions regarding the superiority of different types of HMOs and that plan definitions are often inaccurate or incomplete.

There have been five randomized trials that have been conducted to compare capitation and FFS arrangements. The results of these trials, however, are limited in their external validity as they only included adults from one city (Manning et al., 1984), assigned participants to one HMO (Buchanan et al., 1996; Leibowitz et al., 1992; Manning et al., 1984; Mauldon et al., 1994), or recruited subjects from a subset of the general population such as Medicaid beneficiaries (Buchanan et al., 1996; Leibowitz et al., 1992; Lurie et al., 1992; 1994; Mauldon et al., 1994; Moscovice et al., 1993).

2.2.2. Evidence of Impact

There is a large body of literature regarding the impact of financial incentives on the provision of services and the health of consumers. This analysis focuses on summarizing the results of Level I, Level II and Level III evidence. The impact of capitation and FFS financing on the utilization of health services, expenditures and quality of care, as well as the health status and satisfaction of consumers is reviewed. The sources of evidence will be outlined, then the evidence derived from this work will be described.

2.2.2.a. Sources of Evidence

The RAND Health Insurance Experiment (RAND Experiment) was conducted between 1976 and 1981 and involved the random assignment of individuals less than 62 years of age (n ≅ 3,100) to FFS providers or to a capitated, staff-model HMO (Manning et al., 1984). Although participants assigned to the FFS research group faced various co-payments and deductibles, the results reported here are for individuals who faced 'free' FFS unless otherwise specified. While the RAND Experiment enabled investigators to reduce enrollee selection bias and construct groups with roughly equivalent health plan benefits, the external validity of results may be compromised by the use of only one HMO and the recruitment of participants from one city. The RAND Experiment has been used to evaluate the impact of provider payment on access, utilization, appropriateness of care, one-year health outcomes, and consumer satisfaction (Davies et al., 1986; Manning et al., 1984; Siu et al., 1988; Ware et al., 1986).

In the early 1980s the Omnibus Budget Reconciliation Act in the United States broadened the opportunity for states to contract with HMOs for Medicaid services. In 1987 Hennepin County, Minnesota participated in the Medicaid Competition Demonstration Project - a multi-site research endeavour that evaluated reform initiatives. The Hennepin County project randomly assigned beneficiaries (n ≅ 800) to capitated or FFS care. Therefore, physicians who served individuals who were randomized to the capitated care research group practised under new payment arrangements after the project began. Physicians who rendered care to the FFS research group continued to receive FFS payments for services rendered. Beneficiaries enrolled in one of four HMOs. Only 15 percent of participants actually changed physicians, and all beneficiaries continued to have the same benefit entitlement. Capitation fees were set at 95 percent of estimated FFS costs with adjustments based on age, gender, Medicare status and Medicaid eligibility category (Lurie et al., 1992). The Hennepin Country project has been used to evaluate the impact of capitation on access, utilization, quality of care, and health outcomes (Coffey et al., 1995; Lurie et al., 1992; 1994; Moscovice et al., 1993).

In the early 1990s investigators at RAND evaluated Medicaid demonstrations at three locations using the same randomized, controlled research design. Four research groups of subjects were constructed: (1) individuals who were randomly assigned to receive care in a capitated HMO, (2) those randomly assigned to remain in FFS, (3) beneficiaries who self-selected the HMO providers, and (4) people who self-selected FFS. In addition, these investigators evaluated utilization rates among individuals who were assigned but failed to enroll in the HMO or discontinued their enrollment. Due to the geographic location of all three evaluations, only one HMO provider could be used per site. Therefore, the participants received care from a capitated, staff-model HMO (Buchanan, Leibowitz & Keesey, 1996) or a hospital-based, staff-model HMO (Leibowitz, Buchanan & Mann, 1992; Mauldon, Leibowitz, Buchanan, Damberg & McGuigan,1994). Some of the findings of these randomized trials conflict, likely due to the fact that each evaluation represented a case study of a single HMO provider (Buchanan et al., 1996). These Medicaid evaluations were conducted by RAND to assess the impact of capitated provider payment on utilization, expenditures, and quality of care.

There are two quasi-experimental, observational studies that are noteworthy because they used large sample sizes to provide enough statistical power: (a) to control for patient, provider, organizational and contextual variables that may confound results, and (b) to detect clinically significant and/or administratively relevant differences between groups. The Medical Outcomes Study was conducted between 1986 and 1990 to evaluate the impact of different capitated and FFS health systems on the process and outcome of care. Data was collected cross-sectionally (n = 22,462) using a stratified, sampling strategy to recruit clinicians (n = 523) from a representative group of organizations (i.e., HMOs, multi-specialty, single-specialty and solo group practices) in three American cities. A subgroup of individuals with specific tracer conditions were followed longitudinally (n = 2,349) (Tarlov, et al., 1989). The Medical Outcomes Study has been used to evaluate the impact of capitation on utilization, expenditures, the quality and appropriateness of care, and health outcomes.

In the late 1980s the Health Care Financing Administration funded a four-year, Medicare Competition Demonstration to assess the impact of different capitated and FFS health systems on the use of medical services, health outcomes, and consumers' satisfaction. Stratified, random sampling strategies were used to select geographic locations, organizations and subjects. Data was collected cross-sectionally and longitudinally using administrative data ($n \cong$ 12,500), medical records review ($n \cong$ 1,200), and telephone surveys ($n \cong$ 4,000). The Medicare Competition Demonstration was conducted between 1989 and 1990 (Brown et al., 1993; Clement et al., 1994; Retchin et al., 1992). This demonstration project has been used to evaluate the impact of capitation on utilization, quality of care, health outcomes, and the satisfaction of consumers with health services.

In the early 1990s Abelson and Birch (1993) reviewed research that had been conducted in Canada to assess the impact of different methods of payment on cost, utilization, organization and delivery care. Most of this research: (a) was conducted by individuals from the MOH and academicians, (b) was performed during the early 1970s, and (c) has not been published in peer-reviewed journals. In addition, while some investigators constructed comparison groups that were similar on demographic and health status variables, others did not attempt to control for between-group differences in case-mix or supply factors (e.g., lower hospitalization rates may be due to proximity to this type of care). Abelson and Birch (1993) indicated that a common methodological error made by researchers was the evaluation of users rather than a determination of the likelihood of use. Lastly, most researchers did not attempt to control for provider self-selection and therefore between-group differences (e.g., hospital utilization) could be due to pre-existing differences in the practice patterns of physicians. However, due to the geographic relevance of these studies, findings described by Abelson & Birch (1993) will be cited when appropriate.

In the early 1990s a controlled trial that was conducted in Ontario to evaluate the impact of capitation versus FFS payment on the utilization of hospital-based services (Hutchison et al., 1994). These researchers used a multiple, time-series design and matched capitated, primary care physicians who received ambulatory care incentive payments with FFS doctors. The results of this study will also be presented as evidence due to the geographic relevance of this investigation.

2.2.2.b. Discussion of Evidence

The results of these randomized trials and quasi-experimental, controlled designs will be used to make general statements regarding the impact of capitated and FFS payment mechanisms on: (a) rates of hospital admission, (b) length of in-patient stays, (c) hospital days per beneficiary, (d) use of ambulatory services, (e) intensity of care, (f) costs of care, (g) quality of the care process, (h) health outcomes, and (i) consumers' satisfaction. Where appropriate the results of a small, controlled trial that was conducted in Ontario will be presented (Hutchison et al., 1994), as well as population-based studies (e.g., Oleske et al., 1998) and quasi-experimental trials in which the investigators made adequate attempts to control for other explanatory variables (e.g.

Newcomer, Preston & Harrington, 1996). Table A1 to A3 in Appendix A summarizes the research design and results of studies cited in this section.

Compared with FFS providers, capitated health plans tend to have lower rates of hospital admission for the average enrollee. These differences, however, appear to be less significant when comparing the likelihood of admission for unhealthy patients. Investigators from the RAND Experiment in the 1980s found that enrollees in a staff-model HMO had 40 percent fewer admissions (Manning et al., 1984). Results from the randomized, controlled trial in Hennepin County with the Medicaid population suggest that HMO enrollees who were elderly had lower (11 percent), risk-adjusted rates of admission (Lurie et al., 1994). Moscovice et al.'s (1993) evaluation of the randomized trial in Hennepin Country found no significant differences in inpatient services after Medicaid beneficiaries, who had chronic mental illness, were assigned to prepaid or indemnity health plans.

When investigators at RAND conducted more recent randomized trials, they found no significant differences in hospital admissions between FFS providers and those who received care at a staff-model HMO in one state (Buchanan et al., 1996) or a hospital-based HMO in another state (Leibowitz et al., 1992). There were, however, lower rates of acute visits among children who received care at a hospital-based HMO in a third state. These reductions were attributed to lower admission rates among children with no health problems, and the investigators suggest that HMOs may have minimized unnecessary or discretionary admissions (Mauldon et al., 1994).

Investigators who conducted a systematic review of controlled (non-randomized) trials, that were conducted in the United States after 1980, suggest that HMO enrollees generally had lower hospital admission rates. Some differences in HMO and FFS plans, however, were relatively small (Miller & Luft, 1994). Investigators from the Medical Outcome Study, which recruited participants from the 'general population', found significantly lower hospital admissions among HMO enrollees. In fact, the hospitalization rates for those who received care from solo or single-specialty FFS practices were 40 percent higher than HMO enrollees (Greenfield et al., 1992).

Seniors who were enrolled in HMOs during the Medicare Competition Demonstration did not have lower hospitalization rates compared to beneficiaries who received care from FFS providers. Investigators suggest, however, that hospital admissions per Medicare beneficiary in the FFS sector declined by 25 percent from 1985 to 1989 which may have left smaller opportunities for HMOs to outperform FFS plans on this utilization measure.[4]

Greenfield et al. (1992) commented that researchers tend to document higher differences in hospitalization rates between prepaid and FFS providers when they conduct studies with general populations than when they study diagnostic-specific admissions. Differences in admission rates, therefore, may reflect more discretionary utilization by providers who treat more general populations. Siu et al. (1988) analysed hospital admission decisions for all subjects in the RAND Experiment who received in-patient care (excluding obstetrical care) and determined that prepaid providers reduced the rate of discretionary surgery as well as discretionary and nondiscretionary medical admissions.

When investigators compared hospital admission rates of individuals who received care from capitated versus FFS providers in Ontario in the early 1970s, they found lower admissions among patients enrolled in Health Service Organizations (Abelson & Birch, 1993). A controlled trial in Ontario that used a multiple, time-series design and matched capitated, primary care physicians with FFS doctors found no between-group differences in hospital separations (Hutchison et al., 1994). These researchers speculated that hospital admissions and in-patient days were becoming less discretionary in the mid-1990s, and admission and discharge decisions were increasingly being made by specialists.[5] Therefore, primary care physicians may be less able to influence the decision-making process regarding whether a patient should be admitted to or discharged from a hospital.

Compared with FFS plans, enrollees in capitated health plans tend to have shorter hospital stays. Results from the RAND Experiment in the 1980s found that enrollees in a staff-model HMO had 40 to 45 percent fewer hospital days depending on the diagnostic group evaluated (Manning et al., 1984; Siu et al., 1988). Chronically, mentally ill Medicaid recipients who were randomly assigned to capitated providers were more likely to have shorter in-patient stays than those assigned to receive FFS care (Lurie et al., 1992).

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[4] HMO providers, however, outperformed FFS plans by rendering shorter in-patient stays and lower hospital days per 1,000 beneficiaries (Brown et al., 1993).

[5] In the United States, this decision may be made in conjunction with a case manager employed by an HMO.

A systematic review of controlled trials that were conducted between 1980 and the early 1990s found that capitated plans reduced hospital stays by 5 to 20 percent (range: -1 to 45 percent) (Miller & Luft, 1994).[6] HMO enrollees in the Medicare Competition Demonstration had 17 percent shorter hospital stays (18 to 23 percent depending on the diagnosis) than their FFS counterparts (Brown et al., 1993).

Compared with FFS plans, enrollees in prepaid plans tend to have lower hospital days per enrollee. By testing for significant differences in hospital days per enrollee, the net impact of differences in admission rates and lengths of stays can be appreciated. Results from the RAND Experiment in the 1980s suggested that enrollees in a staff-model HMO had 40 percent fewer hospital days per enrollee (Manning et al., 1984). The results of a systematic review of studies conducted prior to the late 1970s also found that HMO plans had 35 percent fewer hospital days per enrollee (Luft, 1981). A systematic review of controlled trials that were conducted between 1980 and 1993 found that HMO plans consistently had risk-adjusted, lower hospital days per enrollee. The percent difference in hospital days per enrollee was three to 28 percent in the eight studies that used this measurement of resource utilization (Miller & Luft, 1994). Results from the Medicare Competition Demonstration suggest significantly lower hospital days per HMO enrollee, due to shorter hospital stays rather than reductions in the probability of admission (Brown et al., 1993).

A controlled trial that was conducted in Ontario that used a multiple, time-series design and matched prepaid, primary care physicians who received ambulatory care incentive payments with FFS doctors found no significant differences in hospital days per 1000 practice population (Hutchison et al., 1994).

Compared with FFS plans, there does not appear to be consistent evidence that HMO enrollees make more or less contact with medical practitioners. In addition, there is no consistent evidence that HMO enrollees make higher or lower use of outpatient and physician services once contact is established. Results from the RAND Experiment in the 1980s suggest enrollees at one HMO were no more likely to have a face-to-face visit with their physician than individuals who received care from FFS providers (Manning et al., 1984), but they had a

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[6] A reduction in length of hospital stay of -1 percent equals an increase in hospital stay by 1 percent.

significantly higher probability of receiving an outpatient mental health visit (Wells, Manning & Benjamin, 1986). When investigators from RAND conducted randomized trials at two other locations (one HMO at each site) in the 1990s, they found no significant differences in the likelihood that individuals would use medical care given that their caregivers were paid capitation or FFS (Leibowitz et al., 1992; Mauldon et al., 1994)

Medicaid beneficiaries assigned to HMO providers during a randomized trial in Hennepin County, who had a chronic mental illness, were less likely to receive out-patient care. These HMO enrollees also received fewer annual ambulatory visits (Lurie et al., 1992). Seniors on Medicaid from this county, who were randomly assigned to capitated providers, also had a lower likelihood of visiting a physician than those who were assigned to FFS providers (Lurie et al., 1994).

Results from the Medicare Competition Demonstration (quasi-experimental, controlled trial) suggested that a larger proportion of HMO enrollees visit a physician each year. In addition, beneficiaries who had joint or chest pain and were enrolled in HMOs were significantly more likely to visit a physician. These individuals were less likely to see a specialist, to have a follow-up visit or to have their progress monitored (Brown et al., 1993; Clement et al., 1994).

Results from the cross-sectional portion of the Medical Outcome Study (i.e., quasi-experimental, control trial) indicated that adults from the general population, who are enrolled in capitated health plans, have a higher number of office visits per year than those who received care from FFS providers. In fact, HMO enrollees had eight percent more physician visits per year than those who received care from FFS physicians in solo or single-specialty group practices (Greenfield et al., 1992). Adult patients recruited to the longitudinal portion of the Medical Outcomes Study because they had hypertension or diabetes did not receive any more/less physician services (i.e., visits per year) whether they received care from capitated or FFS providers (Greenfield et al., 1995).

In summary, results from three randomized trials suggest that there is no between-group differences in the likelihood that an individual will come into contact with a medical practitioner. The subjects in these studies were recruited from the general or Medicaid population. Results of a fourth randomized trial where individuals, who had chronic mental illness or was elderly, suggests that HMO enrollees were less likely to visit a physician. In addition, the chronically ill HMO enrollees had fewer visits per year. Quasi-experimental studies suggest that seniors are more likely to contact providers if they are enrolled in HMOs and to visit these practitioners more often.

It is difficult to interpret whether higher or lower ambulatory care visit rates among HMO enrollees are appropriate or unnecessary. Lower rates would be appropriate if capitated providers were: (a) rendering more complete care during a visit and thereby reduced the necessity for a subsequent visit, or (b) reducing unnecessary care. Alternatively, lower rates would be inappropriate if prepaid providers were withholding appropriate services. Lastly, higher rates would be appropriate if providers were substituting ambulatory for in-patient care. There have not been any studies evaluating the appropriateness of ambulatory visits rates between capitated and FFS providers.

Compared with FFS plans, enrollees in prepaid plans generally receive less intensive or expensive procedures, tests or treatments per visit or episode of illness. Results from the RAND Experiment in the 1980s suggested that HMO enrollees visited a specialist less frequently for mental health treatment and were more likely to see a therapist or a general/family practitioner rather than a psychiatrist or psychologist (Wells, Manning & Benjamin, 1986). A systematic review of controlled trials that were conducted after 1980 found that HMO plans used an average of approximately 20 percent fewer procedures, tests or treatments (Miller & Luft, 1994). Results from the cross-sectional portion of the Medical Outcomes Study indicated that adults from the general population, who received care from capitated providers, are just as likely to have received a test during a physician visit than those who received care from FFS physicians. HMO enrollees, however, received fewer tests and prescriptions per visit (Greenfield et al., 1992). Among adults in the Medical Outcome study who had hypertension or diabetes, there were no significant differences between those who received care from capitated or FFS providers in terms of their medication usage. Twenty-four percent of individuals with hypertension who received care from FFS providers obtained treatment from a sub-specialist in comparison to eight percent of those who received care in IPAs and two percent of those in HMOs (Greenfield et al., 1995).

HMO enrollees from the Medical Outcomes Study, who had joint or chest pains, were less likely to be referred to a specialist, receive a follow-up visit, or have their progress monitored. They were more likely, however, to visit a physician, receive medication and participate in physiotherapy (Clement et al., 1994). Results from the Medicare Competition Demonstration also indicated that HMO plans made less use of intensive care units, medications, procedures, and tests during in-patient admissions. In addition, HMO enrollees are typically discharged to less-costly health service locations (e.g., skilled nursing versus rehabilitation, home health versus rehabilitation). Although HMO enrollees are equally likely to get home care, these people received 50 percent fewer visits relative to FFS beneficiaries (Brown et al., 1993). These findings of fewer home care visits per beneficiary has been documented by other investigators (Schlenker, Shaughnessy & Hittle, 1995).

Compared with FFS plans, there is no consistent evidence that prepaid arrangements may reduce the cost of care to providers, health plans, or consumers. Results from the RAND Experiment, conducted with data from 1976 to 1981, suggested that the total cost per enrollee was 28 percent lower for enrollees in a staff-model HMO than recipients of FFS care (Manning et al., 1984). Expenditures were approximately three times higher among those who received mental health services under FFS plans (Wells, Manning & Benjamin, 1986). When investigators from RAND conducted randomized trials with the Medicaid population at two other locations (one HMO per location) they found conflicting results. At one site HMO enrollees had higher ambulatory expenditures (i.e., imputed charges) than those assigned to FFS providers. There were no significant differences, however, between HMO enrollees and FFS beneficiaries in terms of in-patient expenditures (Buchanan et al., 1996;). At the second site, Leibowitz et al. (1992) found that differences in ambulatory and in-patient expenditures could be entirely accounted for by selection effects.

A systematic review of quasi-experimental research conducted prior to the late 1970s showed that HMOs had substantially lower costs secondary to lower hospital admissions (Luft, 1981). Miller and Luft's (1994) more recent systematic review of controlled trials found small, non-significant differences in hospital charges per stay and physician/outpatient charges per person between HMO enrollees and recipients of FFS care. Researchers from the Medicare Competition Demonstration estimated that HMOs may have spent 10.5 percent less to offer Medicare benefits than FFS providers (Brown et al., 1993). Some researchers suggested that lower provider costs had not translated to lower expenditures by payers when capitation rates were determined based on utilization in the FFS sector and/or the rate did not account for the differential selection of the enrolled research group (Freund et al., 1989; Leibowitz et al., 1992).

Miller and Luft (1994) concluded that there are inadequate 'bottom-line' estimates of expenditures per enrollee or growth in expenditures per enrollee. Few researchers have included differences in out-of-pocket expenses incurred by enrollees and there has been little research to demonstrate any differences in risk-adjusted premiums. Survey research, however, found that when employers in Minnesota offered HMO plans to families, premiums increased an average of $25 per month. In addition, indemnity plan premiums subsequently increased by $15 due to adverse selection by HMOs (Feldman, Dowd & Gifford, 1993).

Researchers who speculate why prepaid health services might reduce the costs of care to providers and/or health plans attributed savings to lower rates of hospital utilization per enrollee, fewer discretionary medical and surgical admissions, fewer intensive services per ambulatory visit and the use of less costly practitioners and service settings (Brown et al., 1993; Clement et al., 1994; Greenfield et al., 1992; 1995; Miller & Luft, 1994; Schlenker et al., 1995; Siu et al., 1988; Stearns et al., 1992; Wells et al., 1986).

Compared with FFS plans, enrollees in prepaid plans appear to receive comparable quality of care in terms of process indicators and health outcomes. Researchers who have evaluated service quality tend to test for significant differences in the process of care (e.g., access, appropriateness, etc.), and outcomes between capitated and FFS systems. Results from the Medical Outcomes Study suggested that adults from the general population reported higher levels of financial access to primary care when they enrolled in capitated plans. People who obtained primary care from FFS providers, by comparison, reported higher levels of organizational access, continuity and accountability. Service coordination was higher but comprehensiveness was lower in HMOs than FFS plans (Safran, Tarlov & Rogers, 1994). A larger proportion of individuals who received care from FFS providers under indemnity plans trusted their physicians to "put their health and well-being above keeping down the health plan's cost" than salary, capitated, or FFS managed care patients. Thirty-seven percent of individuals did not know how their doctor was paid and 30 percent were incorrect about their doctors method of payment (Kao, 1998).

Results from the RAND Experiment suggested that a staff-model HMO in Seattle had lower rates of discretionary surgical admissions, as well as lower rates of discretionary and non-discretionary medical admits (Siu et al., 1988). Investigators from RAND who conducted a more recent randomized trial with Medicaid beneficiaries in one state suggested that HMO providers reduced the likelihood of acute care visits and these reductions were concentrated among those who had no health problems (Mauldon et al., 1994).

Results from the Medical Outcomes Study suggested that individuals who received care from general medical clinicians were less likely to be diagnosed and receive appropriate care for clinical depression if they saw a capitated provider.[7] In a randomized trial, method of provider payment was not a determinant of appropriate care for depressed people who saw mental health specialists (Wells et al., 1989).

Results from the 1987 National Health Interview in the United States indicated that HMO enrollees are more likely to have received five of six cancer screening tests (Bernstein et al., 1991). In addition, Medicare beneficiaries who enroll in HMOs seemed to be diagnosed at earlier stages or similar stages of cancer compared to those who received care from FFS providers (Riley et al., 1994). Lastly, the findings from a population-based study suggested that female Medicare beneficiaries who received care from capitated providers were more likely to receive therapy that is recommended for early stage breast cancer. These investigators did not, however, find between-group differences in 10-year, risk-adjusted breast cancer deaths (Potosky et al., 1997).

In Ontario, two studies have been conducted to compare the level of preventive and health promotion activity among physicians who practice in salaried, capitated, or FFS environments. Vayda found that FFS physicians were less likely to have a system in place to recall patients for immunization and screening programs than capitated or salaried practitioners (as cited in Abelson & Birch, 1993). By comparison, Abelson & Lomas (1990) found no significant differences between these groups in terms of their approaches to disease prevention and health promotion. Salaried physicians, however, were more likely to self-report involvement in health promotional activities (Abelson & Lomas, 1990).

The results from randomized trials in Hennepin County with Medicaid recipients indicated that method of payment was not a determinant of the type of therapy rendered or the use of medications among elderly beneficiaries, who were diagnosed with hypertension or diabetes (Coffey et al., 1995). Investigators, who conducted a retrospective study at a medical practice that served patients with capitated or FFS health plans, found no significant differences

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[7] Appropriate care was defined as the detection of depression, as well as the provision of counselling or referral.

in the stage of breast cancer (n = 200 cases) at which physicians (n = 174) made a diagnosis (Kulkarni et al., 1989).

Results from the RAND Experiment in the 1980s suggested that 'average' enrollees in a staff-model HMO had health outcomes after three or five years that were roughly comparable to individuals who received care from FFS providers. Health outcomes were measured in terms of physiological status, serious symptoms, functional status, role functioning, mental health, social contacts, days spent in bed and general health (Sloss et al., 1987; Ware et al., 1986). Results from a randomized trial in Hennepin County with Medicaid recipients indicated that method of payment was not a determinant of health outcomes of Medicaid recipients who were elderly or chronically, mentally ill. Health outcomes were measured over the course of seven to 12 months and included self-rated general health, functional status, role and community functioning, and psychiatric symptoms (Lurie et al., 1992; 1994). HMO enrollees who were diagnosed with schizophrenia, however, had slightly greater declines in community functioning than those who received care from FFS providers (Lurie et al., 1992).

Investigators from the Medical Outcomes Study also found no significant differences in health outcomes between adult patients with hypertension or diabetes who received care from capitated or FFS providers over the course of seven years. Health outcomes were measured in terms of physiological, functional and health status as well as mortality rates (Greenfield et al., 1995). Results from the Medical Outcomes Study also suggested that method of payment was not a determinant of the general physical and mental health status of the 'average adult' who received health services from capitated or FFS providers over the course of four years. Elderly and poor HMO enrollees, however, were twice as likely to have reported decline in self-rated, physical and mental health than those who received FFS care (Ware et al., 1996). Ware et al. (1986) found between-group differences when health outcomes were analysed by populations at-risk. In particular, the unhealthy poor had superior outcomes under FFS care.

Results from Medicare Competition Demonstration studies found no significant differences in the likelihood of decline in functional status between beneficiaries who received care from capitated or FFS providers (Retchin et al., 1992). Method of provider payment was not a determinant of: (a) persisting symptoms or the likelihood of recovery among Medicare beneficiaries who had pain in their joint or chest (Clement et al., 1994); or (b) mortality, hospital re-admissions or post-admission complications among Medicare beneficiaries who had a stroke or colon cancer (Brown et al., 1993). Lastly, Oleske et al.'s (1998) population-based study found that HMO enrollees were less likely to have low-birth-weight infants, but method of payment was not a significant determinant of other adverse maternal or newborn outcomes.

In summary, there is some indication from randomized trials that prepaid plans may make more appropriate use of acute care but that there are few differences in the process of ambulatory care between capitated and FFS plans. Quasi-experimental studies find that prepaid plans made more use of preventative services, but the results from both randomized and controlled trials suggest that method of payment was not a significant determinant of health outcomes for the general population. Individuals identified as at-risk, however, had better health outcomes in FFS plans.

Compared with FFS plans, enrollees in capitated health plans are just as satisfied with their care but they value different features or services. Results from the RAND Experiment in the 1980s suggested that enrollees in a staff-model HMO were just as satisfied with their overall care compared to individuals who received services from FFS providers. HMO enrollees were more satisfied with the costs of care, emergency services, and office waits; but were more dissatisfied with the availability of specialists and hospital services. Method of provider payment was not a determinant of how an individual rated their access to and the availability of family physicians. People who were assigned to FFS providers, however, were more satisfied with the continuity of care (Davies et al., 1986).

Quasi-experimental studies have also found that HMO enrollees tend be just as satisfied with the overall services rendered by their health providers as FFS recipients (Brown et al., 1993; Kasper & Riley, 1992; Tudor, Riley & Ingber, 1998; Rossiter, Langwell, Wan & Rivnyak, 1989; Tudor, Riley & Ingber, 1998). HMO enrollees, however, are more satisfied with financial access to services or the cost of care (Brown et al., 1993; Kasper & Riley, 1992; Newcomer, Preston & Harrington, 1996; Tudor et al., 1998). HMO enrollees are just as or more satisfied with the interpersonal quality of providers (Brown et al., 1993), but tend to be less satisfied with technical quality (Rossiter, Langwell, Wan & Rivnyak, 1989; Tudor, Riley & Ingber, 1998).

2.2.3. Summary

There are a number of different methods by which to remunerate providers. As payment mechanisms differ in the 'signals' they send to providers, and insofar as these incentives influence behaviour and the practice patterns of physicians, financing schemes may impact the delivery of health services (Birch et al., 1994; Giacomini et al., 1996).

There are a number of threats to the internal validity of quasi-experimental designs that have been used to evaluate the impact of physician payment mechanisms. While there have been a few randomized trials that have been able to randomly allocate participants, provider organizations are not randomly selected nor adequately represented. In addition, there are a number of economic, political, institutional and contextual variables that may limit the external validity of studies to other jurisdictions or time periods. While the more salient issues that impact the validity of these evaluations have been described here, other factors that might impact the results obtained by researchers include the historic context of provider reimbursement (e.g., income dissatisfaction), physician supply, enrollee volume per provider, the contractual terms of the financial arrangement (e.g., withholds), the type and amount of risk and reward sharing, etc. Despite these limitations, researchers who have conducted randomized and/or controlled trials seem to generate consistent evidence that capitated and FFS providers differ in some respects (e.g., utilization of in-patient services) and not in others (e.g., quality of care and overall consumer satisfaction).

2.3.0. Historic Perspective on the Payment of Physicians

2.3.1. Physician Payment in Canada

The cornerstone of Canada's health services sector is the *Canada Health Act* of 1984, which affirms the federal government's commitment to providing residents with medically necessary hospital and physician services. The Act states that the "primary objective of Canadian health policy is to protect, promote and restore the physical and mental well-being of residents of Canada and to facilitate reasonable access to care on the basis of defined need". The Act establishes "criteria and conditions in respect of insured health services and extended health care services provided under provincial law that must be met before [federal] full cash contribution may be made" (Health Canada, 1997).

To receive federal bloc grants and tax point transfers[1] each fiscal year under the *Canada Health and Social Transfer*[2], provincial and territorial governments must offer their residents health plans that are publically administered, comprehensive, portable, universally accessible, and without cost at the point of delivery. Since the establishment of the *National Medical Care Insurance Act* in 1966, provincial governments have been the primary source of funding for physician services and thereby allocate money raised through the tax system. Most physicians in Canada operate as private practitioners and receive remuneration on a fee-for-service (FFS) basis (College of Family Physicians of Canada, 1998). Modifications to this method of payment, however, have been made in response to budgetary constraints at the federal and provincial levels.

There have been a number of changes in the past few decades to the Canadian health care system in response to economic, demographic, technological, and societal forces. Fiscal restraint has caused provincial governments to become increasingly interested in predicting and limiting the total amount of money spent on physician services. Total expenditures under a FFS approach to provider payment are determined by the price per service, the volume of services rendered, and the number of physicians (Birch, Goldsmith & Makela, 1994). Therefore, provincial governments have sought budgetary control over expenditures on physician services by: (a)

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[1] "Tax point transfer" refers to the transfer from the federal government to provincial governments the right to tax certain amounts.

[2] The transfer of funds from federal to provincial governments for health, education, and social services.

placing 'hard caps' on total expenditures, (b) managing growth in utilization by using 'soft caps', (c) limiting or reducing the prices listed on fee schedules, (d) enforcing income thresholds, (e) restraining growth in physician supply, (f) de-listing services that are not deemed to be 'medically necessary', and (g) introducing alternative forms of remuneration (Lomas, Fooks, Rice & Labelle, 1989).

All province governments have used 'hard caps' to limit the total amount of money spent on physician services - with the exception of Saskatchewan and Manitoba which have employed a 'soft cap'. While hard caps are used to place an upper limit on total expenditures, soft caps provide a strategy where the government and physicians jointly assume responsibility for growth in service volume. When expenditure caps are exceeded, provincial governments recapture funds through retrospective or prospective fee proration, and/or reduction in planned fee increases (Lomas et al., 1989; Barer, Lomas & Sanmartin, 1996). Ontario, Newfoundland, Nova Scotia, Prince Edward Island, and Quebec all combine hard caps with individual physician thresholds, and these thresholds have been used to manage the remuneration of doctors whose annual billings are considered to be high (Barer, Lomas & Sanmartin, 1996; Lomas et al., 1989).

Historically, governments and medical associations in each province have negotiated to determine which services would be included in publicly-funded health plans and how much will be paid for each insured service. Today, there is a widespread feeling that the process of fee bargaining is costly in terms of political, human, and financial resources; and the prices listed on the FFS schedules do not reflect the relative value of different medical services (Stoddart & Barer, 1992). This has led Alberta, British Columbia and Ontario to investigate the relative value of fees (Government of Alberta, 1993; Wade, 1999; Serediak, 1993).

Provincial governments are able to control another determinant of total expenditures by restraining growth in the supply of physicians. When the supply of physicians is restrained, doctors are able to share financial resources among fewer practitioners. Physician supply has been constrained by limiting the availability of billing numbers (e.g., Ontario and New Brunswick), discounting the billings of new physicians (e.g., British Columbia, Ontario, Quebec and Saskatchewan), buying back billing numbers from doctors who are approaching retirement (e.g., Nova Scotia), limiting medical school enrollments (e.g., Ontario and Alberta), and restricting the entry of physicians trained outside of the province (e.g., Ontario and Saskatchewan) (Barer et al., 1996).

Another strategy that has been implemented by provincial governments, with the goal of limiting expenditures on physician services, is the de-listing of insured services. This has been accomplished by determining that certain physician services are not 'medically necessary', and thereby not covered under the terms of the *Canada Health Act* (Barer et al., 1996; Charles et al., 1997). In the early 1990s a joint management committee that included government representatives and members of the Ontario Medical Association (OMA) was established to identify services that were not medically necessary and therefore eligible for de-listing (Charles et al., 1997). This approach to cost control enables providers to have the opportunity to seek remuneration from alternative payers, as physicians have not been able to directly bill residents or private sector organizations for insured services since the late 1980s. It is estimated that private sector funding of physician services in Ontario amounted to approximately $20 million in 1997 (Preyra & Deber, 1997).[3]

In summary, the *Canada Health Act* affirms the federal governments commitment to providing residents with access to publically administered health plans and the provincial governments roll in remunerating doctors for medically necessary services. While most physicians in the country receive remuneration on a FFS basis, each province has implemented administrative mechanisms to control the amount of money spent on these services. Provincial strategies have been directed toward controlling total expenditures (i.e., hard caps), utilization (i.e., soft caps), the price of each insured service, and the supply of physicians. As the mechanisms used in each province vary, the next section will describe modifications to the FFS arrangement in Ontario and highlight the alternative methods of payment that have been used to compensate primary care physicians.

2.3.2. Physician Payment in Ontario

The Ontario Health Insurance Plan (OHIP) has been the primary funding source for physician services in this province since the enactment of the *Canada Health Act*. The Ontario Ministry of Health (MOH) allocates approximately 95 percent of it's budget for physician services to the OHIP which reimburses physicians on a modified-FFS basis. Total billings in 1994-1995 were $3.960 billion. The remaining 5 percent of the MOH's budget is disbursed

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[3] Total private sector health expenditures in the province in 1997 approximate $10.16 billion, while public sector spending approached $20.06 billion (Canadian Institute for Health Information, 1999a, 1999b).

through Alternative Funding Plans (AFP) that provide remuneration to providers on the basis of capitation, salary, or sessional fees (Chan & Anderson, 1996).

2.3.2.a. Modified FFS Sector

Approximately 94 percent of practising physicians derive the majority of their earnings from billing OHIP on a FFS basis (Canadian Institute for Health Information, unpublished data cited in Chan, 1999). OHIP payments to doctors are based on the type of insured service rendered and the fees outlined in a Schedule of Benefits. There are approximately 8000 fee codes, but 900 of these service codes account for more than 90 percent of medical services performed (Chan, Anderson & Thériault, 1998a; Henry, 1999). Physicians are given discretion as to how to interpret the Schedule of Benefits, as OHIP gives few guidelines regarding how to distinguish between similar fee codes (e.g., minor and intermediate assessment) (Chan et al., 1998a).

Over the past decade there have been a number of modifications to this FFS arrangement including the use of: (a) hard caps on total expenditures, (b) soft caps to manage growth in utilization, and (c) thresholds to control the incomes of individual physicians. These modifications have primarily been made to restrain growth of and enhance the predictability of total provincial expenditures on the OHIP. While most changes have been made following negotiations between the MOH and the OMA, on a few occasions these deliberations have required arbitration.

Historically, negotiations between the MOH and the OMA have focussed on changing and updating the services listed in the Schedule of Benefits (i.e., adding new procedures) and the prices associated with each intervention (Serediak, 1993). However, as total expenditures are a function of price and volume, the MOH has also become involved in managing the quantity of services rendered (Lomas et al., 1989). Between 1971 and 1985, utilization per capita in the country rose by 68 percent or at an annual rate of 3.8 percent (Barer, Evans & Labelle, 1988). Lomas et al. (1989) speculate that the increase in utilization per capita may have been driven by rapid increases in physician supply and fewer patients per practitioner, which created a context where the provision of more services per patient became one way to increase or maintain the income levels of physicians.

In 1982 the Ontario MOH and OMA established a committee to examine province-wide growth in the utilization of physician services. By the late 1980s a non-binding arbitrator was consulted and this "fact finder" concluded that the "gradual increase[s] in utilization per physician contributed significantly to physicians' incomes, and the financial responsibility therefore [for increases in service quantity] should be shared between the government and the profession" (Lomas et al., 1989, p. 90). As utilization per physician in the year preceding arbitration was approximately 1.5 percent, it was recommended that a global fee increase for 1987 be one half of this amount (0.75 percent) (Lomas et al., 1989). In 1988 negotiations between the MOH and the OMA also went to an arbitrator, who again recommended an adjustment to the overall fee increase based on a fifty-fifty split of responsibility for the prior years utilization.

In early 1991 the MOH and OMA signed an agreement requiring that the government and physicians jointly share responsibility for future increases in the volume of service provided to residents of the province beyond a specified threshold (i.e., a soft cap). In addition, individual practitioners' incomes were capped. Physicians were subjected to a one-third reduction in fees if their billings exceeded a $400,000 threshold, while those who billed above $450,000 were subjected to two-third reduction (Chan & Anderson, 1996). Exemptions were made for: (a) physicians in geographic areas deemed to be under-served, (b) certain specialists that were in high demand, and (c) the technical component of the diagnostic and therapeutic procedures (Chan, Anderson & Thériault, 1998b). The 1991 agreement also laid the foundation for the Alternative Funding Program (Thorne, 1994). Fees on the Schedule of Benefits were increased by 3.95 percent in October 1991. By October 1992, individual thresholds were raised to $402,000 and $452,250 and fees were increased another one percent (Chan & Anderson, 1996).

In August 1993 the government placed a limit on total OHIP expenditures (i.e., hard cap) - $3.850 billion for 1993/1994 and $3.085 billion for 1994/1995 and 1995/1996 (Chan & Anderson,1996). Hard caps imply that expenditures by the government in excess of these caps are fully recouped from physicians. When these expenditure targets were exceeded in Ontario, the MOH made adjustments for overruns by using an across-the-board percentage reduction in fees (i.e., clawbacks) (Barer, Lomas & Sanmartin, 1996). In November 1994 a utilization adjustment of $16 million was recovered from physicians (Chan & Anderson, 1996).

In October 1993 the Social Contract in the province called for a 4.8 percent fee reduction for six months. Between 1993 and 1994 fees on the Schedule of Benefits were adjusted no less than four times due to economic pressures on the provincial government. The 1993 contract also attempted to reduce the supply of physicians in the province by restricting new billing numbers to Ontario graduates. The 1993 Social Contract ended March 31, 1996. By 1994 a number of medical interventions were de-listed, including cosmetic surgery, sterilization and circumcision (Chan & Anderson, 1996).

Between fiscal years 1980-1981 and 1996-1997 utilization of physician services in Ontario increased at an annual compound rate of 4.1 percent and utilization per capita grew at an annual rate of 2.5 percent. Most of the increase occurred in the mid- to late- 1980s, while annual growth subsided in the early 1990s (i.e., 1.8 percent average annual growth) and the first decline in utilization occurred in 1993-1994 (Kralj, 1998).

Between 1989-1990 and 1992-1993, physician billings to the OHIP increased by 21.3 percent (i.e., $3.256 to $3.950 billion). Price-adjusted billings per physician during this time increased by 19.9 percent, while price-adjusted billings per capita increased by 11.4 percent. It has been estimated that billings increased by 7.6 percent due to growth in the population (Anderson, Chan, Carter & Axcel, 1996).[4] The number of general and family practitioners (GP/FP) per 10,000 residents in 1994-1995 was 7.93, an increase of 1.9 percent since 1989/1990. The mean gross payment per active physician in 1994-1995 was $179,000, an increase of 4.1 percent since 1989-1990.

In July 1996, the MOH introduced a third tier to individual physician threshold caps with discounts of 33.3 percent, 66.7 percent and 75 percent at each tier. The income level at which the threshold takes effect varies by specialty. The GP/FP thresholds were set at $300,000, $325,000 and $350,000 until April 1, 1999 when they were increased to $320,000, $345,000 and $370,000 for the 1999/2000 fiscal year (Ontario MOH, 1999).[5] Kralj (1998) suggested that some physicians have changed the specialty under which they were registered with OHIP in order to obtain higher individual thresholds. For example, Kralj indicated that growth in billings by physicians who registered as nuclear medicine specialists may be due to this type of change in

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[4] "Billings include Social Contract fee reductions in 1993/1994 and 1994/1995, but exclude threshold reductions and retroactive adjustments to payments. Price adjusted billings represent the amount that would have been billed if prices had remained constant at their 1994/1995 level" (Anderson, Chan, Carter & Axcell, 1996, p35).

[5] On April 1, 1999, the income thresholds for other specialists were set at $400,000, $425,000 and $450,000 for the fiscal year 1999/2000.

registration. When OHIP billings for the period April-October 1996 where compared to billings from April-October 1997, the number of doctors designated as nuclear medicine specialists increased by 10.7 percent and the volume of this type of service increased by 37.7 percent.

In May 1997 the MOH and the OMA reached a three-year arrangement that expires March 31, 2000 (Wexler, 1999). This agreement enabled physicians to bill 1.5 percent more per year from 1998 to 2000 in recognition of population growth and aging. A provision was made to increase prices, and in April 1999 fees listed on the Schedule of Benefits were increased by 1.45 percent (Ontario Medical Review, 1999). The agreement negotiated an allowance for a 2 percent increase in utilization, but a moratorium was placed on clawbacks (Preyra & Deber, 1997). Between April and November 1997 medical services utilization increased at a rate of 3.54 percent (Kralj, 1998). Negotiations for the next agreement are expected to commence January, 2000 (Wexler, 1999).

The May 1997 agreement between the MOH and OMA also mandated the establishment of a commission to develop a 'budget neutral' Relative Value Schedule (RVS) to replace the current Schedule of Benefits (Wade, 1998; 1999). Since that time the Resource Based Relative Value Schedule (RBRVS) Commission of Ontario has identified six resources that will be considered during the development of the new RVS, including: (1) the time required to offer medical services, (2) the knowledge, judgement and evaluation/management skills required to render care, (3) the physical effort and technical skills required to provide medical intervention, (4) stress due to the risks borne by patients and providers during the provision of a medical service, (5) direct and indirect practice costs, and (6) the foregone income associated with specialty training (i.e., opportunity costs) (Wade, 1998). Ultimately, the Relative Value Schedule will "rank and rate insured physician services according to the resource inputs required to perform those services ... to correct any distortion in the relativity of fees that may have occurred over time" (Wade, 1999, p. 1).

2.3.2.b. Not Fee-For-Service Sector

There are a number of health care organizations and physicians in Ontario that are remunerated through Alternative Payment Programs. The method of payment and the rate of pay used to compensate providers in these programs depends on the content of each contract. For example, in 1997 physician services that were rendered through emergency departments in eight hospitals in the province received compensation based on a standard rate per patient. Seven chronic care Alternative Payment Programs received remuneration based on a rate per bed, and four regional geriatric programs received salaried and sessional payments. At this time, there were 58 Alternative Payment Programs that received $121 million to support 479 full-time and 785 part-time physicians (Preyra & Deber, 1997).

In 1997 there were six Alternative Funding Plans that provided remuneration to 441 full-time and 393 part-time physicians. Approximately $926 million was distributed to these plans from the MOH, and the method of payment used to compensate these providers depended on the nature of the contract (Preyra & Deber, 1997). For example, in the early 1990s the Department of Pediatrics at the Hospital for Sick Children and the University of Toronto signed an agreement with the MOH to receive a global budget for the provision of physician services. Doctors who work at this practice receive a base salary and merit bonuses for outstanding teaching, service and research (Haslam & Walker, 1993). In 1994 the South Eastern Academic Medical Organization (SEAMO) in Kingston and the MOH signed an Alternative Funding Plan contract that provides an annual grant that is used to remunerate physicians who render inpatient and outpatient medical services and conduct non-clinical faculty activities at three teaching hospitals. Individual physicians are remunerated using an activity-based compensation model (Thorne, 1994).

Community Health Centres (CHCs) emerged in Ontario in the 1970s as a pilot project of the MOH, and there were 54 of these organizations in Ontario in 1998 (Association of Ontario Health Centres [AOHC], 1998). In 1997/98 there were 54 physicians who work at CHCs (Chan, 1999). These Centres are non-profit, community-governed, multi-disciplinary organizations that receive global funding to provide primary care to meet the specific needs of a defined population. Health promotion and illness prevention services focus on raising awareness of the broader determinants of health such as employment, education, isolation and poverty. In many communities, CHCs provide programs and services to people who have difficulty accessing a full range of appropriate primary care (AOHC, 1996). In 1996 there were 55 CHCs that provided services to approximately 184,000 people. In 1997 there were 120 salaried physicians working at these centres (Preyra & Deber, 1997).[6]

Health Service Organizations (HSOs) were established in Ontario in 1973 as a pilot project of the MOH. In 1998, HSOs indicated they their objectives were to:

1. "create an environment that is supportive of physicians and other health care personnel and which allows flexibility in responding to the health care needs of the population served;
2. develop a coordinated system of health care delivery which makes the most appropriate use of health care resources and which is accessible, efficient, and economical;
3. provide special attention to health maintenance and illness prevention measures which will enhance the health status of the population served; and
4. decrease institutional health care by giving emphasis to ambulatory care, self care and home care" (AOHC, 1998).

HSOs were initially funded on a global budget basis, but by 1978-1979 these organizations received remuneration on a capitated basis for the provision of primary health care. In 1979 an Ambulatory Care Incentive Plan was instituted to financially reward physicians in HSOs for reductions in the hospitalization rates of their rostered population, but this provision was eliminated in 1992 (Hutchison, Birch & Gillett, 1996a). At one time HSOs had the option to capitate specialty services to avoid "unnecessary and questionable referrals to specialties", but this too was eliminated in 1992 (Hutchison et al., 1996a, p. 15).

In 1987 the Premier of Ontario announced a plan to double the number of Ontario residents enrolled in HSOs, and declared that the funds for program expansion would be transferred from the FFS sector (Hutchison et al., 1996a). In 1979 there were 13 HSOs, but by 1987 there were 27 of these organizations serving approximately 190,000 enrollees. At their peak in 1991 there were 88 HSOs that provided care to over 500,000 residents. The Premier's

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[6] CHCs have also been established in Alberta, British Columbia, Manitoba, and Saskatchewan. Quebec has established a similar service delivery and funding model - the Centres Locaux De Services Communitaires (CLSC) (Abelson & Birch, 1993). In 1998 there were over 300 of these organizations in the country (AOHC, 1998).

program to expand the number of HSOs was frozen in 1991. Capitation rates were reduced by 9 percent in 1992 and by an additional 4.5 percent in 1993. Between 1985 and 1990, capitation rates increased from 6.2 to 16 percent per year due to increases in fees and service volume in the FFS sector. By 1994-1995, 77 HSOs received $77.5 million in capitated payments and program grants from the MOH (Chan & Anderson, 1996; Preyra & Deber, 1997).

By 1996 these organizations received funds on the basis of a blended funding arrangement which included capitated payments for general practice, FFS for designated medical specialty services, program grants, and charge backs or negation (AOHC, 1996). The capitation formula used to compensate HSOs for providing primary care adjusts the provincial, average, per capita costs in the FFS sector by the age and gender characteristics of rostered individuals. Initially, monthly payments were withheld (i.e., negation) when enrollees received services from physicians in the FFS sector. In 1993, however, negations were replaced with a 50 percent charge back for billings incurred by enrolled patients who visited physicians in the FFS sector (AOHC, 1996; Hutchison et al., 1996a). Apparently, HSOs do not receive any information from the MOH that would allow them to evaluate and respond to the needs of enrollees who also use FFS providers (personal communication, P. Ellison, July 1999).

Between 1995 and 1998 the number of HSOs in the province was 77 (Government of Ontario, 1998; Hutchison et al., 1996a). Seventy-one of these organizations were physician-sponsored practices, two HSOs were sponsored by non-profit corporations, and four HSOs were sponsored by health science centres (AOHC, 1998). In 1997/98 there were 82 HSOs in Ontario (Chan, 1999). By the late 1990s the median number of individuals enrolled in HSOs was approximately 4930, and in 1996 these organizations served a population of approximately 440,000 (AOHC, 1996; Hutchison, Birch, Hurley, Lomas & Stratford-Devai, 1996b). While there has been a moratorium on the development of HSOs since the early 1990s, a recent primary care initiative in the province will increase the number of physicians remunerated on a capitated basis (Government of Ontario, 1998).

In the late 1980s and early 1990s the MOH was considering the use of Comprehensive Health Organizations that would receive capitated payments for assuming the responsibility for providing or purchasing a full range (i.e., primary, secondary and tertiary care) of health services to residents who chose to become members (Abelson & Birch, 1993). The MOH indicated that the capitation rate methodology used to remunerate these organizations would account for the age, sex and illness patterns of members, but details regarding how and when this would be done were never given (Eyles, Birch, Chambers, Hurley & Hutchison, 1991). Although this model of delivery has been endorsed by the Ontario College of Family Physicians (1999a), Comprehensive Health Organizations have never been fully developed in any community in the province.

In conclusion, the *Canada Health Act* forms the basis of the relationship between physicians and their primary source of funding and establishes the government's responsibility to provide residents with medically necessary services. Most physicians in Canada and Ontario are private practitioners and receive remuneration on a FFS basis. There have been a number of modifications to this payment approach, however, in response to fiscal pressures on governments. Most provincial Ministries of Health have imposed administrative mechanisms to control the price paid for publicly-funded benefits, the volume of service rendered to residents, and the number of practitioners who bill.

In Ontario, there have been a number of modifications to the FFS arrangement between the MOH and physicians who work in the province. Initially, negotiations regarding OHIP expenditures focussed on changing the prices listed in the Schedule of Benefits. As the government came under fiscal restraint in the early 1980s, avenues were sought to control expenditures on medical care. As per capita utilization of physician services increased at an average, annual rate of approximately 4 percent between the early 1970s and mid-1980s , the government became interested in managing the volume of services rendered to residents through the use of soft caps and/or hard caps with clawbacks. Annual growth in utilization declined to 1.8 percent in the early 1990s.

Individual thresholds were introduced in 1991 and continue to be used. Between 1993 and 1996 the MOH-OMA agreement placed restrictions on new billing numbers in an attempt to control physician supply. It would appear that the price and volume controls used in Ontario restrained growth in expenditures in the early and mid-1990s. Although soft caps remain today, a moratorium was placed on clawbacks in 1997. Since the MOH-OMA agreement in 1997 the use of medical services has resumed growth at a rate of 3.5 percent.

The MOH and physicians have a mutual financial interest in de-listing services, a number of insured services have been removed from the Schedule of Benefits, and private remuneration is growing. Individual thresholds remain in effect to restrain the billing practices of certain physicians and address perceived income inequities within the profession.

In addition, certain regions of the province and cities (including Toronto) have been designated as oversupplied for general practitioners. New physicians who work in these locations face discounted fees (Ontario MOH, 1998).

The May 1997 MOH-OMA agreement established the RBRVS Commission to develop a budget-neutral, relative value scale to deal with perceived distortions in the relative value of fees on the Schedule of Benefits. The MOH currently supports a number of alternative models of service delivery and approaches to funding, but payments to doctors who operate in these environments only account for five percent of expenditures on physician services. Although the government and medical profession renewed their commitment to implementing and evaluating payment reform initiatives in primary care, they also agreed that OHIP funds would not be used to pay for a pilot project.

2.4.0. Current Situation

There is evidence from across Canada that governments and providers have renewed interest in implementing and evaluating alternative methods of paying for medical and allied health services. For example, Alberta and Saskatchewan now use capitation in the population-based formula used to fund health regions for the provision of inpatient, ambulatory (e.g., day procedures, clinics and emergency care), long-term, and community-based care (Alberta Health, 1996; Saskatchewan Health, 1994). Although physician services are not yet included in the Alberta and Saskatchewan formularies, Manitoba and a health region in Ontario have investigated the possibility of including physician services in a population-based formula to allocate financial resources to health regions (Eyles et al., 1991; Frohlich & Carriere, 1997; Mustard & Derksen, 1997).[1] In addition, while some physician organizations in Ontario currently receive capitated payments to provide primary care, a recent initiative by the MOH and the OMA would increase the number of doctors remunerated using this approach (Government of Ontario, 1998; Health Canada, 1999c). Primary care reform initiatives that include capitation financing are underway in Alberta, British Columbia, Ontario, Quebec and Saskatchewan (Hutchison et al., 1999; Health Canada, 1998; 1999b; 1999c). Therefore, the next section of this chapter describes payment reform initiatives that are occurring in Canada. Particular attention is given to recent developments in Ontario.

2.4.1. Recent Developments in Canada

In 1991 the Deputy Ministers of Health in Canada commissioned a review of the medical resource policies in Canada. A section of the final report, *Integrated Medical Resource Policies for Canada*, described problems with FFS payment and outlined future policy directions (Stoddart & Barer, 1992). The main problems identified included: (a) perceived inequity in provincial fee schedules and the subsequent inequities in incomes of different physician specialities, (b) the effect of FFS payment on service volume and continuity of care, (c) the political, human and financial costs associated with the fee bargaining process, (d) the lack of incentives for efficient allocation of physician resources, and (e) the effect of FFS payment on the relationship between hospitals and physicians who use them. The authors of this report

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[1] The capitation rate formulae used in these provinces will be discussed in the chapter on Capitation and Risk Adjustment.

recommend that "primary care should be [a] focus in the first round of payment reform ... The payment of fees for particular services [i.e., FFS payment] is neither effective nor efficient way to encourage and reward the management and gatekeeper functions [of primary care physicians]. Much more serious consideration needs to be given to capitation payment models or mixed capitation plus limited fee-for-service models" (Stoddart & Barer, 1992, p. 35)

In 1992 the College of Family Physicians of Canada proposed a 'Blended Funding Mechanism' for consideration by primary care physicians. This proposal had four components: (1) a base salary to compensate practitioners for a minimum number of work hours including payment for holidays, continuing medical education, pensions, and insurance; (2) compensation for overhead costs; (3) non-volume modifiers to encourage participation in teaching, research, etc.; and (4) volume modifiers to compensate individual work based on resource based relative value fee units (College of Family Physicians of Canada, 1995). This model was endorsed by the Ontario College of Family Physicians (OCFP) in 1995 and 1999 (OCFP, 1995; 1999b).

In March 1999 the OCFP proposed a 'revised' blended funding approach that was described in a report prepared for the Ontario Health Services Restructuring Commission (OCFP, 1999a). This model included five components: (1) a base salary to reflect training and experience, (2) overhead costs, (3) "capitation payments reflecting age, sex and severity of illness and geographic consideration", (4) fee-for-service funding for special services, and (5) a bonus system to encourage achievement of health targets. By November 1999 the College produced a position paper endorsing their 1995 blended funding model, but indicated that "a capitation type of remuneration could be used based on a patient roster" as the volume modifier.[2]

In 1994 the National Forum on Health was established to "inform and involve Canadians and advise government on innovative ways to improve the health of the population" (National Forum on Health, 1997). In a paper commissioned by the Forum, Marriott and Mable (1999) reviewed developments in other countries that have publicly-funded health care systems to highlight key issues to guide the evolution and reform of Canada's health care system. These authors indicated that one of the major trends in health sector reform was the horizontal and vertical integration of provider organizations. The key features in fully integrated models of delivery included: (a) capitation funding for all health services, (b) the registration of all citizens

[2] Refer to point number 4 in the preceding paragraph.

with the provider of their choosing, (c) an emphasis on primary care with general practitioner gatekeepers, (d) the declaration of a comprehensive set of core services or benefits that would become the responsibility of provider organizations, and (d) the autonomy of health organizations in determining administrative and financial relationships with providers. These authors suggested that residents should have the right to enroll with a provider of their choosing and transfer between capitated health organizations[3], and that rates include age and gender adjusters, as well as "other important factors" that account for "regional variations" in health needs and costs and enhance the specificity of funding formulae. Potential adjusters might include mortality indicators, health need factors, levels of education, car ownership, number of single mothers and/or ethnic makeup.[4] Unfortunately, it is unclear whether these authors recommend: (a) that capitated payment be made to providers that enroll the entire population of a geographically-defined region, or (b) residents roster with one of a number of capitated health care organizations that compete for enrollees.[5]

In 1994 the Deputy Ministers of Health commissioned a paper that outlined the "policy options for changing physician payment and delivery systems" and focused on "approaches to physician remuneration other than fee for service" (Birch, Goldsmith & Makela, 1994, p. 7). The authors of this document recommended an approach to financing primary care physician services that would be congruent with the goal of improving the health of the population. The proposed method of payment included the use of: (a) capitation with risk-adjusted rates to account for the relative needs of different populations, and (b) supplemental payments for providers that achieved specific outcomes (i.e., performance rewards).

Subsequent to this report, the Federal/Provincial/Territorial Advisory Committee on Health Services published a discussion document in 1995 and proposed a model for reorganizing

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[3] In fact, the Canada Health Act prohibits any restrictions from being placed on an individual's ability to choice a physician or location of care.

[4] The population-based, funding formularies used in the United Kingdom between 1977 and 1999 incorporated some of these area-based measures when calculating capitation rates for inpatient and community-based care. Empirical models used to allocate financial resources for general practitioner services in England between 1991 and 1999, however, considered the relative deprivation of rostered patients as measured by the Jarman Index.

[5] This distinction is important as the second scenario creates opportunities for risk-selection, which has direct implications for the selection of capitation rate adjusters.

primary care. The method of payment recommended was capitation with performance rewards. Again, it is difficult to determine from this document whether the authors recommend capitation on the basis of geographically-defined populations and/or capitated payments to primary care organizations who compete to roster residents within a specific region. The committee recommended that funding levels be "determined through the application of a capitation rate against the roster or against census data on the population of a geographic catchment area (especially rural areas). Capitation rates would be adjusted for age and sex with further adjustments for morbidity (e.g., standardized mortality ratios), geographic location and accessibility, community health needs and socioeconomic level, as appropriate. An extra allowance [would] be provided to areas of low population density to ensure they are adequately served by primary care providers ... Primary care organizations would incur risk in relation to the roster size each was able to maintain. Risk resulting from a relatively needy or ill population would be controlled by the capitation rate adjustments" (p. 11).

In 1994/1995 Saskatchewan began to distribute financial resources to district health boards using capitation as a basis for the funding methodology. The services for which this approach is now used include long-term care, inpatient care, outpatient non-primary care, home-based services, and rural health initiatives. In 1998-1999, approximately 80 percent of funding to health districts will be allocated using this funding method (Canadian College of Health Service Executives [CCHSE], 1998). In 1997/1998 Alberta began to distribute funds for inpatient, ambulatory (i.e., day procedures, clinics and emergency care), long-term and home care services toward regional health authorities using capitation as a basis for the funding methodology. District health boards in Saskatchewan and regional health authorities in Alberta are both responsible for providing a defined set of services to all residents within a geographically-defined area. While the funding methodology in both provinces is based on risk-adjusted capitation rates, the formula also accounts for regional differences in the cost of factor inputs, cross-boundary utilization, expected changes in population size, and no loss provisions (Saskatchewan Health, 1994; Alberta Health, 1998; 1999).[6] A needs-based funding formula was also being

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[6] The no loss provision in Alberta, for example, means that total funding for any region cannot be lower than prior year financial allocations. The intent of using top-ups, when necessary, is to provide regional authorities with some financial stability during the transition to population-based funding (Alberta Health, 1998). Details regarding these reforms are described in more detail in the chapter on Capitation and Rate-Adjustment.

developed to allocated funds to regional and community health boards in Manitoba, the Northwest Territories, and Nova Scotia (CCHSE, 1998; Frohlich & Carriere, 1997).

In response to a recommendation by the National Forum on Health, Health Canada established the Health Transition Fund in 1997 to generate information and evidence on the organization, funding and delivery of health services in the areas of home care, pharmacare, primary care and integrated service delivery (Health Canada, 1999a). This Fund has provided financial support for a number of pilot projects that include the use of capitation. For example, two projects in Quebec and one in Ontario incorporate the use of capitated payments to providers who offer: (1) integrated services for the frail elderly, (2) community-based services in a municipality, or (3) a new model of primary care service delivery (Health Canada, 1998; 1999b; 1999c).

In 1998 the Canadian Health Services Research Foundation (CHSRF) commissioned three papers on capitation and integrated health systems. Funding was primarily derived from the Ontario Health Services Restructuring Commission and CHSRF, with support from the Ministries of Health in British Columbia, Alberta, Saskatchewan and Manitoba (CHSRF, 1999). One document reviewed Canadian and international experiences with capitation funding, formula development and implementation for integrated health systems (Hutchison et al., 1999). The second document synthesized research evidence on the experiences of jurisdictions that use capitation funding (Hurley et al., 1999), while the last report described governance issues in integrated health systems (Forest, Gagnon, Abelson, Turgeon & Lamarche, 1999).

2.4.2. Recent Developments in Ontario

The organization, delivery and financing of health services in Ontario are undergoing reform and change is occurring across the full continuum of care. The 1991 agreement between the MOH and the OMA laid the foundation for programs that incorporated approaches to provider payment other than FFS. Since the mid-1990s various associations and interest groups in the province have created position statements declaring their vision of primary care and physician payment reform. These stakeholders included the five Chairs of Ontario's medical education programs (i.e., Forster et al., 1994), the Association of Ontario Health Centres (1995), the Provincial Co-ordinating Committee on Community and Academic Health Science Centre Relations (PCCCAR) (1996), the Ontario Medical Association (Graham, 1997), and the Ontario College of Family Physicians (1999). These proposals all endorse the use of capitation in some form. In addition, the MOH and the OMA will be implementing and evaluating a primary care model of delivery that incorporates the use of capitation (Government of Ontario, 1998).

In 1994 the five Chairs of Ontario's medical education programs published a document declaring their vision of primary care and physician remuneration. They proposed that the government have two budget components, one for individual health care and one for population health. Practice organizations would be entitled to funding from each component depending on the size and characteristics of their roster. Each family physician would receive a base salary according to their training and seniority. "A practice could earn its income on a FFS basis for individual care but per program for preventive or early diagnostic programs. Capitation could be combined with FFS payments for certain services ... incentive payments would recognize successful delivery of various kinds of services, mostly preventive services" (Forster et al., 1994, p. 157).

In 1996 the Sub-Committee on Primary Health Care of the PCCCAR recommended a move to "need-adjusted capitation formula" (PCCCAR, 1996, p. 41). This committee proposed that the government have three funds. One of these funds would provide remuneration to a primary care health agency for services rendered (i.e., mandatory service fund). Payments would be based on a FFS approach until the health agency reached a benchmark threshold - this threshold would be determined on the basis of the size of the roster and a capitation rate. In addition, there would be incentive funds for the attainment of health goals and targets. The next fund would be for exempt services such as obstetrical care, while the third fund would provide program funding for enhanced services and priority programs.

In early 1996 the OMA proposed a 'Reformed FFS' model (RFFS) that was very similar to the PCCCAR proposal for physician remuneration through the mandatory service fund. Under the OMA proposal, individual physicians would bill OHIP on a FFS basis until they reached a benchmark threshold. This threshold or ceiling on billings would be equal to the practitioner's roster size and a per enrollee rate determined by a capitation formula. This rate would be calculated by adjusting the provincial average rate by the age, sex and disease/illness characteristics of the roster. Services that would be exempted from the bench-mark threshold included obstetrical deliveries, emergency room work, anaesthetic services, surgical assists, house calls, palliative care and care rendered to residents in long-term care institutions or those with high-needs (e.g., HIV patients) (Graham, 1997). Survey research from a representative sample of OMA physicians indicated that only 53 percent of doctors in the province viewed this RFFS model as 'acceptable', while 81 percent rated FFS as acceptable. Thirty-seven percent of respondents viewed salary as acceptable and 36 percent rated capitation as acceptable (Jenkins, 1997).

In 1995 the Ontario College of Family Practitioners (OCFP) proposed a blended funding mechanism that contained four components: (1) a base salary to reflect workload; (2) overhead costs to separate income from expenses, (3) non-volume modifiers to encourage doctors to become involved in research, work in rural settings, etc.; and (4) volume incentives (OCFP, 1995). In 1999, the College revised these components to include the: (1) a base salary to reflect training and experience; (2) overhead costs, (3) capitation payments reflecting "age, sex and severity of illness and geographic consideration"; (4) FFS funding for special services such as night emergency call; and (5) a bonus system to encourage achievement of health targets (OCFP, 1999).

By mid-1996 the Minister of Health in Ontario launched primary care reform pilot projects and establish an Implementation Steering Committee (Kidd, 1997). After almost two years of deliberations the MOH and OMA announced that reform initiatives would be implemented at five locations in the province (Government of Ontario, 1998). While one of the original locations withdrew (i.e., Wawa), the total number of sites is now seven - Thunder Bay, Ottawa, Parry Sound, Hamilton, Chatham, Paris and Kingston. As of October 1999, 90 of 110 participating physicians had signed contracts with the government, and these practitioners have rostered over 80,000 residents. With the expansion of sites from five to seven, as many as 200 physicians and 450,000 people are expected to participate (Graham, 1999). The stated goals of this pilot project include the improvement of: (a) access to primary care, (b) quality and continuing of service, (c) patient and provider satisfaction with the health care system, and (d) the cost-effectiveness of health services. Although the financial arrangements used to remunerate physicians who participate in this pilot project have not been made public, the MOH and OMA initially envisioned that some sites would receive remuneration according the RFFS model proposed by the OMA in 1996. The remaining sites would receive "global capitation ... a variation of the current HSO model" (Graham et al., 1998a, p. 14; 1999; Gray, 1998).[7]

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[7] The exact modifications to the HSO model that would be made have not been specified.

Under the MOH-OMA reform initiative physicians, who chose to receive remuneration under the RFFS option, would not be subjected to restrictions on direct billing for 'excluded services' or for patients who were not rostered. Any changes to the Schedule of Benefits in the province, including recommendations from the RBRVS Commission, would apply to all rostered patients. In addition, five new fee codes would be created to enable physicians in the pilot study to bill for preventive care services, case conferencing, certain quality assurance initiatives, and home-care supervision. Physicians would not be subject to the individual thresholds place on FFS practitioners. Instead, physicians or Primary Care Networks could opt to have either individual or combined benchmark thresholds.

The formula used to determine the rate paid to physicians and/or Primary Care Networks would be based on factors including age and gender. In 1997, physicians were told that "the capitation rate per patient, adjusted to age, gender sex and health condition, must be negotiated" (Graham, 1997, p. 48). By 1998 the Government of Ontario indicated that the capitation rate would be "based on factors including age and gender. The capitation rate may later take into consideration such factors as urban verus rural living and the different health needs posed in different communities" (Government of Ontario, 1998). In 1998 physicians were told that the average capitation rate was set at $145 (Gray, 1998). The final contract included age (19 groups) and gender adjustments with the provision that the rates would be subject to review after a period of 18 months (Minister of Health, 1999). In summary, participating physicians would receive a blended compensation package with three streams of payments: (1) funds for capitated services to enrolled patients, (2) payments for excluded services for all patients, and (3) payments for capitated services to non-enrolled patients (Graham, 1998b).

Apparently, there has been some concern that the income of physicians who participate in the MOH-OMA pilot study might be adversely affected as a result of the transition to a new system of remuneration. The OMA Working Group on Primary Care Reform is currently evaluating strategies such as risk-pools to ensure income stability. On April 1, 1999 this MOH-OMA project received $18.4 million from Health Canada under the Health Transition Fund (Health Canada, 1999d).

In summary, there is evidence from across Canada that governments and physicians are interested in evaluating alternative methods of paying for medical services. When a national stakeholder analysis was conducted in the early 1990s, the primary culprit cited as the problem with medical resource policy was the FFS approach to remuneration (Stoddart & Barer, 1992). There have been a number of position papers put forward by national and provincial organizations as well as policy analyst groups declaring various visions of primary care and physician payment reform. One of the themes that immerges when these documents are reviewed is the use of capitation. Proposals recommend that capitation be combined with performance rewards (Birch et al., 1994; Federal/Provincial/Territorial Advisory Committee on Health Services, 1995), incentive payments (Forster et al., 1994; PCCCAR, 1996), program budgets (PCCCAR, 1996), or FFS (Graham, 1997; PCCCAR, 1996). Alternatively, capitation could be incorporated into a formula that would be designed to allocate financial resources among health regions (Alberta Health, 1999; Saskatchewan Health, 1994) or determine billing thresholds (Graham, 1997; PCCCAR, 1996).

It is recognized that capitation rates must be adjusted to account for the relative needs of different populations, but most proposals simply make this recommendation without declaring the adjusters that should be used - other than age and gender. In addition, it is often not clear whether stakeholders support capitation on the basis of geographically-defined populations or whether residents will roster with capitated health care organizations that compete for enrollees. This distinction is important as the second scenario creates opportunities for risk-selection, which has direct implications for the selection of capitation rate adjusters.

3.0.0.Purpose and Objectives

The purpose of this research project was to identify and evaluate capitation rate adjusters that could be used to fund a family practice for the provision of primary care services for rostered adults. The objectives of this project were to evaluate the use of:

1. Age and gender as rate adjusters.
2. Age, gender and other individual characteristics as rate adjusters.
3. Age, gender, other individual characteristics and community attributes as rate adjusters.
4. Age, gender and community attributes as rate adjusters.

3.1.0. Research Questions and Hypotheses

What are the relative contributions of various individual-level (predisposing, enabling, and need), provider-related and community-level enabling characteristics to explaining variability in physician resource utilization between individuals and groups?

Hypothesis 1: Age and gender (hereinafter referred to as a base model) will be significant determinants of physician resource utilization after controlling for provider-related characteristics.

Hypothesis 2: Measures of need will explain more of the variability in the use of physician services than individual-level predisposing factors, enabling characteristics, and/or community-level characteristics.

Given that it may not be feasible from a policy perspective to collect numerous individual-level measures, which individual-level variables and/or measures of community-level enabling characteristics make the most significant contribution to a base model?

Hypothesis 3: The inclusion of individual-level (predisposing, enabling and need) and community-level enabling variables other than age and gender will significantly improve the performance of the base model.

Given that it may not be feasible from a policy perspective to collect individual-level measures other than age and gender, do area-based measures improve the performance of the base model?

Hypothesis 4: The inclusion of community-level enabling variables will significantly improve the performance of the base model.

3.2.0. Application of the Behavioural Model to Primary Care Capitation

The 1998 version of the Behavioural Model was selected as a theoretical framework for understanding the range of determinants that may influence how individuals, from a defined population, use primary care physician services. The variables selected for evaluation as potential rate adjusters included individual attributes (i.e., predisposing, enabling and need factors) and community characteristics. As the Behavioural Model identified other potential determinants of health service utilization, these factors were either controlled through the research design or statistically if participants varied in their exposure. Figure 8 depicts the variables evaluated in this project and this illustration is located at the end of the chapter.

When evaluating individual attributes and community characteristics for their appropriateness as adjusters, consideration was given to face validity, feasibility of data collection (i.e., current availability, the size of new investment in data infrastructure, administrative costs), measurement properties (i.e., reliability, frequency, stability, sensitivity to change), resistance to manipulation (i.e., 'gameability'), presence of perverse incentives, and predictive accuracy at the individual- and group-level. These are the criteria that have been used by others who have evaluated the suitability of different rate adjusters (e.g., Epstein & Cumella, 1988; Hutchison et al., 1999). This section provides an overview of the application of the Behavioural Model to this research project and examines the majority of these criteria. Sections 3.3.0. and 3.4.0. address the predictive accuracy of these variables at the individual- and group-level.

3.2.1. Health Delivery System and Environmental Characteristics

Phillips et al. (1998) suggested that characteristics of the health care delivery system influence health behaviour, personal health choices, and the use of health services. All participants and providers in this study were subject to the same health policies[1], resources, organizational and financial arrangements, as these individuals were recruited from one family practice and patients resided in communities that were located close to the research site. While participants and providers did not vary in their exposure to these health system determinants, the results of this study must be understood in the context of these contextual influences.

[1] Unless there exists intra-institutional biases.

Phillips et al. (1998) suggested that: (a) other environmental characteristics such as the economic climate and relative wealth of a region are determinants of health behaviour and service utilization, and (b) these effects exist secondary to the geographic location of a population. In the context of this research project, participants were considered to be influenced by the same macro-economic environment - in other words, all individuals were exposed to the economic environment of Ontario and Canada. These individuals, however, resided in different communities and were thereby exposed to different socioeconomic contexts by the virtue of the fact that they lived in households in different regions of Toronto. Phillips et al. (1998) suggested that when environmental determinants are measured at the level of the community in which individuals reside, they are considered to be community-level enabling variables.

3.2.2. Community-Level Enabling Variables

The community characteristics that were evaluated for potential use as rate adjusters included unemployment rates, government transfer payments as a proportion of total income, average dwelling value, female labour force participation rates, average income, median income, average census family income, median census family income, average income of private households, median income of private households, and the incidence of low income of the population in private households. These variables were selected based on evidence regarding a link between these contextual characteristics and health and/or service utilization.

Unemployment and Participation Rates. There is evidence of a link between unemployment and ill health. Systematic reviews of the international literature conclude that unemployment is linked to mortality and morbidity (Canadian Public Health Association, 1996; Jin, Shah & Svoboda, 1995; Lavis et al., 1998b), and unemployment rates have been identified a significant determinant of rates of mortality in Canada (Adams, 1981; Wolfson et al., 1999). Unemployment and labour force participation rates have been proposed as indicators for monitoring non-medical determinants of health among Canadian communities (Canadian Institute for Health Information, 1999).

Associations between unemployment or labour force participation rates and health service utilization rates at the community-level provide no confirmation that individuals who are unemployed are the people who are experiencing health problems (Avison, 1998). Turner (1995), however, found evidence of a significant interaction between individual-level employment status and the unemployment rate of a community and concluded that the health effects of joblessness increased with higher unemployment rates. Campbell et al. (1991, p. 753) suggested that unemployment rates act "as a marker of both material and social deprivation, not among the unemployed but for the community as a whole".

Unemployment rates have been used or proposed as rate adjusters in other jurisdictions. The unemployment rate of a community is one of eight variables included in the Jarman Index, which is a measure of social deprivation that has been used in England, Wales and Scotland to adjust primary care payments (Delamothe, 1990; Jarman, 1991).[2] The Carstairs and Townsend Indices have been proposed as alternatives to the Jarman Index due to their measurement properties, and both of these indices include unemployment as a variable (Campbell, 1991; Ben-Shlomo, White & McKeigue, 1992). In fact, unemployment rates have been proposed as an alternative to the Jarman Index, as these rates explain more of the variability in rates of general practice visits, hospital admissions and mortality rates (Campbell, Radford & Burton, 1991; Carlisle, Johnstone & Pearson, 1993). Unemployment and female labour force participation rates are both components of the Socio-Economic Risk Index (SERI) that was developed in Manitoba as an index of health status and need for services. The SERI has been proposed as a rate adjuster, if the Government of Manitoba decided to fund regional health authorities for the provisions of physician services (Frohlich & Mustard, 1996; 1997; Mustard & Frohlich, 1995).

Income and Relative Wealth. There is evidence of a link between income, health and service utilization. The level and distribution of personal and/or household income between individuals and communities have been identified as determinants of rates of morbidity, mortality and the use of health services (Kennedy et al., 1998; Lynch et al., 1997; Mustard et al., 1997; Wolfson et al., 1993; 1999). In addition, the incidence of low income has been proposed as an indicator for monitoring non-medical determinants of health among Canadian communities (Canadian Institute for Health Information, 1999).

Associations between area-based measures of economic context, income or the distribution of wealth and rates of health service utilization provide no confirmation that individuals who are unemployed or have low income are the people who experience health problems. Research conducted in Manitoba, however, contributes evidence that the inverse

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[2] Unemployment rates have also been used in England between 1995 and 1999 to risk-adjust funds allocated to regional authorities for acute and general inpatient services (Diderichsen et al., 1997; Smith et al., 1994; 1996).

income gradient in health status that is observed at the community-level accurately characterizes relationships at the household-level (Mustard et al., 1999). In addition, research that has been conducted in Ontario provides evidence that the median household income of communities was a significant determinant of individual-level variability in oral health behaviours and the likelihood of visiting a dentist, and these results held true even after controlling for the effects of self-reported household income (Locker, Payne & Ford, 1996; Locker & Ford, 1996).

While community-level indicators of income reflect socioeconomic environments, research suggests that it may be appropriate to use these measures as proxies for individual-level income when the latter are not available (Mustard et al., 1999; Krieger, 1992). While mean household income is not a good predictor of self-reported income among a sample of adults in Ontario, this community-level measure predicted as much variation in oral health outcomes and behaviours as did individual-level measures of income (Locker & Ford, 1996). Therefore, as measures of income were not available for patient participants in this study, community-level indicators of relative wealth were evaluated as indicators of economic context and personal circumstance.

Individual-level measures of income have been used in enrollment-based capitation funding formula in other jurisdictions. For example, the primary care capitation formula used in New Zealand adjusts for an individual's level of income (Hutchison et al., 1999).[3] In addition, the capitation formula used in the United States to pay for Medicare beneficiaries who enroll in Health Maintenance Organizations also adjusts for an individual's income.[4]

The use of census data to derive measures of employment and income for rate adjustment purposes is desirable from a number of perspectives, but it also has limitations. For example, the feasibility of using census data is high as this information is currently available, and linkage of OHIP and census data would not require a substantial financial investment in primary data collection. In addition, census data is collected, aggregated and available for use through a process that is transparent, and the amount of time required for these procedures is declining.

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[3] The adjuster accounts for whether or not an individual is a Community Service Card holder, and these cards are available to people of low income (Hutchison et al., 1999).

[4] The adjuster accounts for whether or not an individual is eligible for Medicaid - a program that insures low income Americans for health services. In the future, it is expected that the welfare status of an individual will be used as an adjuster (Hutchison et al., 1999).

Aggregate measures are made available through public-use files, with the exception of measures of income in small communities. The use of census data for rate adjustment would, however, require accurate information on the residence of beneficiaries. As the residential location of enrollees would impact the amount of payment received by capitated providers, these organizations would have an incentive to ensure that the Ministry maintained complete and accurate data on postal codes. In addition, the rates paid to providers who enrolled individuals who do not have a residential address would need to be determined.

The census is only conducted every five years, although between-census projections could be used to derive annual estimates of rates. An infrequent data collection period, however, has implications for the timeliness of information and the validity of measures between each census. Although the unemployment rates used in this study were derived from the 1996 Census, these rates are available on a monthly basis (Lavis et al., 1998). Measures of income, however, could only be compiled every five years or estimated.

The degree to which measures derived from the census are stable over time is difficult to measure, as change in rates may reflect true differences in a community or simply measurement error. Frohlich and Carriere (1997, p. 4) recognized that census data "contain significant rounding, sampling and perhaps systematic error" and evaluated the stability of a rate adjustment formula using these data. These researchers recommended that data from more than one time period be used to create rolling averages for use in resource allocation formulae.

Area-based indices of health that were derived from national household survey data are used as adjusters in the Netherlands - where individuals selectively roster with competing capitated insurers. Therefore, community-level measures of health are attributed to individuals (van de Ven et al., 1994). Although the Canadian government currently conducts surveys to assess and monitor health, the sampling strategies used in these evaluations are only representative of provincial jurisdictions and large regional health districts. While Statistics Canada is initiating a nation-wide, community-based survey - the Canadian Community Health Survey (CCHS) - to provide regular and timely cross-sectional estimates of health determinants, health status and health system utilization, this data will only be available for 130 health regions rather than smaller geographic units (Statistics Canada, 1999).

The 1996 Census contained new questions on disability, but Statistics Canada (1997, p. 11) warned that information derived from these items should be used with caution as "comparisons of 1986 and 1991 disability data from the Health and Activity Limitation Survey and from the census indicated that there are major differences in the two data sources". While these items likely hold potential as rate adjusters, this information was only collected from a 20 percent sample of households. Therefore, information obtained from this type of census question necessitates that area-based measures of health be attributed to individuals, unless capitation is established on the basis of geographically-defined rosters. Hutchison et al. (1999) suggested that obtaining health status information for the entire population every five years as part of the census for the purpose of rate adjustment may be feasible.[5]

The use of some area-based measures from the census as adjusters may hold more political appeal than others. Indicators that measure sectors of the economy over which governments are expected to assume direct accountability, such as unemployment rates, may not be politically attractive. Alternatively, measures that may have face validity from the public's perspective, such as the incidence of low income, may be more appealing. Governments may, however, opt to avoid adjusting for non-medical determinants of service use that the public doesn't directly associate with health. For example, the Resource Allocation Working Party in England avoided using non-health adjusters "in order not to provide excuses for not remedying the cause" (Holland, 1998, p. 939).

3.2.3. Individual-Provider Related Variables

Phillips et al. (1998) suggested that provider-related variables include: (a) the characteristics of individual practitioners that interact with patient characteristics to influence utilization, and (b) the patient factors that may be influenced by providers. In the context of this research project, individual-provider related determinants of utilization were controlled by the research design and statistically. For example, the use of an eligibility criterion requiring that patient participants consider themselves rostered to a physician provided a control for between-subject variability in one type of provider-related variable - namely having a regular source of care. Having a regular source of care was identified as a provider-related determinant of utilization according to the Behavioural Model (Phillips et al., 1998), and evidence derived from research conducted in Canada supports this theoretical proposition (Dunlop, 1998). Therefore, the inclusion of this eligibility criterion in the research design provided a control for some

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[5] Naturally, this type of data could also be used for other important policy initiatives.

provider-related characteristics. Information identifying the primary physician was also entered into multivariable models to statistically control for influences that related to specific practitioners.

3.2.4. Population Characteristics

The predisposing characteristics of individuals that were evaluated for potential use as rate adjusters included age, gender, marital status, the number of adults at home, educational status, work status, and country of birth. Enabling resources included the use of English as the primary language in the home. Characteristics of need included perceived health and disability, activity limitation, and the use of hospital and primary care services in the preceding year.

Age and Gender. Hutchison et al. (1999) argued that "age and gender adjustment (while insufficient) will almost always be an appropriate starting point for health care capitation formulae" (p. 20). Evidence from recent research conducted in Ontario supports the notion that age and gender are determinants of primary care physician use, as both characteristics have been identified as determinants of whether or not an individual will visit a general practitioner in a one year period and the frequency of visits among those who make at least one (McIsaac, Goel & Naylor, 1997). In Manitoba there is evidence of gender differences in annual expenditures on physician services, particularly among individuals between 20 and 50 years of age (Mustard, Kaufert, Kozyrskyj & Mayer, 1998).

Age and gender are used in primary care capitation formula in Alberta (e.g., Tripartite Pilot Projects), British Columbia (e.g., Primary Care Demonstration Project), Ontario (e.g., Health Service Organizations and Primary Care Reform Project), Saskatchewan (e.g., Alternative Payments and Resource Planning) and Finland (e.g., Population Responsibility Program) (Hutchison et al., 1999). Capitated primary care environments in the Netherlands, Norway, and the United Kingdom adjust for age, but do not adjust payments on the basis of gender (Hutchison et al., 1999).[6]

It is expected that the use of age and gender as rate adjusters has face validity from the public's perspective and is feasible from an administrative perspective. As this type of information is currently available, the use of these adjusters would not require a substantial

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[6] Providers in these jurisdictions compete to roster enrollees, and individuals are able to select from an array of capitated providers (Hutchison et al., 1999). Recent reforms in England and Wales, however, will result in more geographically-based primary care groups (Groves, 1999).

investment in data infrastructures. Research on the completeness and accuracy of administrative databases suggests that this type of demographic information is of high quality in Canadian data sets (Williams & Young, 1996).

Marital Status & Number of Adults in the Home. There is conflicting evidence in Canada regarding the significance of marital status as a determinant of the incidence of a visit to a physician and the frequency of visits among those who make at least one (Birch et al., 1993; Broyles et al., 1983; McIsaac et al., 1997). Marital status has, however, been identified as a significant determinant of self-ratings of poor health (Kennedy, Kawachi, Glass & Prothrow-Smith, 1998), as well as the incidence and frequency of physician contacts in other jurisdictions (Joung, van der Meer & Mackenbach, 1995; Wolinsky, 1978). The size of a family and the presence of others in the home have been identified as determinants of self-rated health (Kennedy et al., 1998), the frequency of visits among those who contact a physician at least once (Stoller, 1982), and the number of annual visits to a general practitioner (Arling, 1985; Wolinsky, 1978).

Educational Status. Research evidence suggests that there is a relationship between the educational status of Canadians and their morbidity and mortality (Hay, 1988; Mustard et al., 1997), and similar results have been found in other jurisdictions (Kennedy et al., 1998). In fact, an adult's educational status is typically viewed as a stable, long-term marker of socioeconomic status as education attainment is usually set early in life (Hay, 1988; Mustard et al., 1997).

There is conflicting evidence regarding the significance of the educational status of Canadians as a determinant of: (a) the incidence of a visit to a physician (Birch et al., 1993; McIsaac et al., 1997; Stoller, 1982), or (b) the frequency of annual visits among those who make at least one (Birch et al., 1993; Stoller, 1982). Educational status has been identified as a determinant of the frequency of annual visits to a physician in the United States (Andersen & Aday, 1978; Arling, 1985), and recent evidence suggests that the educational status of Ontario residents is a significant determinant of the incidence of a visit to a general practitioner and the frequency of visits among those who make at least one (McIsaac et al., 1997).

Work Status. There is evidence of a link between employment, health and health service utilization. The employment status of Canadians has been identified as a significant determinant of: (a) the incidence of a visit to a physician (Birch et al., 1993; Dunlop, 1998), (b) the frequency of visits among those who made at least one (Birch et al., 1993), (c) the number of visits per annum to a physician (D'Arcy, 1986; D'Arcy & Siddique, 1985; Jin et al., 1995), and (d) high-use of general practitioner services among Canadians (Dunlop, 1998). The employment status of Ontario residents has been identified as a significant determinant of high-use of general practitioner services among men (McIsaac et al., 1993).

Country of Birth. Research evidence from Ontario suggests that immigrants, in comparison to Canadian-born residents, have slightly higher contact rates with general practitioners after controlling for age and self-rated health status (Wen, Goel & Williams, 1994). Information derived from nation-wide surveys, however, suggested that recent immigrants tend to be in better health than Canadian-born residents. By comparison, the longer that an immigrant lives in this country the more their health resembled that of their Canadian-born counterparts (Chen, Wilkins & Ng, 1996; Federal, Provincial and Territorial Advisory Committee on Population Health, 1999b).

Immigration status has been used as a rate adjuster in other jurisdictions. The National Health Service used an area-based measure of the proportion of the population born in 'New Commonwealth' in a funding formula to allocate resources to regional authorities for psychiatric services between 1995 and 1999 (Diderichsen et al., 1997). This same adjuster was used in a formula to allocate funds to health authorities for community-based services in England between 1997 and 1999 (Buckingham & Freeman, 1997).

The feasibility of using information on the marital, employment, and immigration status and social support available to Ontario residents is low as this type of data are currently not available to the Ministry of Health. Therefore, the use of any of these characteristics as rate adjusters would require a large investment in a data development and maintenance. Annual administrative costs of this type of primary data collection would be high, but may or may not be as high as the administrative costs of the current fee-for-service system. As data collection would likely occur during a visit to a physician, information on high-users would be more accurate than low- or non-users. The face validity of marital status from the public's perspective is likely to be low, relative to the employment and immigration adjusters. Alternatively, the face validity of the last adjuster may vary depending on whether more or less money is paid for individuals who are born abroad.

Home Language. According to the Behavioral Model, 'enabling resource' variables include those characteristics that impact the means and/or resources that individuals have available to them for the use of services. Researchers in Ontario have suggested that culture and language may impact the use of health care services, as residents from immigrant or ethnic/cultural groups report higher rates of contact with general practitioners, similar rates of contact with specialists and lower use of emergency departments compared to individuals born in Canada (Wen, Goel & Williams, 1994).

The results of a pilot study conducted at the research site suggested that individuals who were immigrants were four times more likely to be high-uses of physician services (i.e., six or more visits per year) than individuals born in Canada. When presented with this information, the Family Physician-in-Chief at the practice speculated that immigrants were more likely to be high-users due to language barriers. "In instances where language was an issue, more visits may result because the patient remained anxious and uncertain as to the nature and/or management of their illness" (personal communication, P. Ellison, December, 1997).

The feasibility of using information on the home language of Ontario residents is low, as this type of data would require an investment in infrastructure for primary data collection. In addition, measurement error and 'gameability' are high relative to other potential adjusters. For example, the proportion of individuals in Toronto who speak a language other than English is high, and it is likely that multi-lingual families may use more than one language in the home. The face validity of this type of adjuster is likely to be moderate, particularly considering that publically funded health services should be available in Canada's two official languages.

Health Status. The measures of need that were evaluated for potential use as rate adjusters included health status, disability status, activity limitation, prior utilization of primary care, and prior hospitalizations. Research that has been conducted in Ontario, elsewhere in Canada and abroad provides strong evidence of a link between needs for health services and use of health services. In fact, characteristics of need have been identified as the strongest determinant of health service utilization in Canada (Birch et al., 1993; Dunlop, 1998; McIsaac et al., 1997) and abroad (Bice & White, 1969; Sharp, Ross & Cockerham, 1983; Wolinsky, 1978).

The self-rated health status of Ontario residents has been identified as a significant determinant of the incidence of a visit to a general practitioner, the incidence of an emergency room visit, and high-use of physician services or emergency departments (Brown & Goel, 1993; McIsaac et al., 1997). In addition, the self-rated health status of Canadians has been identified as a significant determinant of the frequency of visits among those who visit at least once (Birch et al., 1993) and total annual visits to a physician (Roos & Shapiro, 1981). Similar conclusions have been reached in other jurisdictions (Andersen & Aday, 1978; Wolinsky, 1978).

Epstein and Cumella (1988) conducted a systematic review of the literature and determined that self-rated health status reached statistical significance 94 percent of the time (15/16 instances tested) when predicting ambulatory care utilization. Evidence from research conducted in the United Status suggested that adding information on self-rated health to an age and gender formula improved the explanatory power of multivariable models predicting annual expenditures on health services (Fowles et al., 1996; Newhouse et al., 1989; Parkerson, Broadhead & Tse, 1995).

Disability Status. Self-reported disability status was evaluated for its potential use as a rate adjuster. Researchers have proposed that this measure of need be incorporated to capitation formula in other jurisdictions, due to its explanatory power when predicting total annual health expenditures (Hornbrook & Goodman, 1996; Newhouse, 1986; Schauffler et al., 1992; Thomas & Lichtenstein, 1986). Empirical evidence has led some to argue that "disability status seems like a nearly ideal risk adjuster"(van de Ven et al., 1994, p. 125). This adjuster has been included in a capitation formula in the Netherlands.

After conducting a systematic review of the literature, Epstein and Cumella (1988) determined that disability status reached statistical significance 59 percent of the time (20/34 instances tested) when predicting ambulatory care utilization. Self-rated disability status and/or the presence or absence of chronic conditions has been identified as significant determinants of the incidence of a physician visit, the frequency of visits among those who make at least one, and annual expenditures on these services in Canada (Broyles et al., 1983; Roos et al., 1998). Similar conclusions have been reached in other jurisdictions (Arling, 1985; Wolinsky, 1978; van Vliet & van de Ven, 1992).

Activity Limitation. Self-reported activity limitation was also evaluated for its potential use as a rate adjuster. Measures of limitation in activities of daily living have been identified as determinants of the incidence of a visit to a physician (Stoller, 1982), the frequency of visits among those who visited at least once (Broyles et al., 1983; Stoller, 1982), and visits per annum (Wolinsky, 1978).

The use of self-rated health status, disability status and/or activity limitation as rate adjusters would likely have the highest face validity from the perspective of the public and providers. The feasibility of using this type of information, however, is low as all of these measures of need would require a large investment in data infrastructures. The expense of data collection and/or independent audits of these indicators would be substantial, as subjective measures may be susceptible to potential fraud (Newhouse et al., 1989).

The use of standardized instruments to assess the health and disability status of enrollees would provide a means by which providers and payers could measure and monitor unmet needs, and offer a "uniform metric across all diseases and health problems" (Hornbrook & Goodman, 1995, p. 68). As standardized assessment of self-rated health status, disability or activity limitation would not require that rostered populations access services, these measures of need might be less sensitive to selection bias than adjusters derived from utilization data (Hornbrook & Goodman, 1995). Newhouse (1998), however, argued that the addition of information on health status to a multivariate model was just as accurate at predicting annual expenditures as a formula derived from the use of diagnostic information derived from administrative data. Unfortunately, the use of a health status measure for rate adjustment may create adverse incentives for practitioners who improve the health of their population at a faster rate than others, because these providers would be financially penalized with lower allocations in future time periods.

Prior Year Visits & Hospital Utilization. Research evidence consistently suggests that prior use of services is a "potent determinant of subsequent use" (Starfield, 1998, p. 795). Research conducted in Canada suggested that hospital admission and/or the frequency of mental health visits in the preceding year were significant determinants of the frequency of visits to a physician (Roos & Shapiro, 1981; Roos et al., 1998). In addition, measures of prior utilization invariably made a significant contribution to explaining individual-level variability in total annual expenditures on health services (Andersen et al., 1990; Ash et al., 1989; Beebe, Lubitz & Eggers, 1985; Epstein & Cumella, 1988; Newhouse et al., 1989; Thomas & Lichtenstein, 1986; van Vliet & van de Ven, 1992; 1993). Researchers that have used measures of prior utilization to predict future utilization of health services and proposed the use of these indicators in capitation formula have documented the explanatory power of information on:

1. Prior year total costs, inpatient costs and/or outpatient costs (Anderson, Cantor, Steinberg & Holloway, 1986; Ash, Porell, Gruenberg, Sawitz & Beiser, 1989;

Newhouse et al., 1989; Thomas & Lichtenstein, 1986; van Vliet & van de Ven, 1992; 1993).

2. The presence or absence of a hospital admission (Ash et al., 1989; Beebe et al., 1985; Lubitz et al., 1985; Schauffler, Howland & Cobb, 1992; Thomas & Lichtenstein, 1986).
3. The number of prior admissions to a hospital (Beebe, Lubitz & Eggers, 1985; Thomas & Lichtenstein, 1986).
4. The number of days spent in a hospital (Beebe et al., 1985; Thomas & Lichtenstein, 1986).
5. The level of ambulatory care use or frequency of physician consults (Anderson et al., 1990; Schauffler et al., 1992; Thomas & Lichtenstein, 1986; van Vliet & van de Ven, 1993).

Prior use adjusters have been used, evaluated or recommended in other jurisdictions. The primary care capitation funding formula used in New Zealand adjusts rates on the basis of whether or not an individual holds a 'High Use Health Card'.[7] Eligibility for this card is based on the annual number of consultations with a general practitioner (Hutchison et al., 1999). The Primary Care Demonstration Project in British Columbia adjusts capitation rates on the basis of age, gender and information derived from in-patient and ambulatory care visits. Researchers in British Columbia now recognize and will be evaluating bias in data due to access and use (personal communication, R. Reid, 1999).[8] While the capitation rate formula used by the American government to pay providers who compete to enroll Medicare beneficiaries does not include information derived from prior utilization, researchers and policy advisors had recommended that administrative data derived from hospitalization be used for rate adjustment (Ash et al., 1989; Newhouse et al., 1997; Newhouse, 1998; Ellis & Ash, 1995; Ellis et al., 1996; Weiner et al., 1996).

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[7] Other adjusters include age, gender, and low income status.

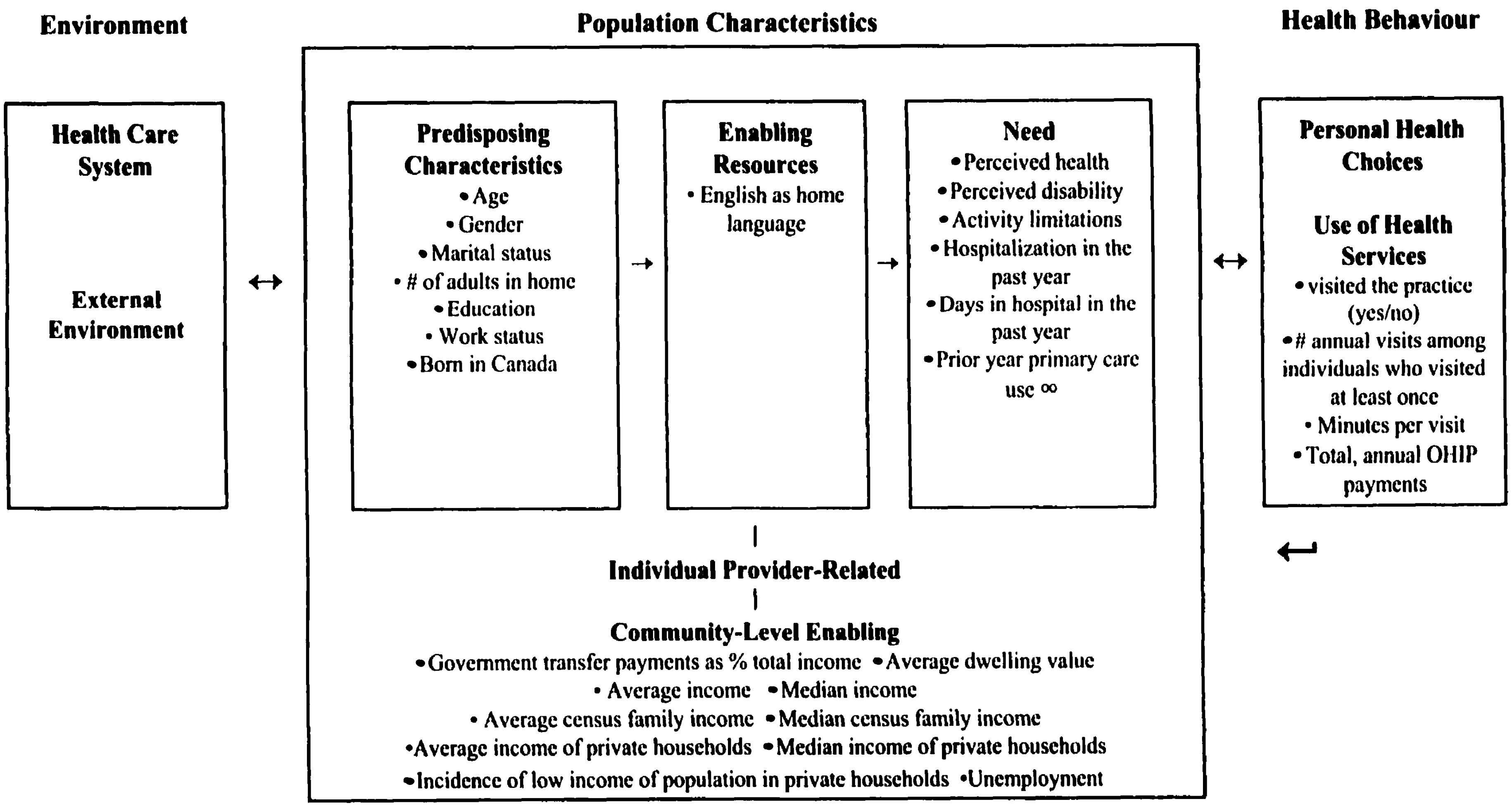
[8] Diagnostic information are more readily available for high-users than low-users, and no information is available on the medical conditions of individuals who do not visit during the time period in which the adjuster is constructed. In the case of Adjusted Clinical Groups which are being piloted in British Columbia, diagnostic information is collected from one year of administrative data.

While some researchers have proposed that data on prior ambulatory care usage, hospital admission and/or historic expenditures be incorporated into capitation formula, others have argued that "the problem with using prior use as a predictor, especially when resource allocations are based on it, is that it is highly amenable to manipulation by practitioners, whose recommendations for follow-up appointments leads to about 40 percent of all visits" (Starfield, 1998, p. 795).

The use of the measures of prior utilization as rate adjusters would require longitudinal linkage of individual-level OHIP data, or linkage of OHIP data with hospital discharge abstracts. Although information on prior utilization would require a smaller investment in a data infrastructure than other measures of need, these adjusters may have less face validity from the public and provider perspectives.

Figure 8

Independent and Dependent Variables Incorporated into the Utilization Model Proposed by Phillips et al. (1998)



Note. All community-based measures are at the level of the forward sortation area (FSA). ∞ This variable was only available for individuals in the random sample study.

3.3.0 Research Methods

3.3.1. Research Design, Unit of Analysis, and Ethics Approval

3.3.1.a. Research Design

A cross-sectional research design that involved stratified sampling (hereinafter referred to as the "Medical Minutes study") was used to explain variability in the amount of time that physicians spend providing medical services for one encounter with a patient. This measure of physician resource utilization was selected as time is one of the major resources consumed during the provision of medical services (RBRVS Commission of Ontario, 1997).

Alternative measures of physician resource utilization were also collected for individual patients - the total annual OHIP payments and the number of annual visits. This portion of the project was conducted using a survey research method that involved a stratified, random sampling strategy (hereinafter referred to as the "Visit/Payment study"). The information derived from a mailed questionnaire was linked with retrospective, administrative billing data.

3.3.1.b. Unit of Analyses

As described in the chapter on rate adjustment, in an environment where capitated providers' roster a sample of residents from a geographic region, risk-adjustment is needed to account for the variability between individuals. Therefore, the unit of analysis was an individual and adults rostered to the family practice research site were the population of interest. For the purpose of this study, individuals were considered to be rostered when they demonstrated that they used the Department of Family and Community Medicine, Toronto, Canada as their predominant source of primary care services.

3.3.1.c. Ethics Approval

The Medical Minutes study involved the compilation of social, demographic, health, and billing information on each participant, as well as the amount of time that their physician spent providing medical services. Patients who participated in this portion of this research project were informed about the project, agreed to partake in the study, and signed a consent form. The receptionists at the Department of Family and Community Medicine were provided with a written description of the protocol in order to secure informed consent from eligible patients. The physicians and residents who collected data regarding the amount of time they spent providing medical services were informed about the project either verbally or by memorandum. Therefore, the submission of information from these providers on the amount of time they spent providing medical services was considered as their consent to participate in the medical minutes study.

The Visit/Payment study involved the compilation of social, demographic, health, and billing information on each participant. All of this information is routinely collected from adult patients by administrative and clinical personnel at the practice. In addition, a statement on the questionnaire that was used to solicit this information indicated that the data derived from this process could be analyzed "to help us better understand the populations we service, and perhaps plan special programs". For the purpose of this project, this information was linked with billing data to better understand the populations serviced by the practice. Telephone and mail solicitation of data was conducted to update social, demographic and health information and minimize missing data elements. The entire OHIP record for an individual was not accessed from the Ontario MOH, but billing data from the practice was used. The submission of a completed questionnaire was considered as consent.

This project received approval from the Executive of The Toronto Hospital Committee for Research on Human Subjects on June 6, 1998 and the Office of Research Services at the University of Toronto on July 21, 1998.[1] A copy of the research proposal that was submitted for ethics review is provided in Appendix B, and the two approvals are provided in Appendix C. The consent form used for this study is in Appendix D.

3.3.2. Study Participants

3.3.2.a. Research Site

The Department of Family and Community Medicine at the University Health Network served as the research site. The Department is located in southwestern Toronto and is a large, academic, family practice that provides primary care services to approximately 13,000 individuals annually. The physicians who work at the practice offer educational experiences to first and second year residents. Staff physicians bill OHIP for services provided by residents under their supervision.[2]

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[1] The Toronto Hospital merged with other health service organizations to become a part of the 'University Health Network' in mid-1999.

[2] When a physician resident provides a service at the practice, they complete a Service Encounter Form that is co-signed by their clinical supervisor. The information contained on this form is used by a billing clerk to electronically submit claims to the OHIP.

Eleven physicians (hereinafter referred to as regular physicians) and the residents they supervised participated in the study. The 11 practitioners were chosen as they held routine office hours at the Department of Family and Community Medicine throughout the period of data collection.[3] While there were a number of other doctors who work at the practice, these individuals either did not provide care to patients during the entire period of data collection, or delivered services on an ad hoc, part-time basis. The residents supervised by the 11 practitioners were also included as participants as: (a) identifiers would be used to control for individual provider-level influences on the amount of time physicians or residents spent with patients (i.e., Medical Minutes study), and (b) it would be impossible to distinguish the care provided by residents from that which was provided by their supervisors using retrospective billing data (i.e., visit/payment study).

During the period of time when the Medical Minutes study was conducted, the Department of Family and Community Medicine offered primary care services during daytime hours from Monday to Friday and evening hours from Monday to Thursday. The family practice was divided into three multi-disciplinary work groups: Red Team, Blue Team and Green Team. Although registered nurses, a registered practical nurse and physician residents were assigned to each team, some of these individuals rotated among teams during different work shifts. There were similar work routines among the teams, and they all shared an administrative supervisor and medical record staff.

The Department of Family and Community Medicine has used computerized information systems for over 10 years and has collected information on the social, demographic and health profiles of their patients since 1996. Prior to this current project, these data were used for clinical and administrative purposes but not for research endeavors.

3.3.2.b. Subjects

This project involved the recruitment of two groups of adults: (a) a stratified, cross-sectional sample, and (b) a stratified, random sample. The first sample was recruited to assess the relationship between the characteristics of patients and the amount of time physicians spent providing medical services for one encounter with a patient. The second sample was selected to

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[3] The size of the patient caseloads assigned to these participants during the period of this study varied from 225 to 960.

assess the relationship between the characteristics of patients and their propensity to visit the practice, visits per annum, and annual payments made by OHIP to the practice on behalf of these beneficiaries.

3.3.2.b.i. Medical Minutes Study

A stratified, cross-section of patients was recruited between July 13, 1998 and October 19, 1998 to identify determinants of the amount of time physicians spent providing medical services. To be included in this sample, individuals must: (a) have visited the practice on at least one prior occasion; (b) had a regular physician as their designated primary provider[4], (c) be 16 years of age on or before July 1, 1998; and (d) signed a consent form. People who visited the practice for the first time were excluded from the sample due to the non-routine nature of their visit, and the fact that this may influence the amount of time their physicians spent providing medical services.[5] Patient participants were required to have one of the 11 regular physicians as their designated primary provider, although they may have received medical services from a resident who was supervised by one of these doctors. Participants in this study must have been old enough to provide informed consent. In addition, the literature suggests that capitation rate adjusters may be different for children than adults (Ben-Shlomo, White & McKeigue, 1992; Fowler & Anderson, 1996; Newhouse, Sloss, Manning & Keeler, 1993).

The sample was stratified by regular physicians in an attempt to ensure that the visits included in the sample: (a) were representative of the relative volume of services provided by these practitioners, and (b) did not over- or under-represent the practice patterns of certain doctors. If this had not been done, the data collection method that was used to obtain consent from patient participants and record the amount of time that physicians spent providing medical services would have resulted in data over- or under-representing the practice patterns of certain physicians. For example, regular physicians who worked on teams that had receptionists who were diligent in obtaining consent from patients would be over-represented without stratification.

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[4] The administrative staff at the Department of Family and Community Medicine make a notation on each patient's clinical record to identify the physician who has historically assumed responsibility for providing care. This physician is the 'designated primary provider'.

[5] Evidence from the literature supports this assumption (Kristiansen & Mooney, 1993; Smith et al., 1995; Wilson, 1991).

In addition, the physicians who were more diligent in recording the time they spent providing medical services would be over-represented without stratification.

3.3.2.b.ii. Visit/Payment Study

The sample frame used for this portion of the project (i.e., the identification of determinants of a visit, annual visits and annual charges) was constructed in June 1998 in an attempt to identify individuals who might be considered to be rostered to the Department of Family and Community Medicine. For the purpose of this study, individuals are considered to be rostered when they demonstrate that they used the practice as their predominant source of primary care. Figure 9 highlights the inclusion criteria used to determine a patient's roster status.

The clinical database at the Department of Family and Community Medicine was used to construct the sample frame. To be included in the sample frame individuals must have: (a) had a regular physician as their designated primary provider;[6] (b) been 16 years of age or older at the beginning of the data collection period (i.e., May 31, 1996); (c) registered to the practice prior to May 31, 1996;[7] (d) visited the practice between May 31, 1996 and June 1, 1998 [8]; (e) had a postal code indicating that they were a resident of Ontario; and (f) had a mailing address or postal code indicating that they did lived within commuting distance from Toronto.[9] The final sample frame included 4,245 individuals, which represents approximately 42 percent of all electronic clinical records. This sample frame was then stratified by age and gender and a random sample of individuals was selected based on these proportions.

One of the inclusion criteria required that patient participants make limited use of other doctors for primary care services to ensure that participants considered themselves to be rostered

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[6] It was important to exclude patients who did not have a regular physician as their designated provider, as individuals who registered with 'other doctors' at the Department would not have been able to access these practitioners whenever they needed primary care.

[7] Patients were considered to be 'registered' at the family practice when they provide basic demographic (i.e., name, address, date of birth) information and their OHIP number. This occurs during a patient's first visit to the practice.

[8] Researchers in Ontario found that 76 percent of adult males and 86 percent of adult females report at least one visit to a general practitioner over the course of a one year period (McIsaac, Goel & Naylor, 1993). Researchers in Manitoba report that 94 percent of residents of that province had at least one contact over a two year period (Tataryn, Roos & Black, 1995).

[9] Cases were excluded if their postal code did not begin with the letter "M" or "L".

to the practice. Patients were asked "In the past 12 months, how many times have you visited a family doctor who does not work at this clinic?". The response categories included "0 visits, 1 visit, 2 visits, 3 or more visits". As the exact volume of external physician resource use among individuals who visited another family doctor three or more times in the past year is uncertain (*n*=78), the final inclusion criteria for the Visit/Payment study required that participants visit another family physician two or less times in the preceding year. Results of one-way analysis of variance (ANOVA) indicated that individuals who did not visit a family doctor at another practice (*n*=536), as well as those who visited another physician one (*n*=74), two (*n*=49) or three or more times (*n*=78) in the past year did not differ significantly in terms of total annual OHIP payments ($F[3,733] = .885, p=.45$) or visits per annum ($F[3,733] = 1.30, p=.27$). Those who did not provide an answer to this question were excluded from the study, as the extent to which these individuals used other family doctors could not be determined.[10] The criteria used to construct the sample is summarized in Figure 9.

[10] In fact, results of one-way ANOVA indicated that those who did not respond to this question (n=119) did not differ significantly from those who did not visit a family doctor at another clinic nor those who visited one of these practitioners one, two or three or more times in the past year - in terms of total annual OHIP payments ($F[4,851] = 1.59, p=.17$) or visits per annum ($F[4,851] = 2.15, p=.07$).

Figure 9

Criteria for Selection of the Sample Frame and Participants - Visit/Payment Study

Individuals in the sample frame must have:

(a) Had a regular physician as their designated primary provider;*

(b) Been 16 years of age or older as of May 31, 1996;

(c) Registered to the practice prior to May 31, 1996;*

(d) Visited the practice between May 31, 1996 and June 1, 1998;*

(e) Been an Ontario resident for OHIP billing purposes; and

(f) Had a mailing address or postal code that indicated that they lived within commuting distance from the Department of Family and Community Medicine.*

Participants must have:

(a) Completed a social/demographic/health status questionnaire;

(b) Answered the question regarding the extent to which they used a family doctor who does not work at the research site;* and

(c) Indicated they had not used a family doctor at another practice more than twice in the past 12 months.* .

Note. * These criteria were used to construct a sample that represented people who might be considered rostered to the Department of Family and Community Medicine.

3.3.3. Variables

The measures of individual attributes and community-enabling characteristics that were evaluated were selected for the following reasons: (a) the variable must have been included in the Behavioural Model as a determinant of health service utilization, (b) research evidence lend support to the notion that the variable was a significant determinant of physician resource utilization, or (c) the variable may have been used in capitated jurisdictions where providers compete to roster enrollees. Naturally, the variables evaluated must have been available in the clinical or administrative database at the research site or in the public-use 1996 Census files from Statistics Canada.

Figure 8 in Section 3.2.0. provides a summary of the independent and dependent variables used in the analysis. Refer to Sections 1.1.0. and 3.2.0. for a discussion regarding theoretical background.

3.3.3.a. Independent (Control) Variables

3.3.3.a.i. Health Care System

As outlined Section 3.2.0. all participants and providers in this research project were subject to the same health policies, resources, organizational and financial arrangements. While these individuals did not vary in their exposure to these health system determinants, the results of this study must be understood in the context of these contextual influences.

3.3.3.a.ii. External Environment

As outlined in Section 3.2.0. all participants and providers in this research project were exposed to the same macroeconomic environment. Environmental determinants measured at the level of the various communities in which patient participants were lived were considered community-enabling variables. These potential rate adjusters are described in Section 3.3.3.b.ii.

3.3.3.a.iii. Individual Provider-Related

As individual provider-related characteristics can directly or indirectly influence the use of health services (Phillips et al., 1998), this variable was statistically controlled in multivariate analysis. In the Medical Minutes study, the physician who provided the service was selected as an independent variable as this practitioner was the individual who would most likely influence the amount of time spent providing medical services. In the Visit/Payment study, the primary provider was selected as an independent variable. In both studies, this variable was coded as nominal.

3.3.3.b. Independent (Predictor) Variables

3.3.3.b.i. Population Characteristics

Predisposing Characteristics

Age. The age of patient participants in the Medical Minutes study was calculated by measuring the interval of time between their date of birth and the physician visit. The age of a participant in the Visit/Payment study was calculated by measuring the interval of time between their date of birth and May 31, 1997 (i.e., the first day of the data collection period for the dependent variables). Age was coded as a continuous variable for analyses that required the use of linear regression. This variable was coded using age intervals for analyses conducted with logistic regression, so that results could be expressed as odds ratios. Five age categories were coded as follows: 16 to 30 years, 31 to 45 years, 46 to 65 years, 66 to 75 years, and 76 years or older.[11] Table 1 summarizes the coding strategy used for all independent variables, and this table is located at the end of this chapter. The capitation rate formula currently used in Ontario uses 15 different age categories for individuals 15 years of age and older. These categories were not used in this analysis, as many age clusters would have been under-represented in both samples.

Gender. The gender of participants was coded as a binary variable.

Marital Status. Participants were asked to indicate whether their marital status was single, married/partnered, divorced/separated, widowed or other. This information was coded as a binary variable (0 = single, divorced/separated, widowed, and other; 1 = married/partnered) for the following reasons: (a) the purpose of including this information was to measure the presence and/or absence of social support within the home, (b) a dichotomous measure would be more feasible for the Ontario MOH to use as a rate adjuster, (c) this type of adjuster has been used in other jurisdictions (Buckingham & Freeman, 1997), and (d) univariate analysis supported this dichotomy.[12]

Number of Adults in the Home. Patients were asked the following open-ended question: "Including yourself, how many adults (14 years and older) live at home?". This information was coded as a binary variable (0 = did not live with another adult in the home; 1 = lived with one or more other adults). A binary measure was selected for the following reasons: (a) the purpose of including this variable was to measure the presence and/or absence of social support within the home, (b) a dichotomous measure would be more feasible for the Ontario MOH to use as a rate

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[11] These categories were made after reviewing age groupings defined by the Institute for Clinical Evaluative Sciences (McIsaac et al., 1993), the groupings used by Ontario's MOH for capitation rate adjustment (Hutchison et al., 1997) and in consultation with two physicians at the practice (personal communication, T. Basinski & P. Ellison, 1997).

[12] Results of one-way ANOVA with the Bonferroni test for multiple comparisons indicated that individuals who were single, divorced/separated or widowed were similar in terms of total annual OHIP payments. Total annual OHIP payments were significantly lower, however, for people who were married/partnered ($p<.05$). Individuals who were married/partnered also made significantly fewer visits per annum than those who were widowed ($p<.05$), but did not differ significantly from individuals in other marital arrangements. The frequency of annual visits did not differ among those who indicated that they were widowed, single, or divorced/separated. When responses to the marital status question were collapsed into two categories (i.e., single, divorced/separated or widowed versus married/partnered), this variable remained significant as a predictor of total annual payments and the number of annual visits. Marital status, as measured using either five or two categories, was not a significant determinant of the amount of time physicians spent rendering medical services per visit.

adjuster, (c) this type of adjuster has been used in other jurisdictions (Buckingham & Freeman, 1997), and (d) univariate analysis supported this dichotomy.[13]

Education. Participants were asked "What level of schooling have you completed (approximately)?". Response categories included the following six categories "none, primary (1 - 9 years), secondary (10 - 12 years or high school), community college, university or postgraduate". The information on the educational status of participants was collapsed into two groups - individuals who have secondary school education or less, and those with post-secondary education. This coding strategy was selected as: (a) this type of measure would be more feasible for the Ontario MOH to use as a rate adjuster, (b) a similar categorization strategy was used by researchers in Ontario who found that educational status was a determinant of the frequency with which individuals visit a GP (McIsaac et al., 1993),[14] and univariate analysis supported this approach.[15]

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[13] Results of one-way ANOVA with the Bonferroni test for multiple comparisons indicated that the number of adults (i.e., using 5 categories - lives alone, 2 adults, 3 adults, 4 adults and 5 or more adults) in the home was not a significant determinant of the total annual OHIP payments, visits per annum or the amount of time physicians spent rendering medical care. When responses regarding the number of adults living in the home were collapsed into two categories, this variable was significant in predicting total annual OHIP payments ($F[1,650]$) = 8.20, $p<.05$) and the number of visits per annum ($F[1,650] = 7.12$, $p<.05$).

[14] Researchers in Ontario determined that educational status was a significant predictor of whether or not female adults visited a GP over the course of a year and whether male or female adults visited one of these practitioners six or more times over the course of a year. These investigators coded educational status according in the following categories: (a) individual's who did not have high school (i.e., responses 'none' and 'primary'), (b) people who had a high school education, and (b) those who had post-secondary school (i.e., community college, university or postgraduate) (McIsaac et al., 1993).

[15] Results of one-way ANOVA indicated that educational status, as measured using six categories, was a significant predictor of the number of visits per annum ($F[5,651] = 5.83$, $p<.001$) and approached significance when predicting total annual OHIP payments ($F[5,651]$ = 2,18, $p=.054$). The Bonferroni test for multiple comparisons indicated that individuals with primary or secondary education made significantly more visits per year than those with university or post-graduate education ($p<.05$). Individuals with community college education did not differ significantly from those with primary, secondary, university or post-graduate education. When responses to this question regarding educational status were collapsed into two categories (i.e., individuals with secondary school education or less versus those with post-secondary education), this variable remained significant as a determinant of visits per annum ($F[1,655] = 25.01$, $p<.001$) and became significant as a determinant of total annual OHIP payments ($F[1,655] = 8.94$, $p<.05$) and the amount of time physicians spent rendering medical services ($F[1,491] = 5.60$, $p<.05$).

Work Status. Participants were asked "What was your main activity during the past year? (check one only)", and response categories included the following eight categories "working full time, working part time, unable to work, looking for work, going to school, keeping a house, retired, other". Responses to this question were categorized into the following three groups: working, unable to work or looking for work, and other. This coding strategy was selected as: (a) this type of measure would be more feasible for the Ontario MOH to use as a rate adjuster, (b) this categorization is similar to that which has been used by other researchers in Ontario[16], and (c) univariate analysis supported this approach.

When responses to this question regarding 'main activity' were collapsed into three categories (i.e., working, unable to work or looking for work, and other), this variable remained a determinant of total annual OHIP payments ($F[2,654] = 20.89$, $p<.001$), visits per annum ($F[2,654] = 30.18$, $p<.001$), and the amount of time physicians' spent rendering medical services ($F[2,489] = 6.01$, $p<.05$).[17]

Born in Canada. Participants were asked "What is the country of your birth?". Immigrant status was included as a binary variable (0 = born in Canada; 1 = born in another country) as this categorization strategy would be more feasible for the Ontario MOH to implement for the purpose of capitation rate adjustment than the use of specific information on country of birth.

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[16] For example, investigators who analyzed data from the Ontario Health Survey indicated that employment status (i.e., working versus other) was a significant predictor of whether or not men visited a GP six or more times over the course of a year (McIsaac et al., 1993).

[17] Results of one-way ANOVA indicated that 'main activity', as measured using eight categories, was a significant predictor of total annual OHIP payments ($F[7,649] = 7.83$, $p<.001$), the number of visits per annum ($F[7,649] = 10.53$, $p<.001$), and the amount of time physicians' spent providing medical services ($F[7,484] = 4.47$, $p = .001$). The Bonferroni test for multiple comparisons indicated that individuals who were 'unable to work' or 'looking for work' had significantly higher total annual OHIP payments than those with any other 'main activities' ($p<.05$). Individuals who were 'unable to work' had significantly higher visits per annum than those with other 'main activities' ($p<.05$), but did not differ significantly from patient participants who were 'looking for work'. Individuals who were 'looking for work' were not significantly different from others in terms of the frequency of their visits, but there were only eight individuals in this cohort. Physicians spent less time providing medical services to individuals who were retired than those with other 'main activities'.

Enabling Resources

Home Language. Participants were asked to respond to the following phrase - "language spoken in your home?". This information was coded as a binary variable (0 = English as home language; 1 = language other than English used in the home) for three reasons. First, this categorization strategy would be more feasible for the Ontario MOH to implement for the purpose of capitation rate adjustment than the use of specific information on language usage and proficiency. Second, results from a pilot study conducted at the end of 1997 suggested that 77 percent of patients at the practice spoke English in the home, but no other language accounted for more than two percent of individuals. Third, results from the pilot study suggested that patient who spoke a language other than English in the home were significantly more likely to make six or more visits to see a physician at the practice within a one year period of time. Physicians at the Department of Family and Community Medicine indicated that this finding may reflect the reduced ability of these individuals to communicate with their doctor. Therefore, language was considered to be an 'enabling resource'.[18]

Need

Health Status. The health status of participants was measured by asking these individuals to respond to the question "In general, would you say your health is ....". Response categories included "excellent, very good, good, fair, poor". This question was phrased exactly as it appeared on the National Population Health Survey (Statistics Canada, 1995). The information derived from this question was coded as an ordinal variable with five levels as this categorization strategy has been used by researchers in Ontario who have found significant differences in the

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[18] The term 'enabling resource' was used to reflect the topology proposed by Phillips et al. (1998). While classified as 'enabling' this resource may 'enable' individuals to use fewer physician services (i.e., negative relationship) if both patient and provider speak the same language.

frequency of annual visits between each of these groups (McIsaac et al., 1993). Univariate analysis confirmed the appropriateness of this decision.[19] [20]

Disability Status & Activity Limitation. Participants' perception of their disability status was measured using two questions: (1) "Do you have any long-term disabilities or handicaps? By long term I mean a condition that has lasted or is expected to last more than 6 months?", and (2) "Are you limited in the kind or amount of activity you can do because of a long term physical condition, mental condition or health problem?". Response categories for both questions included "Yes" and "No", and these measures of disability were coded as a binary variable. Both the question on long-term disabilities and the question regarding activity limitation were phrased exactly the same as on the National Population Health Survey and the Health and Activity Limitation Survey (Statistics Canada, 1994; 1995).

Prior Hospital Utilization. Participants in the Medical Minutes study and the Visit/Payment study were asked "Were you admitted to a hospital during the past 12 months?". Response categories included "Yes" and "No", and this question was coded as a binary variable. It is difficult to determine from this question whether individuals who received day surgery would have responded yes or no to this question. Those who responded "Yes" were asked two open-ended questions: (1) "How many times?", and (2) "In total, how many nights did you spend in a hospital during the past 12 months". The number of times that a participant was admitted to a hospital was coded as three categories - 0 admissions, one admission, and two or more

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[19] Results of one-way ANOVA indicated that health status was a significant predictor of total annual OHIP payments ($F[4,651] = 6.88$, $p<.001$) and the number of visits per annum ($F[4,651] = 24.05$, $p<.001$). Health status approached significance when predicting the time physicians'spent providing medical services ($F[4,401] = 2.34$, $p = .054$). The Bonferroni test for multiple comparisons indicated that individuals with poor or fair health differed from those with very good or excellent health in terms of total annual OHIP payments ($p<.01$). Those with poor or fair health differed from those with very good or excellent health in terms the frequency of annual visits ($p<.001$), and those with good health differed from those with poor, fair, very good or excellent health in terms of the frequency of annual visits ($p<.01$).

[20] Thomas et al. (1986) determined that a single-question, four-choice measure of perceived health status had roughly the equivalent predictive power as a measure based on nine questions.

admissions.[21] The number of nights spent in a hospital was coded as three categories: 0 nights, 1 to 9 nights, and 10 or more nights. These coding decisions were made following univariate analyses.[22]

Prior Primary Care Utilization. A measure of the number of primary care visits made by participants in the year prior to data collection was included as an independent variable in the Visit/Payment study. This information was not available for participants in the Medical Minute study. OHIP billing information from the research site was used to construct this variable. This measure was initially coded and analyzed as a binary variable (i.e., 0 = zero to five visits; 1 = six or more visits) for the following four reasons.

First, one of the two categories (i.e., zero to five visits) was constructed in order to capture individuals who do not visit during a year, as well as those who saw a physician for one or two episodes of primary care for minor ailments. The second category was constructed to capture individuals who were 'high users'. The selection of six or more visits as an operational

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[21] Results of one-way ANOVA indicated that the frequency of hospital admissions was a significant predictor of total annual OHIP payments ($F[3,654] = 10.28, p<.001$) and the number of visits per annum ($F[3,654] = 9.54, p<.001$). The frequency of hospital admissions was not a significant determinant of minutes per visit. For this analysis, hospital admissions were categorized as no admissions, one admission, two admissions, and three or more admissions. The Bonferroni test for multiple comparisons indicated that individuals with no admissions differed significantly from those with one or more admissions in terms of total annual OHIP payments ($p<.05$) and the frequency of annual visits ($p<.05$). Individuals with one admission differed significantly from those with two or more admissions in terms of total annual OHIP payments ($p<.05$). When responses to this question were collapsed into three categories (i.e., no admissions, one admission, two or more admissions), this variable remained significant as a determinant of total annual OHIP payments ($F[2,655] = 14.62, p<.001$) and visits per annum ($F[2,655] = 14.28, p<.001$). This variable became significant in determining the amount of time physicians spent providing medical services ($F[2,405] = 3.09, p<.05$).

[22] Results of one-way ANOVA indicated that the length of hospital admission(s) in the past 12 months was a significant predictor of total annual OHIP payments ($F[4,654] = 3.55, p<.05$) and the number of visits per annum ($F[4,654] = 7.48, p<.001$). The Bonferroni test for multiple comparisons indicated that individuals with no admissions differed from those with four or more admissions in terms of total annual OHIP payments and visits per annum ($p<.05$). The frequency of hospital admissions was not a significant determinant of the amount of time physicians spend rendering medical services. However, sample sizes for various hospital stays were small and most individuals had no admissions (i.e., 65 percent in the medical minutes study; 87 percent in the visit/payment study). When responses to this question were collapsed into three categories (i.e., 0 nights, 1 to 9 nights, and 10 or more nights) to enhance the feasibility of using this type of adjuster for capitation rate adjustment, this variable remained significant as a determinant of total annual OHIP payments ($F[2,656] = 4.92, p<.01$) and the frequency of annual visits ($F[2,656] = 11.76, p<.001$).

definition of high physician resource utilization is in keeping with the definition used by other researchers in Ontario (McIsaac et al., 1993; Ontario Ministry of Health, 1992).

Second, a dichotomous categorization strategy with a threshold of six or more visits should reduce the adverse incentives inherent in using a rate adjuster based on prior utilization. Therefore, this threshold should minimize the opportunity for physicians to unnecessarily increase the number of times a patient visits during an episode of care (i.e., induce demand) and thereby 'up-code' their status to that of a 'high-user' (i.e., six or more annual visits) with the intent to seek a higher risk-adjusted rate during the next funding term. This type of dichotomous measure is used to adjust primary care capitation rates in New Zealand, where eligible individuals are given a high-use card (Hutchison et al., 1999).

Third, in late 1998 individual patients from the practice were asked to identify the number of times in the preceding 12 months that they used a family doctor who did not practice at the research site. Those who visited an external family doctor three or more times between 1997 and 1998 were excluded from the sample, and individuals who visited an external family doctor two or less times during this period were included in the study (assuming they met other inclusion criteria). The data used to construct the frequency with which participants in the study visited a regular physician at the research site, however, was from June 1, 1996 to May 31, 1997 (inclusive).[23] Notice that the 12-month period of self-declared external usage and the period of data collection on frequency of visitations is for two different time periods. Therefore, the accuracy with which this independent variable measured total prior primary care use is either accurate (i.e., participants did not visit a family doctor at another clinic) or it under-estimates utilization (i.e., participants visited another family doctor one or more times). A binary variable would allow for this measurement error.

Fourth, the use of the number of prior year visits in a capitation formula in Ontario provides: (a) a mechanism for the MOH to continue to collect information from physicians regarding their encounters with enrollees, and (b) an incentive for practitioners to record and submit these data to the government.

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[23] The collection period for data used to construct the dependent variable was from June 1, 1997 to May 31, 1998 (inclusive).

During the data analysis process, it was determined that the dichotomous measure of prior utilization was a significant and powerful determinant of visit frequency and annual payment. In fact, any rate adjustment formula derived from the coefficients of these linear equations would result in large differences in payment for individuals in each cohort (i.e., 0 - 5 versus ≥6 visits in the preceding year). To avoid creating a financial incentive for providers to induce-demand to cross this payment threshold, sensitivity analysis was conducted to determine the impact of using multiple categories of prior use (i.e., 0 - 2, 3 - 5, 6 - 8, and ≥9 visits). Multivariate models were constructed using a continuous measure, on occasion, for comparative purposes - although this measure of prior resource utilization is not recommended for rate-adjustment purposes.

3.3.3.b.ii. Community-Level Enabling Characteristics

Phillips et al. (1998) suggest that community-level enabling variables include the attributes of the community where individuals live that influence utilization. These variables "could be the same as delivery system characteristics [i.e., policies, resources, organization and financing] or external environmental variables [i.e., economic climate and relative wealth] with the distinction being that the level of measurement is the community" (Phillips et al., 1998, p. 592).

The external environments or the communities within which participants lived, however, were assessed using the following measures from the 1996 Census - government transfer payments as a proportion of total income, average dwelling value, average income, median income, average census family income, median census family income, average income of private households, median income of private households, incidence of low income of the population in private households, unemployment rate and female labor force participation rate. All of these measures were coded as continuous.

Government transfer-payments as a proportion of total income. Government transfer-payments[24] as a proportion of total income refers to the relative share of this income source, expressed as a percentage of the aggregate total income of that area. Total income includes

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[24] Government transfer payments include "all payments derived from federal, provincial and municipal governments during the calendar year 1995. This variable is derived by summing the amounts reported [by respondents to the 1996 Census] in: (a) the Old Age Security pension and Guaranteed Income Supplement, (b) benefits from Canada or Quebec Pension Plan, (c) benefits from Unemployment Insurance, (d) federal Child Tax benefits, and (e) other income from government sources" (Statistics Canada, 1997, p. 31).

employment income, government transfer payments, investment income, and other income (e.g., retirement pensions) (Statistics Canada, 1997).

Average Dwelling Value. This variable was selected as another measure of the economic climate and relative wealth, as other Canadian researchers have found it to be related to health status and physician resource utilization (Frohlich & Mustard, 1996; 1997). A dwelling is the "living quarters in which a person or group of persons resides or could reside" (Statistics Canada, 1997, p. 155).[25]

Average Income. The average and median incomes of individuals, census families, and private households were selected as measures of relative wealth. The average income of an area refers to the "weighted mean total of individuals 15 years of age and over who reported income for 1995. Average income is calculated from unrounded data by dividing the aggregate income of a specified group of individuals (e.g., individuals 15 years of age and over, census families, private households) by the number of individuals with income in that group" (Statistics Canada, 1997, p. 27).[26]

Median Income. The median income of an FSA area is that amount which divides the income size distribution into two halves (i.e., individuals or families below the median and those above the median). The average and median incomes of individuals are calculated for those people who are at least 15 years of age, excluding institutional residents, and who have an income (positive or negative) (Statistics Canada, 1997).

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[25] The value of a dwelling refers to the "dollar amount expected by the owner if the dwelling were to be sold ... the value of the entire dwelling, including the value of the land it is on and of any other structure such as a garage which is on the property. If the dwelling is located in a building which contains several dwellings, or a combination of residential and business premises, all of which the household owns, the value is estimated as a portion of the market value that applies only to the dwelling in which the household resides. Alternatively, the value of the dwelling is estimated to be multiplied by 100 the amount of rent per month which could be obtained for that one dwelling" (Statistics Canada, 1997, p. 165).

[26] $Y = \sum(Y_i W_i) / \sum W_i$ where, $Y =$ Average income of the group
$Y_i =$ Actual income of each unit (i.e., individual, family or household) in the group
$W_i =$ Weight of each unit (i.e., individual, family or household) in the group

Average Census Family Income. The average census family income refers to the "weighted mean total income of census families in 1995" (Statistics Canada, 1997, p. 126).[27] Average income was calculated using 'unrounded' data by dividing the aggregate income of census families by the number of families in that group, whether or not they reported income. "Average and median incomes of census families ... are normally calculated for all units in the specified group, whether or not they reported income" (Statistics Canada, 1997, p. 127).

Median Census Family Income. The median income for this family unit is the dollar amount which divides the income distribution for this cohort into two halves. Median incomes were calculated for all census families, whether or not they reported income (Statistics Canada, 1997).

Average Income of Private Households. A 'private household' includes a "person or group of persons (other than foreign residents) who occupy a private dwelling and do not have a usual place of residence elsewhere in Canada" (Statistics Canada, 1997, p. 141).[28] Average income was calculated using 'unrounded' data by dividing the aggregate income of private households by the number of households in that group, whether or not they reported income.

Median Income of Private Households. The median income for private households was the dollar amount which divides the income distribution of this cohort into two halves. Median incomes were calculated for all private households, whether or not they reported income (Statistics Canada, 1997).

The Incidence of Low Income. The incidence of low income is the percentage of private households below the low income cut-offs. Low income cut-offs are derived by considering income levels, family size, and degree of urbanization. For example, the low income cut-offs for individuals whose area of residents includes 500,000 or more people are $16,874 (family size of 1), $21,092 (family size of 2), $26,232 (family size of 3), $31,753 (family size of 4), $35,494

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[27] A 'census family' refers to a "now-married couple (with or without never-married sons and/or daughters of either or both spouses), a couple living common-law (with or without never-married sons and/or daughters of either or both partners) or a lone parent of any marital status, with at least one never-married son or daughter living in the same dwelling" (Statistics Canada, 1997, p. 117).

[28] A private dwelling refers to a "spare set of living quarters with a private entrance either from outside or from a common hall, lobby, vestibule or stairway inside the building. The entrance to the dwelling must be one that can be used without passing though the living quarters of someone else" (Statistics Canada, 1997, p. 159).

(family size of 5), $39,236 (family size of 6), and $42,978 (family size of 7 or more) (Statistics Canada, 1997).

Unemployment & Female Labour Force Participation Rates. The work status of the communities within which participants lived was assessed using unemployment rates and female labour force participation rates from the 1996 Census, as these variables have been used as adjusters in other jurisdictions (Delamothe, 1990; Ben-Shlomo, White & McKeigue, 1992; Campbell, Radford & Burton, 1991; Diderichsen et al., 1999; Smith et al., 1994; 1996) or have been found to be associated with the health status of Canadians (Canadian Public Health Association, 1996; Jin, Shah & Svoboda, 1995; Mustard & Frohlich, 1995).[29]

Statistics Canada calculates the unemployment rate as the "the unemployed labour force[30] expressed as a percentage of the total labour force[31] in the week (Sunday to Saturday) prior to Census Day" (1997, p. 64). The labour force participation rate represents the "total labour force in the week (Sunday to Saturday) prior to Census Day, expressed as a percentage of the population 15 years of age and over, excluding institutional residents" (Statistics Canada, 1997, p. 60). The female labour force participation rate is the total labour force in that group, expressed as a percentage of the population in that group.

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[29] The labour force participation rate for females 15 years of age or older was found to be a significant determinant of health status of residents in Manitoba, and has been included as a component of the Socio-Economic Risk Index (Mustard & Frohlich, 1995).

[30] Statistics Canada considers the individuals who fit the following description to be unemployed - "persons 15 years of age and over, excluding institutional residents, who, during the week (Sunday to Saturday) prior to Census Day, were without paid work and were available for work and either: (a) had actively looked for work in the past four weeks; or (b) were on temporary lay-off and expected to return to their job; or (c) had definite arrangements to start a new job in four weeks or less" (Statistics Canada, 1997, p. 63).

[31] The total labour force refers to "all persons 15 years of age and over ... who were either employed or unemployed during the week (Sunday to Saturday) prior to Census Day (Statistics Canada, 1997, p. 63). Those not in the labor force include institutional residents, and "persons who did not work for pay or in self-employment in the week prior to enumeration and (a) did not look for paid work in the four weeks prior to enumeration, (b) were not on a temporary lay-off, and (c) did not have a new job to start in four weeks or less. It also includes persons who looked for work during the last four weeks but were not available to start work in the week prior to enumeration" (Statistics Canada, 1997, p. 57).

3.3.3.c. Dependent Variables: Use of Health Services

3.3.3.c.i. Visits

The number of times participants in the Visit/Payment study visited a physician at the Department of Family and Community Medicine between June 1, 1997 and May 31, 1998 (inclusive) was summed. This information was used to construct two dependent variables to enable an analysis of physician contacts in two stages. The first stage required an analysis of the determinants of utilization (i.e., zero visits versus one or more visits). Individuals who did not visit the practice were coded as zero and those who visited the practice were coded as one, as a capitation formulae should adjust for the risk that an individual will visit a physician. In logistic regression multivariate models, the dependent variable is typically coded as zero when the outcome is absent and is equal to one when it is present (Hosmer, Taber & Lemeshow, 1991). The second stage required an analysis of the determinants of utilization once an individual sought care in the year. This dependent variable, therefore, was a continuous measure of annual visits.

3.3.3.c.ii. Minutes of Medical Service Per Encounter

Regular physicians and residents from the Department of Family and Community Medicine who participated in the Medical Minutes study were instructed to measure the amount of time they spent providing medical services to patients. Medical services were defined as "the amount of time any physician or resident spent directly with patients as well as indirect time (e.g., charting, etc.). Services can be provided by any resident or physician." Physician residents were instructed not to include the amount of time spent on educational activities that wouldn't have occurred had this doctor been a general practitioner (e.g., discussing the patient's condition with their supervisor). The amount of time a physician resident spent seeking information to learn about a diagnostic procedure or treatment protocol was not to be included, unless these doctors believed that this time would also have been spent by a practicing general practitioner in the process of providing care.

In early 1998 a small group of physicians at the practice was asked by the Family Physician-In-Chief to record the amount of time in minutes they spent directly with patients (N = 75). The distribution of minutes per visits had a range of 3 to 50 minutes and a mean of 22.3 (± 9.57 SD), median of 20, and mode of 25. The quintile cut-points were used to create five equal intervals: 0 - 15 minutes, 16 - 20 minutes, 21 - 25 minutes, 26 - 30 minutes and ≥ 31 minutes. These intervals were reviewed by three physicians who suggested that the 0 - 15 minute interval be altered to include 0 - 5 minutes, 6 - 10 minutes, and 11 - 15 minutes (personal communication, A. Basinski, B. Chan & P. Ellison, June 1998). Therefore, the following intervals were used for data collection: 0 - 5 minutes, 6 - 10 minutes, 11 - 15 minutes, 16 - 20 minutes, 21 - 25 minutes, 26 - 30 minutes, and ≥ 31 minutes. The value of the midpoint of each interval was used to code this information for analyses.

3.3.3.c.iii. Annual Ontario Health Insurance Plan Payments

This dependent variable represents the amount of money received by the Department of Family and Community Medicine from the OHIP for each participant included in the Visit/Payment study. The period of data collection was from June 1, 1997 to May 31, 1998 (inclusive).

Table 1

Coding of Independent and Dependent Variables

Variable	Coding Strategy	Source of Data
Age	Coded as a continuous, interval-level variable for analyses that required linear regression. Coded as a categorical, ordinal variable for analyses that required logistic regression: 16 to 30 years, 31 to 45 years, 46 to 65 years, 66 to 75 years, and 76 years or older.	Clinical database
Gender	0 = Male; 1 = Female. Coded as nominal data.	Clinical database
Marital status	Coded using five categories for descriptive statistics - single, married/partnered, divorced/separated, widowed, or other. Binary (nominal) variable for analyses: 0 = single, divorced, separated, widowed or other; 1 = married or partnered.	Social-demographic-health questionnaire
Number of Adults	Coded using five categories for descriptive statistics - lives alone, two adults, three adults, four adults and ≥ five adults. Binary (nominal) variable for analyses: 0 = do not live with another adult in the home; 1 = live with another adult.	Social-demographic-health questionnaire

Variable	Coding Strategy	Source of Data
Education	Coded using six categories for descriptive statistics - none, primary school, secondary school, community college, university, and postgraduate. Binary (nominal) variable for analyses: 0 = secondary school or less; 1 = post-secondary education.	Social-demographic-health questionnaire
Work status	Coded using eight categories for descriptive statistics - full-time work, part-time work, unable to work, looking for work, keeping house, retired and other. Three categories for analyses: 0 = working, 1 = unable to work or looking for work, 2 = other. Coded as nominal data.	Social-demographic-health questionnaire
Country of Birth	Binary (nominal) variable: 0 = born in Canada; 1 = born in another country.	Social-demographic-health questionnaire
Home language	Binary (nominal) variable: 0 = speaks English in the home; 1 = speaks another language other than English in the home.	Social-demographic-health questionnaire
Self-rated health	Coded using five categories (ordinal-level) for descriptive and inferential statistics: 1 = poor health, 2 = fair health; 3 = good health; 4 = very good health; 5 = excellent health.	Social-demographic-health questionnaire
Self-rated disability	Binary (nominal) variable: 0 = long-term disability; 1 = no long-term disability.	Social-demographic-health questionnaire
Activity limitations	Binary (nominal) variable: 0 = limited activities; 1 = no limitations in activity level.	Social-demographic-health questionnaire
Hospitalized in past year	Binary (nominal) variable: 0 = no hospital admission; 1 = admitted to hospital in the past year.	Social-demographic-health questionnaire
Number of hospitalizations in the past year	Coded using four categories for descriptive statistics: no admissions, one admission, two admissions, and three or more admissions. Three categories (ordinal) for analyses purpose: 0 = no admissions, 1 = one admission, 2 = two or more admissions.	Social-demographic-health questionnaire

Variable	Coding Strategy	Source of Data
Days in hospital in the past year	Coded using four categories for descriptive statistics: one to three nights, four to six nights, seven to nine nights, and ten or more nights. Three categories (ordinal) for analyses: 0 = no admission, 1 = one to nine nights, 2 = ten or more nights.	Social-demographic-health questionnaire
Prior year primary care use[32]	Binary (ordinal) variable: 0 = zero to five visits; 1 = six or more visits.	Social-demographic-health questionnaire
Individual-provider related	Physicians who provided services are coded as a nominal variable in the medical minutes study. Primary providers are coded as a nominal variable in the visit/payment study.	Clinical database
Government transfer payments	Interval-level data.	Census data
Average dwelling value	Interval-level data.	Census data
Average income	Interval-level data.	Census data
Median income	Interval-level data.	Census data
Average census family income	Interval-level data.	Census data
Median census family income	Interval-level data.	Census data
Average income of private households	Interval-level data.	Census data
Median income of private households	Interval-level data.	Census data
Incidence of low income of populations in private households	Interval-level data.	Census data

[32] Data on prior year visits to a primary care physician are only available for individuals in the Visit/Payment Study.

Variable	Coding Strategy	Source of Data
Annual visits	Interval level data for descriptive statistics. Coded as a categorical variable for logistic regression analyses: 0 = no visits, 1 = one or more visits. Transformed for multiple linear regression analyses: log (number of visits more than one).	Administrative data from OHIP billings
Minutes per visit	Coded using seven categories for descriptive statistics: zero to five minutes, six to 10 minutes, 11 to 15 minutes, 16 to 20 minutes, 21 to 25 minutes, 26 to 30 minutes, ≥30 minutes. The value of the midpoint of each interval (interval-level) was used to code this information: 3 = zero to five minutes; 8 = six to ten minutes; 13 = eleven to fifteen minutes; 18 = sixteen to twenty minutes, 23 = twenty-one to twenty-five minutes, 28 = twenty-six to thirty minutes; 33 = thirty-one or more minutes.	Primary data collection from physicians
Annual OHIP payments	Interval-level data for descriptive statistics. This value was transformed in multivariate analyses: log (OHIP + 10). A consonant was added to each annual OHIP payment due to the high frequency of zero values. The number 10 was selected to ensure that the transformed values would not approach zero.	Administrative data from OHIP billings

3.3.4. Data Collection

3.3.4.a. Medical Minutes Study

During the weeks proceeding data collection, meetings were held with a research assistant, as well as the administrative and support staff at the Department of Family and Community Medicine.[1] The purpose of these appointments was to share information regarding the purpose of the study, the criteria used to identify patients that were eligible to participate, and the phraseology that would be used to solicit informed consent. The staff members were then involved in designing a data collection process that would fit the workflow at the practice.

One week prior to commencement of data collection this investigator met with all physician residents[2] to describe the purpose of the study and the process of data collection. Written material was offered to all attendees at this meeting. Two days prior to commencement of data collection, all residents and regular physicians received a memorandum from the Family Physician-In-Chief and this investigator. This document described the purpose of the study, outlined the process by which these practitioners would record the amount of time they spent providing medical services, and provided an operational definition of 'medical services' (Appendix E).

When patients made an appointment (ahead-of-time) to see a physician at the practice, receptionists would schedule a date and time for this visit using the clinical database. During the period of data collection, it was standard policy to have these staff members schedule appointments in 10 minute time blocks. Every morning the staff in medical records used the clinical database to generate a Service Encounter Form for patients who had scheduled appointments. These staff members identified which patients were eligible for inclusion in the study and placed a bright-pink sticker on their Service Encounter Form. Time intervals were printed on these stickers to prompt physicians to record the amount of time they spent providing medical services by placing a check mark next to the appropriate category (e.g., 0 to 5 minutes). This form was attached to the front of the medical chart and forwarded to each of the three teams

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[1] The research assistant worked on this project for approximately 180 hours between July and October, 1998. The practice provided funding for this position and an M.Sc. student from the Department of Health Administration at the University of Toronto was hired. This person had ten years of research experience.

[2] A meeting was not held directly with all of the physicians.

in preparation for arriving patients. The Service Encounter Form contained information that was required by medical and administrative staff during each patient encounter - clinical reminders, the date of the last visit, the date of the last complete medical examination, the time of the appointment, the reason for the visit, the patient's health number and the designated primary provider. This form also contained a billing section with a selection of diagnostic codes, fee codes and corresponding fees. For the purpose of this study, the computer specialist at the practice programmed the clinical database to generate and print a unique, patient identification number on all Service Encounter Forms. A copy of the Service Encounter Form is provided in Appendix F.

When patients arrived at the reception desk at the Department of Family and Community Medicine between July 13, 1998 and October 19, 1998, they were screened by reception staff, the research assistant or this investigator to determine whether they met the eligibility criteria.[3] Bright-pink stickers on the Service Encounter Forms could be used to quickly verify the eligibility of individuals who had scheduled appointments, but the eligibility of 'walk-in' patients also needed to be established. Individuals who met the eligibility criteria and agreed to partake in the study completed a consent form and a social/demographic/health status questionnaire (Appendix G).[4] Receptionists placed a bright-pink sticker on the Service Encounter Forms for walk-in patients who agreed to participate in this research project. All three reception desks were continuously supplied with consent forms, questionnaires, Service Encounter Forms, bright-pink stickers and a memorandum outlining the study. Participants who had difficulty completing the questionnaire due to language barriers or reading difficulties were assisted with this task when/if a receptionist, the research assistant, an administrative volunteer or this investigator were

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[3] Patients who had appointments between 9:00 and 17:00 Monday to Friday were approached. Although the practice offered evening services on Thursdays, there were a limited number of staff members at this time. The practice was not open on statutory holidays.

[4] Since the beginning of 1997, adults who visit physicians at the Department of Family and Community Medicine have been asked to complete a social/demographic questionnaire and update this information on an annual basis. Six new questions were added to this document in early 1998 for the purpose of this study. This new version of the questionnaire asked patients to comment on their overall health and disability status, describe how often they use other family doctors, and provide information on recent hospitalizations. The use of this revised social/demographic/health status questionnaire is now standard practice at the Department of Family and Community Medicine.

available.[5] Once patients visited a doctor, the attending physicians and/or resident completed the Service Encounter Form by selecting or defining OHIP service and diagnostic codes, and documenting the amount of time they spent providing medical services. Completed forms were forwarded to the billing clerk at the practice who used some of this information for claims purposes. This clerk then forwarded all Service Encounter Forms that had bright-pink stickers to this investigator.

This investigator and the research assistant matched all consent forms and Service Encounter Forms using the patient's name and the date of the visit as identifiers. A "participant data set" was constructed to record the names of patients who agreed to participate[6], their unique patient identifier, the name of the doctor who provided the medical service, and the amount of time this physician spent providing medical services. Data from completed social/demographic/health status questionnaires were entered into the clinical database at the practice by the research assistant, this investigator, or the administrative volunteer.

A "research data set" was constructed for data analyses by merging information from the "participant data set" with social/demographic/health status and OHIP data for each participant. This information was retrieved from the clinical database in January 1999 by a computer specialist who works for the practice,[7] but the actual linkage of this data was done by this

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[5] A volunteer was recruited by the administrative assistant at the practice to assist the support staff with the extra workload created by the implementation of this research project. This individual was trained to obtain consent from participants and enter information from the social/demographic/health status questionnaires into the clinical database. This person worked on these tasks for approximately 60 hours between July and August 1998.

[6] The name of each participant was included in this research data set to simplify data quality assessment. Once this process was complete, this variable was removed from the data set to enhance anonymity.

[7] This individual has a Doctor of Philosophy degree and holds an Assistant Professor position at the University of Toronto.

investigator using SPSS® (version 8.0).[8] While the data collection period ended in October 1998 the social, demographic, health status and OHIP data were compiled in January 1999 to ensure that information on billings and payments could be available. This process was conducted to ensure that any discrepancy between billings by physicians and payments from the government could be detected.

Finally, data regarding the socioeconomic context in which participants lived were obtained from Statistics Canada's 1996 Census Area Profile series which provides census information for small geographic areas. This information was obtained from the University of Toronto Data Library and manipulated using a software package entitled Beyond 20/20™ (Browser 4.2). Census data were then merged with the research data set using the forward sortation area (FSA), and this linkage was conducted by this investigator using SPSS®.

3.3.4.b. Visit/Payment Study

On July 15, 1998 a cover letter, social/demographic/health status questionnaire, and self-addressed envelope were mailed to the stratified, random sample of individuals selected from a sample frame that represented adults who were rostered to the practice (Refer to Section 3.3.2.b.ii. Subjects: Visit/Payment Study). A reminder card was mailed on July 27, 1998 to all individuals who did not respond to the first mailing. A second cover letter, social-demographic-health status questionnaire, and self-addressed envelope were sent on August 11, 1998. A second reminder card was mailed on August 28, 1998. Copies of the cover letters and reminder card are located in Appendix H.

Information from completed questionnaires was entered into the clinical database at the Department of Family and Community Medicine by this investigator, the research assistant, or the administrative volunteer. In January 1999, the computer specialist at the practice abstracted social, demographic, health status and OHIP data from the clinical database for each of these

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[8] The linkage of social, demographic, health status and visit information was relatively straight-forward as the unique identification number was used for linkage purposes. The linkage of OHIP information required that the unique patient identifier and the date of the visit be used so that the sum of charges for the index visit could be calculated. A manual review of missing data was required after this process, as information from the "participant data set" regarding the date of the visit did not always match the date of the visit in the OHIP file. This likely occurred when the incorrect date was written on the consent form and this inaccurate information was transcribed into the "participant data set". A manual review of missing fields ensured that OHIP data on charges per visit was available for 543 of 550 participants.

individuals. These files were merged by this investigator using SPSS and unique identifiers for linkage. Census data were then merged using the FSA of each participant.

3.3.4.c. 1996 Census

The Canadian census is a population-based survey that is conducted every fifth year in accordance with the *Statistics Act* of 1970. A communication program is designed and implemented prior to each census, however, to encourage people to participate and help reduce non-response rates (Statistics Canada, 1997). On May 14, 1996, census representatives dropped off questionnaires at approximately 98 percent of households in the country.[9]

All census data, with the exception of population counts, were randomly rounded either up or down to a multiple of 5 or 10 and were suppressed for certain geographic areas to prevent the possibility of associating information with specific individuals. For postal code regions, all characteristic data for FSAs were suppressed in locations that had less than 40 people. Income data was suppressed in areas with a total population of less than 250 persons (Statistics Canada, 1997).

The federal government and Statistics Canada subdivides the country into administrative areas that are defined by federal and provincial statutes. The enumeration area is the smallest administrative region and these areas can be aggregated into census subdivisions or census

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[9] Each representative was responsible for at least one enumeration area which represented between 125 and 440 households. Eighty percent of all households received a short, mail-back, questionnaire which contained seven questions and required respondents to provide their name, their relationship to other household members, their date of birth, sex, legal marital status, common-law status, and first language learned in childhood. The remaining 20 percent of households were given the long-version which could also be mailed-back. This questionnaire included the same seven questions as the short-form as well as items on labour force activity, income, education, activity limitations, citizenship, housing, ethnic origin, and immigration status. The 1996 Census contained four new questions: aboriginal self-reporting, minority population, household activities and mode of transportation to work. Questionnaires were available in English and French, but editions were translated into 49 non-official languages - 12 of which were Aboriginal. Braille, large print, audiocassette and diskette versions were also available (Statistics Canada, 1997).

tracts.[10] In fact, "most postal area boundaries have very little correspondence with census boundaries" (Statistics Canada, 1997, p. 129). The average population per FSA in Ontario was 21,336 (range: 45 - 98,286; standard deviation 14,921).[11] Most FSA in Toronto begin with the letter M; the average population per FSA with this designation was 24,592 (range: 45 - 58,339). All census information at the level of the FSA are designated 'restricted use' by Statistics Canada and can only be accessed for research and teaching purposes. This information was made available to this investigator by the University of Toronto (University of Toronto, 1998).

For the purpose of this study the forward sortation area (FSA) was used to define a local community for four reasons. First, the FSA of most patient participants was available in the clinical database at the research site. Second, the Ontario MOH has information regarding the FSA of OHIP beneficiaries and therefore these data are readily available for use. Third, the majority of individuals know the postal code of their residence (i.e., and hence the FSA) which would enable them to validate this information with their physician during each encounter. Arguably, the inclusion of area-based measures in a capitation formula would provide a reasonable incentive for providers to ensure that the MOH has accurate information on the FSA of beneficiaries.[12] Lastly, information on the FSA of participants was available and software

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[10] Census tracts were created by Statistics Canada to construct 'equal neighbourhood-like areas of 2,500 to 8,000 people (preferably close to 4,000) within all census metropolitan areas [municipalities in large urban centres] and census agglomerations [municipalities in small urban centres] ... the census tract boundaries .... attempt to approximate cohesive socio-economic areas" (Statistics Canada, 1997, p. 126). There were 16,469 enumeration areas, 947 census subdivisions and 1,799 census tracts in Ontario in 1996 (Statistics Canada, 1997).

[11] In 1996, there was 515 FSAs in Ontario (Statistics Canada, 1997).

[12] Ultimately, this process would enhance the accuracy of FSA data that is used by the MOH and others for planning, funding, and research purposes.

available from Statistics Canada currently does not translation geographic data from FSA to other small geographic units such as enumeration areas with adequate precision.[13]

3.3.5. Data Quality

3.3.5.a. Completeness

Ninety percent or more of the records that contained information regarding the predisposing and enabling characteristics of patient participants in the study to identify determinants of medical service time were complete, and 75 percent of the records that contained indicators of need were complete for this sample. The social and demographic data was likely more complete due to the fact that this information may have been entered into the clinical database prior to the period of data collection, and the participant chose not to complete the new version of the social/demographic/health status questionnaire at the time they offered consent.[14]

Information on the predisposing, enabling and need characteristics of patient participants in the Visit/Payment study (i.e., study to identify determinants of a visit, annual visits and annual charges) were available for over 99 percent of records. The FSA was available for all but 14 patient participants in the study to identify determinants of medical service time (i.e., 98 percent complete). Information on community-level enabling characteristics, derived from 1996 Census data, were not available for an additional 5 people (i.e., 97 percent complete), as these individuals lived in FSA where census data was not made available to the public.[15] The FSA was available for all but 3 people (i.e., 99 percent complete) in the Visit/Payment study (i.e., study to

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[13] Wilkins (1998) evaluated the extent to which researchers will make errors when imputing location from postal codes to other geographically defined regions. Using a one percent sample of census data as a gold standard, he calculated that the use of FSA data to re-categorize individuals to enumeration areas would result in 41.8 percent mis-classification. The use of Geocodes/PCCF Version 3 software from Statistics Canada would reduce this error to 15.8 percent. While the Geocodes/PCCF Version 3 software is able to translate postal codes to census tracts with 1.9 percent mis-classification, most of the data derived from income questions are suppressed in public-use files at this level of aggregation (C. Severin, University of Toronto Data Library, personal communication, November 1998).

[14] Questions that were used to profile the 'need characteristics' of participants were added to the questionnaire in 1998 (i.e., a new version), but the clinical database contains information on the social and demographic profile of patients who completed earlier versions of this document.

[15] For postal code regions, all characteristic data for FSAs is suppressed in locations that have less than 40 people. Income data is suppressed in areas with a total population of less than 250 persons (Statistics Canada, 1997).

identify determinants of a visit, annual visits and annual charges), as were the variables that contained census data regarding community-level characteristics. This level of completeness reflects the fact that the postal code was the primary source of information (other than their street address) used to determine whether participants met the geographic proximity eligibility criteria. Table 2 provides a summary of the completeness of the data and the proportion of individual records that had missing data elements.

Table 2: Completeness of Social/Demographic/Health Data

Variable	Medical Minutes Study (N=554)		Visit/Payment Study (N=659)	
	Cases with Information (n)	Complete (%)	Cases with Information (n)	Complete (%)
Predisposing Characteristics				
Age	550	100	659	100
Gender	550	100	659	100
Marital status	488	89	649	99
Adults at home	486	89	652	99
Education	493	90	657	99.7
Work status	492	90	656	99.7
Born in Canada	535	97	656	99.9
Enabling Resources				
Language at home	494	90	653	99
Need Characteristics				
Health status	406	74	656	99.5
Disability status	401	73	655	99.4
Activity limitations	407	74	654	99.2
Hospital admissions	408	74	658	99.8
Time in hospital	408	74	658	99.8
External use ♮	401	73	659	N/A
Community-Level Enabling				
FSA	540	98	656	99.9
Government transfer payments	535	97	656	99.9
Average dwelling value	535	97	656	99.9
Average income	535	97	656	99.9
Median income	535	97	656	99.9
Average family income	535	97	656	99.9
Median family income	535	97	656	99.9
Average household income	535	97	656	99.9
Median household income	535	97	656	99.9
Incidence of low income	535	97	656	99.9
Unemployment rate	535	97	656	99.9
Female labour participation	535	97	656	99.9
Other variables				
Charges per visit	543	99	N/A	N/A
Physician seen	550	100	N/A	N/A
Primary provider	550	100	659	100

Note: ♮ Information from this variable was used to determine participant eligibility, and those who did not have this information on their clinical record were excluded from the sample. N/A = not available.

3.3.5.b. Accuracy

During the course of data collection, the primary people responsible for entering information from completed social/demographic/health status questionnaires were the research assistant, the administrative volunteer and this investigator. The research assistant and this investigator were both trained by an experienced clerk at the practice whose job required that she enter social, demographic, health status and billing data into the clinical and billing databases at the practice. The volunteer was trained by this clerk, the research assistant and this investigator. Lastly, staff who worked at the reception desk were trained to enter information from the social/demographic/health status questionnaires and routinely contributed to this task. During the period of data collection, however, the clerk and receptionists were not required to enter data from questionnaires completed by participants in the study.

In order to assess the accuracy of data-entry by the research assistant, the administrative volunteer and this investigator, a sample of 30 completed questionnaires was selected for audit purposes (i.e., 10 questionnaires per coder). Data entered into the clinical database matched information on the questionnaire in all instances (i.e., 100 percent accuracy). In order to assess the accuracy of the data entered by any coder (i.e., to measure the completeness and accuracy of the clinical database irrespective of who entered this information), a random sample of 40 completed questionnaires was selected for audit purposes. Again, data in the clinical database matched information on the questionnaire in all instances (i.e., 100 percent accuracy).

In order to assess the accuracy of data entered by the research assistant and this investigator from the Service Encounter Form to the participant data set (i.e., medical minutes study to identify determinants of medical service time), a sample of 20 forms was selected for an audit. Data regarding the unique identifier and the doctor seen matched information on the Service Encounter Form in all instances (i.e., 100 percent accuracy), but the wrong interval of minutes of medical service was recorded in one instance (i.e., 19 out of 20 entries were accurate; 95 percent accuracy). This information was shared with the research assistant and all entries into the participant data set were audited on two occasions due to the importance of accuracy for this variable.

Once the research data set was complete, all variables were reviewed to ensure that they were appropriately designated as nominal, ordinal or scale in SPSS®. Numeric values were reviewed to ensure that the mean, minimum and maximum values made sense. A random sampling of records from newly-constructed variables (e.g., sum of the charges per visit, number of annual visits) was selected and manual cross-checks were conducted to ensure the algorithm used to construct these measures was accurate. In addition, manual cross-checks were conducted to confirm the accuracy of unusual values (e.g., charges per visit or annual OHIP payments that were very high).

3.3.5.c. Validity

Each dependent variable was selected as a measure of physician resource utilization, the strength and nature of the relationship between these variables were evaluated to determine the validity of using these measures.

3.3.5.c.i. Concurrent and Predictive Validity

A measure that has criterion-related validity should be highly correlated with another measure of the same phenomenon. While the external criterion should be a 'gold standard', there is no gold standard measure of physician resource utilization. "Concurrent, criterion-related validity measures the degree of correlation of two measures of the same phenomena administered at the same point in time - that is at T1. Predictive, criterion-related validity measures the degree of the correlation of a present measure with a future measure of the same phenomena - that is, the degree of correlation between measurements taken at T1 and T2" (Green & Lewis, 1986, p. 107).

The Pearson correlation coefficient (Pearson *r* or *r*) was used to assess the concurrent validity of using annual OHIP payments and the number of visits made by participants each year as measures of physician resource utilization.[16] Annual OHIP payments were highly correlated with the number of visits ($r = .833$, $p<.001$, $r^2 = 69.39\%$ of the variance). Spearman's *r* (r_s) was used to assess the concurrent validity of using the amount of time physicians spent rendering medical care to participants as a measure of physician resource utilization, by assessing the strength and nature of the relationship between this measure and the size of the payments received from OHIP for services rendered during the visit.[17] These two measures were highly

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[16] These analyses were conducted using data derived from the Visit/Payment study (i.e., study to identify determinants of a visit, annual visits and annual charges) .

[17] The size of the payment received from the OHIP was equal to the amount of services billed. Although physicians only bill for one type of visit per encounter (e.g., minor or intermediate assessment), they also bill for other services (e.g., procedures) rendered during the visit.

correlated (r_s = .676, p<.001, r_s^2 = 45.7 % of the variance), and the scatter plot depicted in Figure 11 in Section 3.4.1.a. entitled 'Findings: Descriptive Profiles' illustrates this relationship.

Time spent by physician participants for each encounter was slightly longer than that which has been reported by other researchers. Physicians in this study, however, measured both direct and indirect time and the mean values reported in the literature primarily include direct service time. When the mid-point of the interval of time physicians spent providing medical services was assigned to each encounter, the mean time spent per visit was 19.79 (median = 18; *SD* = 7.92). The mean reported length of consultations in the United Kingdom ranged from five to 11 minutes (Hughes, 1983; Peter, Tate & Catchpole, 1989; Wilkins & Metcalfe, 1984). Longer visits have been reported in the United States (e.g., 10 minutes; Stange et al., 1998), New Zealand (e.g., 12; Baker, 1976), Canada (e.g., 15 minutes; Collyer, 1969) and Sweden (e.g., 21 minutes; Andersson & Mattson, 1989). Chan, Anderson and Thériault (1998) indicated that fee-for-services physicians in Ontario bill for an average of 25.7 encounters per day or 19.3 office assessments per day. If one assumed that these doctors saw patients for a total of 5 to 7 hours per day, these figures would translate to approximately 11 to 16 minutes per encounter or 15 to 22 minutes per assessment.

Spearman's *r* was used to assess the predictive validity of using the amount of time physicians spend rendering medical services for one encounter as a measure of annual physician resource utilization. Therefore, the strength and nature of the association between the amount of time physicians spend rendering medical services (i.e., data derived from the medical minutes study) and annual OHIP payments and visits per annum (i.e., data derived from the Visit/Payment study) were evaluated. The analysis was conducted using information from individuals who participated in both studies (n = 75). The amount of time (minutes) that a physician spent providing medical services during one encounter was not significantly correlated with the total amount of annual OHIP payments (r_s = .117, p = .318), nor the number of annual visits (r_s = .107, p = .362). Therefore, measurement of physician resource utilization at one point in time (e.g., use of physician resources during one visit or encounter) was not a valid measure of longitudinal use and vice versa (e.g., use of physician resources over the course of a year). This is important as there was no evidence to support the argument that physicians spend more or less time with people whom they see more or less often during the year.

The predictive validity of using annual measures of physician resource utilization from one year to predict utilization in subsequent years was evaluated using the Pearson r and data from two time periods (i.e., June 1, 1996 to May 31, 1997 versus June 1, 1997 to May 31, 1998). Annual OHIP payments were highly correlated across time ($r = .718$, $p<.001$, $r^2 = 51.55\%$ of the variance), as were the number of visits ($r = .723$, $p<.001$, $r^2 = 52.27\%$ of the variance). Table 3 provides a summary of these validity assessments.

Table 3

Criterion-Related Validity of Physician Resource Utilization Measures

	Minutes of service	No. of visits per annum (Year 1)	No. of visits per annum (Year 2)	OHIP payments per annum (Year 1)	OHIP payments per annum (Year 2)
Minutes of service	-	$r_s = .107^{NS}$	-	$r_s = .117^{NS}$	-
No. of visits per annum (Year 1)	$r_s = .107^{NS}$	-	$r = .72^{**}$ $r^2 = 52.27\%$	$r = .81^{**}$ $r^2 = 69.10\%$	$r = .55^{**}$ $r^2 = 30.25\%$
No. of visits per annum (Year 2)	-	$r = .72^{**}$ $r^2 = 52.27\%$	-	$r = .62^{**}$ $r^2 = 38.44\%$	$r = .83^{**}$ $r^2 = 69.39\%$
OHIP payments per annum (Year 1)	$r_s = .117^{NS}$	$r = .83^{**}$ $r^2 = 69.10\%$	$r = .62^{**}$ $r^2 = 38.44\%$	-	$r = .718^{**}$ $r^2 = 51.55\%$
OHIP payments per annum (Year 2)	-	$r = .55^{**}$ $r^2 = 30.25\%$	$r = .83^{**}$ $r^2 = 69.39\%$	$r = .72^{**}$ $r^2 = 51.55\%$	-
Charges or OHIP payments per visit	$r_s = .67^{**}$ $r_s^2 = 45.7\%$	-	-	-	-

Note. * *p<.001. r = Pearson's correlation coefficient. r_s = Spearman's correlation coefficient. NS = not statistically significant.

3.3.5.c.ii. Construct Validity

Construct validity refers to the "extent to which hypothesized relationships between concepts and their measures are verified or not verified on the basis of obtained data" (Green & Lewis, 1986, p. 115). The construct validity of using the amount of time physicians spent rendering different types of medical services to patients was evaluated. This assessment was conducting by testing for significant differences (Student's t-test) between the amount of time spent providing medical services for: (a) minor versus intermediate assessments, (b) general annual health examinations versus general re-assessments, (c) intermediate assessments versus intermediate assessments plus psychological therapy, (d) one psychological therapy session versus two psychotherapy sessions, and (e) psychological therapy versus counseling.

As expected, general annual health examinations (mean = 26.16 minutes, n = 95) took significantly more time (t = 5.06; df = 101; p<.001) than general re-assessments (mean = 15.50 minutes, n = 8).[18] Intermediate assessments (mean = 15.49 minutes, n = 307) took significantly less time (t = -9.20; df = 323; p<.001) than intermediate assessments that are combined with a psychotherapy session (mean = 27.44 minutes, n = 18). Lastly, on average, one psychological therapy session (mean = 27.71 minutes, n = 34) took statistically significantly less time (t = -6.97; df = 33, p<.001) than two psychotherapy sessions (mean = 33.00 minutes, n = 20).

There were, however, no statistically significant differences (t = -1.81, df = 14.5; p=.09)[19] in the amount of medical service time provided for minor assessments (mean = 11.33 minutes, standard error of mean = 2.27 minutes, n = 15) compared to intermediate assessments (mean = 15.49 minutes, standard error of mean = .31 minutes, n = 307). Despite the fact that the amount of time required for physicians in this sample to conduct both assessments was not that different, the OHIP fee schedule allowed physicians to bill $16.25 for a minor assessment and $24.80 for an intermediate assessment. The fee schedule does not offer guidelines to enable physicians to distinguish between these two fee codes, but notes that intermediate assessments should be 'more extensive' (Ontario MOH, 1992). Chan, Anderson and Thériault (1998) observed that the proportion of intermediate to minor assessments has been increasing over the two decades (termed "fee-code creep" by these authors). Interestingly, this cross-sectional sample included 307 intermediate and 15 minor assessments.

Lastly, the amount of time required to provide a psychological therapy session (mean = 27.71, n = 34) was significantly more (t = 2.349, df = 55, p<.02) than the amount of time

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[18] The mean number of minutes per visit was calculated by assigning the mid-point of the interval of time physicians spent providing medical services.

[19] This t-test for equality of means does not assume equal variances as the Levene's test statistic for equality of variance suggests that the variances may not be equal (F = 5.87, p =.016). If equal variances are assumed the t statistic becomes -2.827 suggesting statistically significant differences between minor and intermediate visits (df = 320, p = .005).

required to provide a counseling session (mean = 24.96, $n = 23$). Although these time periods are statistically significant in their differences, the clinical significance of a mean difference of 2.75 minutes is small. The OHIP fee schedule allowed physicians to bill the MOH $47.30 for a psychotherapy or a counseling session.

3.3.6. Data Analyses

3.3.6.a. Descriptive Profiles

3.3.6.a.i. Participants

Descriptive statistics were used to profile the characteristics of participants in both the Medical Minutes and the Visit/Payment studies. The social, demographic and health profiles of these individuals are summarized in Table I1 in Appendix I. The characteristics of the communities in which these adults resided are summarized in Table I2 in Appendix I, and the amounts of physician resources used by different types of people are summarized in Table I3 in Appendix I.

The representativeness of participants was evaluated using two strategies. First, the stratification strategy was assessed to ensure that : (1) the number of participants per primary provider in the Medical Minutes study was representative of the volume of services provided by these practitioners relative to each other, and (2) the age and gender composition of participants in the Visit/Payment study reflected the age and gender structure of the sample frame. Second, bias in the communities represented by participants in both samples was evaluated by determining whether participants were from areas in Toronto: (a) that were similar to the average Toronto community (i.e., census metropolitan community), and (b) that were similar to the average Ontario community. The mean value of the area-based measures (i.e., at the FSA level) of participant's communities was compared to the corresponding mean value of each area-based measure at the level of Toronto (i.e., census metropolitan area) and Ontario. Inferential statistics could not be used to test for significance differences between these means, as measures of variability were not available for the Toronto and Ontario geographic areas.

3.3.6.a.ii. Variables

Prior to univariate and multivariable analyses, response categories defined on the social-demographic-health status questionnaire were collapsed into smaller groups and the distribution of each dependent variable was evaluated. Independent variables were collapsed after considering:

1. The feasibility of using the variable as a rate adjuster. For example, data derived from one survey question - country of birth - was collapsed into two groups (i.e., born in Canada versus born in another country) as this type of approach would improve the feasibility of using this information for rate adjustment.

2. The theoretical rationale for including the variable. For example, information derived from another item - the language spoken in the home - was collapsed into two groups (i.e., English versus another language) as this approach was congruent with the theoretical perspective that language is an enabling resource.[1]
3. The coding strategies and empirical results of other researchers. For example, information derived from one item - main activity - was collapsed into three groups (i.e., working, unable to work or looking for work, other) as this strategy was congruent with the coding approach used by researchers who identified this measure as a significant determinant of physician resource use in Ontario (McIsaac et al., 1993).
4. Rate adjusters that have been used in other jurisdictions. For example, information on prior visits was collapsed into two groups to identify high-users. A primary care capitation formula in New Zealand adjusts rates on the basis of whether or not an individual has a High Use Card (Hutchison et al., 1999).

Univariate analysis was conducted to evaluate the impact and appropriateness of all collapsing strategies, irrespective of the rationale used to collapse data into fewer groups. One-way analyses of variance (ANOVA) with the Bonferroni test for multiple comparisons were used to conduct these analyses. The Bonferroni test adjusted the significance level based on the number of comparisons. Binary variables were coded using dummy variables, nominal and ordinal-level measures were coded using integer values and these variables were specified as either categorical or ordinal in SPSS® (Version 8).

The shape of the distribution of each dependent variable was evaluated, as other investigators have indicated that the distribution of various measures of physician resource utilization are positively skewed (Birch, Eyles & Newbold, 1993; Roos, Carrière & Friesen, 1998). Strategies that have been used by other investigators to address this issue include:

1. The use of separate multivariable analyses to identify determinants of use (i.e., no visits versus one or more per annum) and the determinants of frequency of use among individuals who made at least one visit (e.g., Birch et al., 1993; Broyles et al., 1983;

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[1] While patients and their physicians may jointly speak another language other than English, it would not be feasible to collect information on the languages spoken by both of these individuals and adjust rates based on the ability of patients and their physicians to speak the same language.

Romeis, Gilliespie, Virgo & Thorman, 1991; Roos, et al., 1998; Stoller, 1982; Tataryn, Roos & Black, 1995; Stoller, 1982).

2. The use of logistic regression to identify determinants of use (i.e., no visits versus one or more per annum), or determinants of high-use (i.e., one to five versus six or more annual visits) (e.g., Dunlop, 1998; McIsaac et al., 1997; Roos et al., 1998).
3. The use of logarithm transformations to reduce the skewness of utilization measures (e.g., Andersen & Aday, 1978; Roos et al., 1998).

As measures of physician resource utilization used in the Visit/Payment study were positively skewed, separate analyses were conducted to identify determinants of use (i.e., no visits versus one or more per annum) and frequency of use among individuals who visited the practice at least once. The use of a two-part model allows for a better understanding of the determinants of initial use versus the volume of use among users and improves the robustness of estimates (Duan, Manning, Morris & Newhouse, 1984). As the frequency of annual visits among users was positively skewed (skewness = 4.93; kurtosis = 43.88), the logarithm of annual visits was used as this strategy resulted in a distribution that was more normal (skewness = 0.428; kurtosis = -0.466) than other transformations.[2]

The logarithm of annual OHIP payments plus a constant of 10 was used as this transformation reduced the skewness score from 12.65 (i.e., distribution of the unadjusted data) to -0.30 and the kurtosis score from 224.34 to 0.18.[3] The amount of time that physicians spent providing medical services was used in an unadjusted form (skewness = 0.26; kurtosis = -1.03), as transforming these values did not significantly improve the shape of the distribution.[4]

3.3.6.b. Univariate Analyses

Univariate analyses were conducted to evaluate whether there was an association between each independent and dependent variable. By conducting univariate analyses to identify

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[2] The logarithm of the frequency of visits plus a constant of 10 was also evaluated (skewness = 1.92; kurtosis = 5.53) as was the square root of the frequency of visits (skewness = 1.744; kurtosis = 5.40).

[3] A constant of 10 was added as the distribution contained a large proportion of zero values. The square root of total, annual OHIP payments was also evaluated (skewness = 2.37; kurtosis = 16.80).

[4] The logarithm of minutes of medical services was also evaluated (skewness = -.72; kurtosis = .97) as was the square root of the measure (skewness = -.11; kurtosis -.70).

variables that were associated with each outcome, the number of variables entered into multivariable models could be reduced (Concato, Feinstein & Holford, 1993). ANOVA was used to test hypotheses regarding the presence or absence of an association between nominal or ordinal independent variables and each continuous dependent variable - the number of visits to the practice per annum among those that visited, the minutes of medical services provided by physicians during a visit and annual OHIP payments received by the practice for an individual. The *F* statistic from the ANOVA table was derived from linear regression when the independent and dependent variables were both continuous. All statistical analyses were conducted using SPSS® Version 8.0.

The Crosstabs procedure was used to form two-way tables to test hypotheses regarding the presence or absence of an association between nominal or ordinal independent variables and the dichotomous dependent variable - visited the practice or not. The Pearson Chi-Square (χ^2) statistic and two-tailed tests of significance were used to evaluate these associations. The results of Fisher's Exact Test were reported when a table had a cell with an expected frequency of less than 5. The χ^2 statistic from a simple, logistic regression model was used to evaluate whether there was an association between each continuous independent variable and the dichotomous dependent variable.[5] When an association was found to be significant, the eta coefficient was calculated.[6] The results of all univariate analyses are provided at the end of Section 3.4.2.

Interaction terms were established a priori after conducting a review of the literature. Researchers have documented significant interactions between the severity of medical conditions and economic deprivation (Arling, 1985), the severity of medical conditions and disability status (Arling, 1985), social support and disability status (Arling, 1985), social support and health status (Birch, Eyles & Newbold, 1993), level of education and health status (Birch et al., 1993),

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[5] Decisions made using this χ^2 statistic were the same as those derived by using linear-by-linear associations in the Crosstab procedure or by using Students' *t* statistic to detect between-group differences in means.

[6] This coefficient is "appropriate for data in which the dependent variable is measured on an interval scale and the independent variable on a nominal or ordinal scale. When squared, *eta* can be interpreted as the proportion of the total variability in the dependent variable that can be accounted for by knowing the values of the independent variable. The measure is asymmetric and does not assume a linear relationship between the variables" (Norusis, 1993, p. 218).

employment and gender (McIsaac, Goel & Naylor, 1997), geographic region and health status (Birch et al., 1993; Katz, Hofer & Manning, 1996), and age and socioeconomic status (Frohlich & Carriere, 1997).

Although significant interaction effects reveal information of theoretical importance, they have failed to make a significant contribution to the explanatory power of multivariable models (Arling, 1985; Ronis & Harrison, 1988). Therefore, some authors have advised that interaction terms be used sparingly as they increase the likelihood that significance will occur by chance alone, reduce the degrees of freedom leading to restrictions in the sensitivity of significance tests, increase the likelihood of multi-collinearity and can be confounded by non-linear effects (Ronis & Harrison, 1988). Therefore, the following interaction terms were assessed for their significance in predicting the incidence of a visit, minutes of medical service, the frequency of annual visits, and total, annual charges - age and gender, social support and disability status, social support and health status, level of education and health status, and work status and gender. The significance of each interaction term was assessed using ANOVA and plots (i.e., for continuous dependent variables) or by entering each term directly into a logistic regression model (i.e., to determine their significance as a determinant of the likelihood of a visit). All interaction plots are presented in Appendix K.

Univariate analyses were conducted to determine the appropriateness of using information on individual-providers as a control variable. The primary provider variable was selected as a measure of 'individual-provider' when evaluating determinants of whether or not an individual visited the practice, the number of visits made to the practice among adults who visited and total, annual OHIP payments. The physician who rendered the service was selected as a measure of provider effects when evaluating determinants of the amount of time physicians spent providing medical services, as this provider was the individual who would mostly likely to influence this measure of resource utilization.

3.3.6.c. Hypotheses Testing

To test Hypothesis 1 - each dependent variable was regressed on age and gender as these variables form the basis for capitation formulae in most jurisdictions and will "almost always be an appropriate starting point for health care capitation formulae" (Hutchison et al., 1999, p. 20). Individual provider-level data was included as a control variable when this measure was found to be significant in univariate analyses.

Hypothesis 2 was tested by regressing each dependent variable on age and gender followed by block entry of individual-level (predisposing, enabling and need) and community-level enabling variables. The relative contribution of each separate block of variables was evaluated. Then, these blocks were entered in a hierarchical fashion beginning with individual-level need, predisposing and enabling variables followed by community-level enabling characteristics. The contribution of each category of variables to the explanatory power of each model and the significance of the change in R^2 value was evaluated. Individual provider-level data were included as a control variable when this measure was found to be significant in univariate analyses.

Hypothesis 3 was tested by regressing each dependent variable on age and gender followed by forward, step-wise entry of variables identified in univariate analyses as significant predictors. The contribution of each variable to the explanatory power of each model and the significance of the change in R^2 value was evaluated.

Hypothesis 4 was tested by regressing each dependent variable on age and gender followed by forward, step-wise entry of community-level measures identified as significant in univariate analyses. The stepwise criteria used for logistic regression - a variable was entered into the model if the probability of its score statistic was less than .05, and was removed if the probability was greater than .10. Stepwise criteria for all linear models - probability of F-to-enter less than or equal to 0.05, and the probability of F-to-remove greater than or equal to 0.10.

3.3.6.c.i. Multivariable Modelling

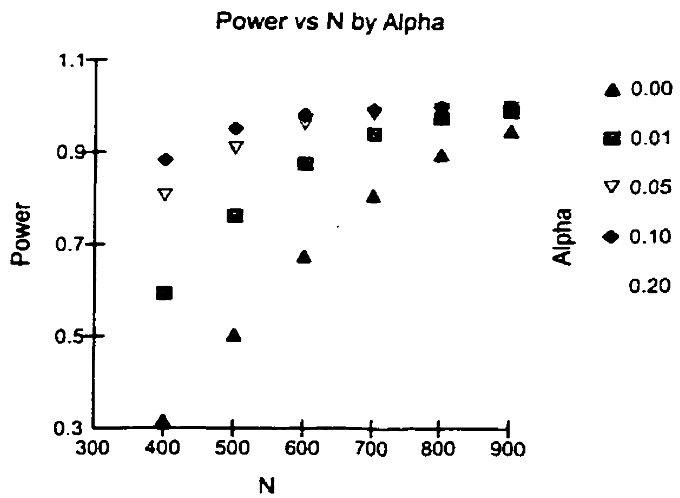
Variables included in multivariable models were those identified as statistically significant determinants of physician resource utilization at alpha-level of .05. Sensitivity analyses were conducted to evaluate the impact of selecting an alpha-level of .10.

Sample sizes. To determine the sample size required to undertake the Medical Minutes study, Figure 1 was developed using the software program Power Analysis and Sample Size (Version 6.0) (Hintze, 1996). This illustration was constructed assuming 20 predictors (R^2 added: .10) and three control variables (R^2 added: .05).[7] Therefore, it was determined that a sample size of 600 would be required to ensure enough cases for cross-validation.

[7] Effect size = 0.117.

Figure 10

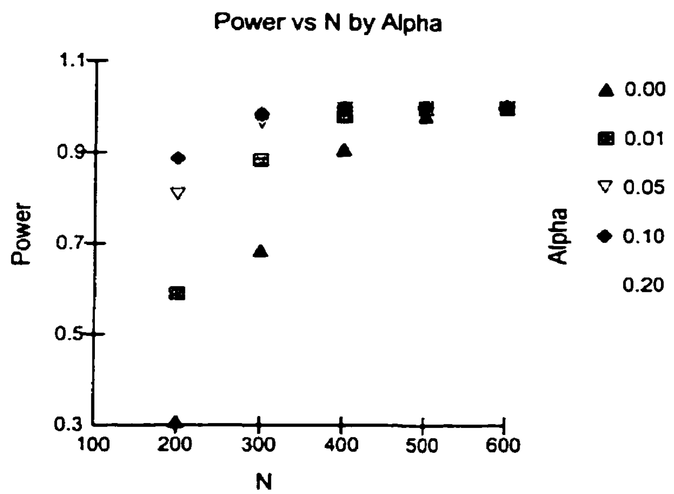
Power versus Sample Size by Alpha-Level: Medical Minutes Study



To determine the sample size required to undertake the Visit/Payment study, Figure 11 was developed. This illustration was constructed assuming 20 predictors (R^2 added: .05) and three control variables (R^2 added: .05).[8] Therefore, it was determined that a sample size of 1000 would be required to ensure enough cases for cross-validation.

Figure 11

Power versus Sample Size by Alpha-Level: Visit/Payment Study



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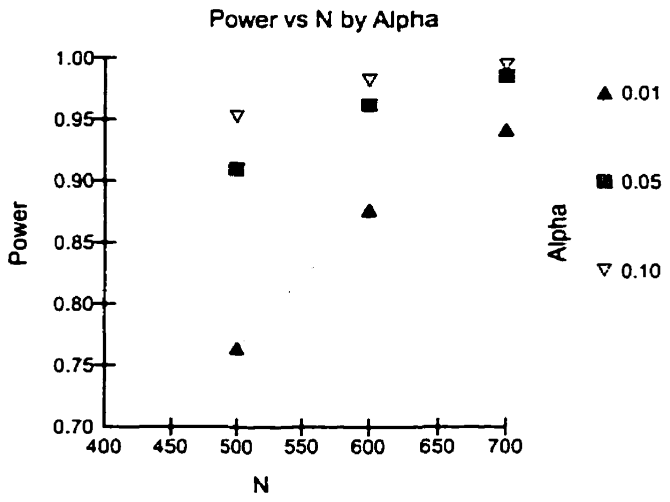
[8] Effect size = 0.055.

The Medical Minutes study was conducted until the desired sample size was reached, and a number of strategies were implemented to maximize the number of participants in the Visit/Payment study (see Section 3.3.4.). The number of participants in the former study was 550, while the number of participants in the latter was 659. Figure 12 summarizes the power analyses conducted after recruitment of subjects.

Figure 12

Power versus Sample Size by Alpha-Level



Multicollinearity. As it was expected that some of the measures of need (e.g., various measures of hospital utilization), economic environment (e.g. government transfer payments as a percent of income and incidence of low income) and relative wealth (e.g., average and median income) would be correlated, a correlation matrix was developed to assess the relationship among these measures. These matrices are provided in Figures J1 to J7 in Appendix J. When the Pearson correlation coefficient was greater than .80, only one measure was used in multivariable analyses if both variables were identified as significant in univariate analyses. The measure selected for inclusion in multivariable models was the variable with the highest χ^2 or F statistic.[9]

Four strategies were used to minimize multicollinearity in models identifying determinants of visit frequency and annual payments.[10] First, only one of the measures of prior hospital utilization (i.e., presence/absence of an admission) was used as all indicators of inpatient resource utilization were significant in univariate analysis and were highly correlated. The measure of the incidence of an admission had the highest F statistic in univariate analysis. Second, correlations among other measures of need (i.e., health status, disability status and activity limitations) were screened - but the Pearson correlation coefficient among these variables were less than .80. Therefore, these measures of need were included in multivariable models when any of them reaches statistical significance in univariate analyses. Third, associations between other independent variables (e.g., marital status and the number of adults in the home, as well as educational status and work status) were assessed using the Crosstabs procedure, Phi and Cramer's V statistic. As this analysis indicated an association, the variables with the highest F statistic in univariate analysis (i.e., marital status & educational status in analyses of visits; adults in the home and work status in analyses of annual payments) were selected for inclusion in multivariable analyses. Lastly, measures of community-level enabling characteristics were used as many of these indices of economic climate and relative wealth were highly correlated.

The following variables were selected for multivariable analyses (that required block entry of community-level enabling factors) to identify determinants of visit frequency among individuals who visited at least once, as they had the highest F statistic and were not highly correlated - the incidence of low income of the population in private households, governments

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[9] When univariate analyses were conducted to evaluate interaction terms, the following interactions were significant as determinants of the incidence of a visit - marital status * disability status, marital status * health status, the number of adults in the home * disability status, and the number of adults in the home * health status. Since marital status and the presence of other adults in the home were both selected as measures of social support, and disability and health status were both selected as measures of health - only one of these four significant interaction terms was used in multivariable analyses. The interaction term - the number of adults in the home * health status - was selected as it had the largest chi-square value ($\chi^2(1,649) = 11.86, p = .000$).

[10] The variables identified in the preceding paragraph were not significant in univariate analyses as determinants of the incidence of a visit or minutes per visit and would not be entered simultaneously into a multivariable equation.

transfer payments as a proportion of total income, the average census family income, and the female labour force participation rate.[11] The following variables were selected for multivariable analyses (that required block entry of community-level enabling factors) to identify determinants of total, annual OHIP payments, as they had the highest *F* statistic and were not highly correlated - the median income of private households, the proportion of total income derived from government transfer payments, and average census family income.[12]

Logistic regression. Multiple, logistic regression was used to evaluate the relative significance of different independent variables in determining the likelihood that an individual would visit the practice during a one year period. This multivariable approach to modelling was used to calculate adjusted odds ratios and confidence intervals. Although age was coded as a

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[11] The incidence of low income among the population in private households was selected first, as this measure had the highest *F* statistic (30.32). The use of this measure meant that the following indices could not be used due to their high correlation with the measure of low income - median incomes (F statistic = 3.50), median census family income (F statistic = 22.56), average income of all private households (*F* statistic = 20.85), median income of all private households (*F* statistic = 27.08), and the unemployment rate (*F* statistic = 28.97). A Pearson coefficient of .80 was used as an indicator of high correlation.

Next, the measure of government transfer payments was selected as this measure had the highest *F* statistic (19.16) among the remaining variables. The use of this measure meant that average income (*F* statistic = 17.15) could not be used due to high correlation.

The average census family income was selected next as this measure had the highest *F* statistic (15.28) among the remaining variables. The use of this measure meant that average dwelling value (F statistic = 4.59) could not be used due to high correlation.

Finally, the female labour force participation rate was selected (*F* statistic = 6.17) as this was the only remaining measure that was not highly correlated with other variables selected. A correlation matrix was created to verify that the selected variables (i.e., the incidence of low income, government transfer payments, average census family income, and the female labour force participation rate) were not highly correlated.

[12] The median income of private households was selected first, as this measure had the highest *F* statistic (14.03). The use of this measure meant that the following indices that were identified in univariate analyses could not be used due to high correlation: median income (*F* statistic 7.41), median census family income (*F* statistic = 7.49), the incidence of low income (*F* statistic = 11.83), average income of private households (*F* statistic = 8.38), and unemployment rates (*F* statistic = 12.56). A Pearson coefficient of .80 was used as an indicator of high correlation.

Next, the measure of government transfer payments was selected as this measure had the highest *F* statistic (7.29) among the remaining variables. The use of this measure meant that average income (*F* statistic 4.66) could not be used due to high correlation. The only other variable that was significant in univariate analyses was average census family income (*F* statistic = 4.69), and this measure was not highly correlated with median income of private households or government transfer payments.

continuous measure for linear regression modelling, this variable was coded as categorical during logistic regression to ease in interpreting the coefficients.

For each logistic regression model, the -2 log likelihood ratio was reported as well as results from a classification table, the Hosmer-Lemeshow χ^2 statistic, and Negelkere's R^2. The likelihood ratio is similar to the *F* test in ordinary least squares regression, as it measures the overall significance of the model (Birch, Eyles & Newbold, 1993). The smaller the likelihood value the better the fit (Norusis, 1993). The classification table is a two-way table that can be used to compare predicted and observed outcomes, and calculate the proportion of cases that are correctly classified by the logistic model. The Hosmer-Lemeshow χ^2 statistic is another measure of overall fit, and this statistic is particularly useful when the model includes multiple and/or continuous predictor variables (Norusis, 1993).[13] Negelkere's R^2 value is similar to the R^2 value used in ordinary least squares regression, as it measures the explanatory power of the model. Higher values indicate a greater level of explanatory power (Norusis, 1993). Unlike the R^2 value, however, it is not a measure of the percentage of variance explained by the model (Birch, Eyles & Newbold, 1993).

The number and proportion of individuals who visited the practice during the year and the number and proportion of adults who did not visit were calculated to ensure that the logistic regression model would not be over-fit or under-fit. "A large number of outcome events is needed if many independent variables are included in the analysis' (Concato, Feinstein & Holfort, 1993, p. 203), as the results of models that have fewer than 10 outcome events per independent variable may be inaccurate (Harrell, Lee, Matchar & Reichert, 1985). Participates in the Visit/Payment Study included 659 adults - 579 of these individuals visited the practice at least once (87.8 percent) and 80 (12.2 percent) did not.

Ultimately, information from the classification table was not used to evaluate the predictive accuracy of the logistic regression models, as all of the models correctly classified individuals approximately 88 percent of the time. In addition, all models classified all individuals as having at least one visit. Therefore, the predictive accuracy was similar for each

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[13] This statistic is derived by "forming 10 groups of equal size containing the deciles of the fitted values. Observed and expected values are calculated by summing the estimated logistic probabilities and observed values of the outcomes variable in the usual fashion. This statistic ... follow[s] a chi-square distribution with eight degrees of freedom when the fitted model is the correct model (Hosmer et al., 1991, pg. 1632).

equation, as the proportion of individuals who visited the practice was similar between models. Variability in the percent classified as correct simply reflected slight difference between-models in sample size and thus the incidence of not visiting. The Hosmer-Lemeshow χ^2 statistic was not significant in any of the multivariable models - suggesting non-significant differences in observed or expected outcomes among randomly selected subgroups of participants.

Linear regression. Multiple, linear regression was used to develop multivariable models to evaluate the explanatory power and assess the relative contribution of potential predictors of the amount of time physician spent providing medical services during a visit, the number of visits to the practice per annum among those that visited at least once, and annual OHIP payments received by the practice for an individual.

Predictive validity was assessed using cross-validation - this approach to modeling required that each case in each data set be randomly assigned to training and test samples. Models were developed using the training sample followed by a subsequent validation of the robustness of the model with the remaining participants (i.e., test sample) (Concato et al., 1993; Harrell, Lee, Matchar & Reichert, 1985).

Goodness-of-fit of linear models was assessed using the R^2 value. When multiplied by 100 the R^2 value is equal to the percentage of variability in the dependent variable that is explained by the model. R^2 values are provided in tabular format for analyses conducted with the training, test, full and trimmed samples. Trimmed samples excluded outliers identified when equations were fit to the full sample. The standardized beta coefficients reported in tabular format are derived from the full sample of participants, and were presented for comparative purposes. The R^2 values described in the text of this dissertation are those derived from the full sample for two reasons. First, these values were selected for reporting purposes as each multivariable model included few outliers. Second, the identification of the characteristics of individuals or services excluded from any capitation agreement between payers and providers would need to be specified.

3.3.6.c.ii. Predictive ratios

Multivariable models of annual OHIP payments were evaluated using the predictive ratio. While the R^2 value assessed the predictive validity of the formula at the individual-level (which is important when evaluating the utility of a formula in limiting differential selection), the predictive ratio was used to assess the predictive accuracy of a formula at the group-level. This is important when evaluating the net financial impact of a formula on providers who intentionally or unintentionally roster a biased selection of enrollees. The predictive ratio has been used by other researchers to evaluate capitation formulae (Anderson et al., 1990; Ash et al., 1989; van Vliet & van de Ven, 1992).

The predictive ratio for a group of individuals was calculated by summing the capitation payments predicted by a regression formula for a specific cohort and dividing this by the sum of the actual payments. "Predictive ratios greater than one indicate groups for which the model will lead to overpayment; predictive ratios less than one reflect groups whose costs are higher than the model predicts. The best models will have all predictive ratios for a wide selection of subgroups quite close to one" (Ash et al., 1989, p. 25).

Selection bias could occur during the enrollment period. For example, a group of physicians may choose to specialize in serving individuals with disabilities, or decide to avoid servicing individuals who have mobility problems by locating their practice in a location that would be difficult or inconvenient to access in a wheelchair. Alternatively, differential selection could occur after the enrollment phase. For example, providers may elect to de-roster individuals who have high visit rates or who were admitted to a hospital. Therefore, predictive ratios were calculated for select populations that varied by disability status, health status, prior visits, and hospitalization history (i.e., yes/no).

Predictive ratios were calculated for the following rate adjustment formulae for these reasons:

1. Age and gender. These two adjusters are used in most jurisdictions that use capitation and represent an "appropriate starting point for health care capitation formulae" (Hutchison et al., 1999, p. 20),
2. Age, gender and self-rated health status. The health status adjuster was added to the base model as this measure of need might be considered a standard by which to compare other formulae (Hutchison et al., 1999),
3. Age, gender and prior visits. The prior visit variable was identified in this study as a significant determinant of the incidence of a visit, the frequency of visits among those who visited at least once, and annual OHIP payments. In addition, this variable made the largest contribution to the explanatory power of these multivariable models as

measured by the standardized beta coefficient. Lastly, data on prior utilization are available to the Ontario MOH via prior year OHIP records.

4. Age, gender and hospital admission. The hospital admission adjuster was selected due to its significance and explanatory power as a determinant of visit frequency among those who visited at least once and annual OHIP payments. This variable also approached significance as a determinant of the incidence of a visit. Lastly, data on admission history are available to the Ontario MOH via linkage between OHIP data and hospital discharge abstracts.
5. Age, gender and the incidence of low income. The low income adjuster was selected due to its significance as a determinant of visit frequency among those who visited at least once and annual OHIP payments.[14] This information is available to the Ontario MOH via linkage between OHIP and Census data.
6. Age, gender, prior visits <u>and</u> hospital admission in the preceding year. These last two adjusters were selected: (a) due to the reasons identified above, and (b) to see if the use of four rather than three adjusters improved the predictive performance of the formula at the group-level. A community-based measure was not added to this model as the explanatory power of these indicators were insignificant once information on prior visits and hospital admissions were included in multivariate models.

3.3.6.c.iii. Payment Schedules

Once potential adjusters were identified, example payment schedules were developed. These schedules were constructed using two-by-two tables with age and gender categories, and cell values were calculated using regression equations derived from a number of different potential capitation rate formula. The values represent the mean and median payments that would be made if the Ontario MOH had used each formulae to adjust the average rate paid to the

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[14] While the median income of private households and unemployment rates were identified as determinants of annual payments, these measures of relative wealth and economic climate are highly correlated with the incidence of low income. In addition, the incidence of low income measure may have more face validity and feasibility from a policy perspective. For example, members of the public may not understand the term 'median' and policy-makers may not want to be accused of adjusting for a social issue (i.e., unemployment) that they are expected to address.

practice for all participants. The purpose of designing these schedules was to demonstrate the redistributive effect of different formulae. These tables are presented in Appendix N.

A table was also constructed (Table 16 in Section 3.4.3.) to evaluate the level of association between total, annual OHIP payments and funds that would have been received by the practice if different capitation formulae had been used. Values were assigned to each participant using the regression equations derived for each funding formula, and Pearson correlations were used to assess the level of association. Again, estimates of capitated payments reflected funds that would have been paid if the Ontario MOH had used each formulae to adjust the average rate paid to the practice for all participants.

3.3.6.c.iv. Outlier analyses

Outliers were identified using standardized residuals (i.e., three or more standard deviations). The characteristics of these individuals were profiled, and the multivariable models were re-fit afer these cases were trimmed from the sample.

3.4.0. Findings

3.4.1. Descriptive Profile

3.4.1.a. Medical Minutes Study

Informed consent was obtained from 686 individuals during the period of data collection, but physicians supplied information on the amount of time they spent providing medical services for only 559 of these people (i.e., 81.5 percent). Clinical data could not be linked for an additional nine people (i.e., 1.6 percent of 559) as the unique identifier was either missing from the Service Encounter Form or this value was not accurately transcribed. Therefore, the final sample included 550 subjects or 80.2 percent of those who agreed to participate.

The stratification strategy was successful in ensuring that the visits included in the sample were representative of the relative volume of services provided by the various primary providers, and did not over- or under-represent the practice patterns of certain physicians. Table 4 outlines the size of the caseload assigned to these primary providers (i.e., number of cases and proportion of total) as well as the size of the sample represented by these physicians (i.e., number of cases and proportion of total). The majority of patient participants in the Medical Minutes study were seen by the doctor designated as their primary provider (93.6 percent; $n = 515$). Thirty-five individuals, however, were seen by 14 different residents. Eight of these doctors were first year residents, while six of these doctors were in their second year of residency.

Table 4

Medical Minutes Study: Stratification Strategy by Regular Physician

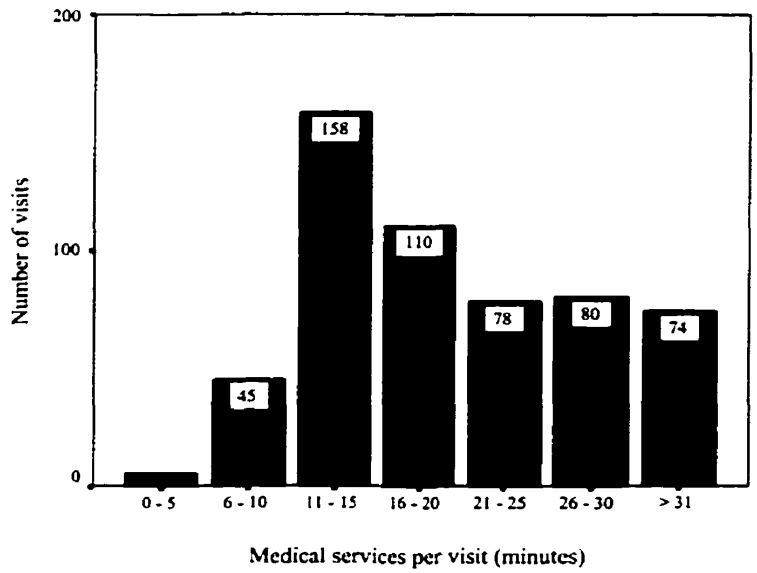
Regular Physician	Team	Patient Caseload (April 1996 to April 1998)		Sample	
		Patients (#)	Proportion of Patients in Practice Assigned to a Regular Physician (%)	Participants in Sample with Regular Physicians Designated as Primary Provider* (#)	Proportion of Participants in the Sample who have the Regular Physician Designated as Their Primary Provider (%)
1	Blue	488	7.6	30	5.5
2	Blue	226	3.5	29	5.3
3	Blue	577	9	35	6.4
4	Blue	565	8.8	63	11.5
Total Blue Team			29.1		28.5
5	Red	922	14.4	78	14.2
6	Red	961	15	73	13.3
7	Red	541	8.5	70	12.7
Total Red Team			38		40.2
8	Green	289	4.5	44	8
9	Green	419	6.6	32	5.8
10	Green	964	15.1	61	11.1
11	Green	435	6.8	35	6.4
Total Green Team			33		31.3
Subjects		-	100	550	100

Note. * These subjects have a 'regular physician' as their designated primary provider, but they may have seen another doctor/resident during the current visit.

The majority of the physicians spent between 11 and 20 minutes providing medical services for an encounter with a participants. As the operational definition provided to physicians required them to include charting time for the encounter, this measure may include some time without the participants present. Figure 13 summarizes the amount of time that these physicians spent providing medical services. When the mid-point of the interval of time physicians spent providing medical services was assigned to each encounter, the mean time spent per visit was 19.79 (median = 18; *SD* = 7.92).

Figure 13

Amount of Time Physicians Spent Providing Medical Services to Participants (N = 550)[1]

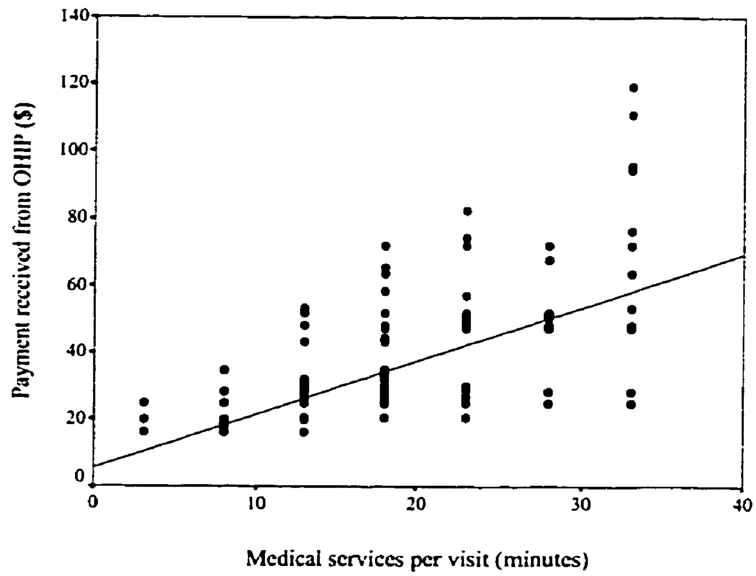


Physicians billed the OHIP an average of $36.94 for each visit (*SD* = $18.47; range $16.25 to $119.40). As described in Section 3.3.5. the amount of time physicians spent providing medical services was highly correlated with the amount of money billed and/or received from OHIP for their services (r_s = .676, p<.001, r_s^2 = 45.7 percent of the variance). The amount of money paid by OHIP was equal to the amount of money billed by physicians in all instances. Figure 14 illustrates the relationship between medical services per visit and OHIP payments per visit.

[1] Physicians spent less than five minutes providing medical service to five individuals.

Figure 14

Scatter Plot of the Relationship Between the Amount of Medical Services Per Visit and Payments Per Visit (n = 543).



The most frequent service codes used by physicians to bill for their services included:

1. Intermediate assessment (n = 307 or 56 percent of encounters).
2. General annual health examination (n = 95; 17 percent).
3. Psychological therapy (n = 55; 10 percent).
4. Counseling (n = 23; 4 percent).
5. Intermediate assessment with psychological therapy (n = 18; 3 percent).
6. Minor assessment (n = 15; 3 percent).

When the service codes billed by physicians was collapsed into three types of visits, intermediate medical care accounted for 63 percent of visits while general medical and psychological counseling each accounted for 18 and 19 percent of the visits.[2]

Table I1 in Appendix I provides a descriptive profile of individuals in the Medical Minutes study. Participants ranged in age from 16 to 92 years (mean = 50.70; SD = 17.38). The most frequent diagnostic codes assigned for billing purposes included:

[2] Intermediate medical care = minor and intermediate assessments, general re-assessment, and prenatal care. General medical = general annual health, pre-operative visits, major prenatal care. Psychological counseling = any visit that included psychotherapy and counseling service codes.

1. Hypertension (8 percent).
2. Depression (6 percent).
3. Musculo-skeletal symptoms not yet specified (5 percent).
4. Family planning (5 percent).
5. Diabetes (5 percent).
6. Coronary artery disease (5 percent).[3]

Most participants were female (64 percent), married or partnered (52 percent), lived with another adult in the home (68 percent), were born in Canada (64 percent) or spoke English in their home (90 percent). Participants had high levels of education as 65 percent held post-secondary education or more, in fact 47 percent had university or postgraduate education. Most individuals worked full or part-time (55 percent) or were retired (22 percent). Seven percent were unable to work, and two percent reported that they were looking for work. Sixteen percent of participants rated their "general state of health" as excellent, while 30 percent rated their health as very good. An additional 33 percent rated their health as good, and 16 percent indicated that their health was fair. Only five percent of participants indicated that their health was poor. Thirty-five percent of participants indicated that they had a long term disability, and 33 percent reported that they were limited in the kind or amount of activity they do because of a long term physician condition, mental condition, or health problem.

Thirteen percent of participants had been hospitalized during the preceding 12 months, and 16 participants were hospitalized from one to three days. Eleven participants spent from four to six days, four people spent seven to nine days, and 13 individuals spent 10 or more days in a hospital.[4] Sixty-six percent of participants did not visit a family doctor from another clinic in the past 12 months, and an additional 25 percent visited a physician outside of the practice one or two times in the preceding year. Only 10 percent of participants visited a family doctor from another clinic three or more times in the preceding year.

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[3] The diagnostic code used to prepare this descriptive summary was the code assigned to the service code. If a patient was assigned more than one service code for a visit, the diagnostic code attached to the "A" service code was selected.

[4] While 52 participants indicated that they spent time in a hospital in the past 12 months, only 44 of these individuals responded to the question regarding the number of days spent in a hospital.

Participants were from 27 different communities in Toronto, and one to 27 participants resided in each community.[5] These communities were similar to the average community in Toronto and Ontario in terms of the female labour force participation rate, median income, median census family income, average household income and median household income. These home communities were similar to the average community in Toronto (but not the average community in Ontario) in terms of the proportion of immigrants and recent immigrants, average dwelling value, and the proportion of the population in the community that spoke English in the home. Participants' communities were 'much higher' than the average community of Toronto in terms of unemployment rates, the proportion of total income attributable to government transfer payments, average income and average census family income. Participants' communities were 'higher' than the average community of Toronto in terms of the incidence of low income. Lastly, participants' communities were less educated than the average community in Toronto or Ontario.

Tables I1 and I3 in Appendix I provide a summary of the social, demographic and health characteristics of participants. Table I2 in Appendix I provides a summary of the socioeconomic status of participants' communities, as well as the status of the average community in metropolitan Toronto and in the province of Ontario.

3.4.1.b. Visit/Payment Study

A stratified random sample of 1,200 individuals was sent social/demographic/health status questionnaires. Responses were received in the mail from 895 individuals (74.6 percent of 1,200). Seventy-one individuals were deemed to be ineligible because: (a) their envelope was marked 'Return-to-Sender' due to an incorrect address, (b) respondents or the clinical database indicated that they no longer received care at the Department of Family and Community Medicine, or (c) the practice was informed that the individual was deceased.[6] An additional nine people refused to participate. When the social, demographic, health status and billing data for these individuals was abstracted from the clinical database, an additional 264 individuals were

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[5] Forward sortation areas were used to identify the home communities of patient participants. Census data derived from these forward sortation areas indicated that between 45 and 63,701 inhabitants lived in each community in May 1996.

[6] After the sample frame was constructed and the sample selected, this investigator was informed that the clinical database at the practice included information on whether individual patients had died or transferred to another provider. Naturally, this information was only available for those individuals for whom the practice had been informed about their status.

considered to be 'non-respondents' as their record did not have information for more than five variables.

Therefore, social, demographic and health status information was available for approximately 856 individuals (71.3 percent of 1,200).[7] As patient participants may have visited a physician at the practice before or after the period of data collection and completed a questionnaire at that time, the number of people for whom there is relatively complete social/demographic/health status information was different than the number of individuals who responded to the mailing. Seventy-eight of these 856 individuals visited a family doctor at another clinic three or more times in the past 12 months. Information on the external use of primary care physicians was not available for an additional 119 people.

In summary, 1,200 questionnaires were sent to a stratified, random sample of individuals. Seventy-one people were deemed ineligible and nine refused to participate. There were 264 non-respondents. Seventy-eight individuals were excluded on the basis that they visited a family doctor at another clinic three or more times in the preceding year, and 119 individuals were excluded as they did not provide information on the extent to which they visited other primary care physicians. Therefore, 659 people were included as participants in the Visit/Payment study. This represented 55 percent of 1,200 individuals or 65.7 percent of eligible adults.[8] Figure 15 summaries this process.

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[7] Twelve hundred individuals minus 71 ineligibles minus nine refusals minus 264 non-respondents.

[8] 659 participants/(1,200 minus 78 ineligible due to high external use minus 119 ineligible as they did not provide information regarding external use)

Figure 15

Selection Process for the Identification of Participants

1,200 individuals		⇒	The original stratified, random, sample.
minus	71	⇒	Individuals deemed to be ineligible due to incorrect address, moved, or deceased.
minus	9	⇒	Individuals who refused to participate.
minus	264	⇒	Individuals deemed to be non-respondents due to the fact that their record in the clinical database were missing information for more than five variables.
minus	78	⇒	Individuals deemed ineligible because they indicated that they visited a family doctor at another clinic three or more times in the preceding year.
minus	119	⇒	Individuals deemed ineligible because they did not provide a response to the question regarding whether they visited a family doctor at another clinic in the preceding year.
	659		Participants

Participants in the Visit/Payment study ranged in age from 17 to 89 years (standard deviation ± 17.0); 58 percent were female while 42 percent were male. The age and gender structure of participants was similar to the sample frame, as illustrated in Table 5, suggesting that the stratification process was successful. The proportion of male participants in each age interval was the same as the sample frame (χ^2= 971, df = 16, p <.000), and the proportion of female participants in each age cohort was the same as the sample frame (χ^2= 1267, df = 16, p <.000).

Table 5

Visit/Payment Study: Stratified Random Sample

	Age Intervals (years)	Sample Frame			Stratified Random Sample Size (#)	Participants		
		Number	Proportion of Gender (%)	Proportion of Sample Frame (%)		Number	Proportion of Gender (%)	Proportion of Sample (%)
Male	16 - 30	256	14.6	**6**	72	28	10.1	**4.2**
	31 - 45	547	31.3	**12.9**	155	78	28.2	**11.8**
	46 - 65	546	31.2	**12.9**	154	101	36.5	**15.3**
	66 - 75	263	15	**6.2**	74	46	16.6	**7**
	> 75	138	7.9	**3.3**	39	24	8.7	**3.6**
Female	16 - 30	482	19.3	**11.4**	136	70	18.3	**10.6**
	31 - 45	808	32.4	**19**	229	111	29.1	**16.8**
	46 - 65	731	29.3	**17.2**	207	127	33.2	**19.3**
	66 - 75	297	11.9	**7**	84	56	14.7	**8.5**
	> 75	177	7.1	**4.2**	50	18	4.7	**2.7**
Total		4245		100	1200	659		100

Most participants were married or partnered (59 percent) or lived with another adult in the home (47 percent). Participants had high levels of education - 52 percent held a university or postgraduate education and an additional 19 percent had completed community college. Most of the participants reported that their main activity was working full-time or part-time (58 percent), while 23 percent were retired. Four percent reported that they were unable to work, and one percent reported that they were looking for work.

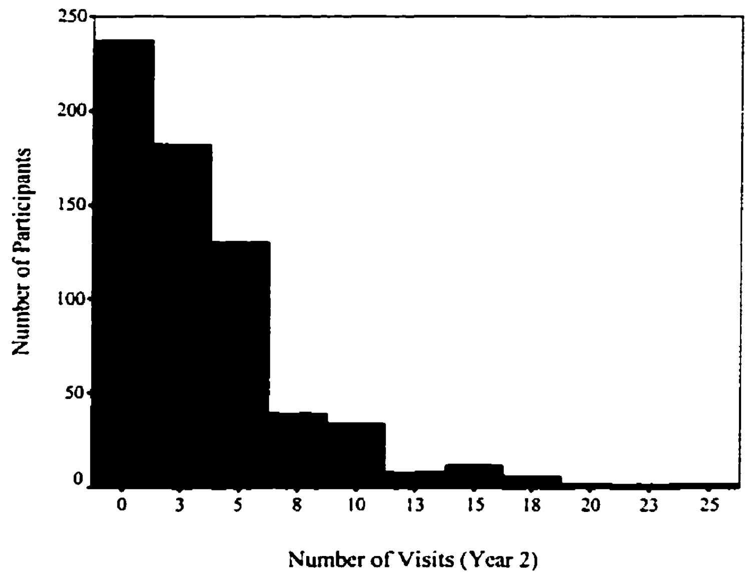
When asked to rate their "general state of health", 64 percent rated their health as either good or very good. An additional 21 percent rated their health as excellent, and 12 percent reported fair health. Only three percent of participants reported that their health was poor. Thirty-one percent of participants indicated that they had a long term disability, but only 25 percent reported that they were limited in the kind or amount of activity they do because of a long term physical condition, mental condition, or health problem. Twelve percent of participants had been hospitalized during the preceding year, 43 percent of these individuals were hospitalized for one to three days. Eighty-one percent did not visit a family doctor from another clinic in the past 12 months. Eleven percent visited a family doctor from another clinic once in the preceding year, and an additional seven percent made two visits to a family doctor from another clinic in the past year. Only five participants saw a physician at the practice for prenatal services during the period of time in which data was collected regarding visits. Table I3 in Appendix I provides a summary of the social, demographic and health status characteristics of participants.

Participants in the Visit/Payment study were from 132 different forward sortation areas, and between one and 31 people resided in each area. These communities were similar to the average community in Toronto and Ontario in terms of unemployment rate, female labour force participation rate and the proportion of total income derived from government transfer payments. Participants' communities were similar to the average community in Toronto (but not the average community in Ontario) in terms of the proportion of the population that was immigrant, recent immigrant, and who use English as a home language. The communities' incomes were also higher as measured by average and median income, average and median census family income, and average household income. The median household income of participants' communities, however, was lower than the average community in Toronto. The incidence of low income was higher and the educational status was lower. Table I2 in Appendix I provides a summary of the socioeconomic status of participants' communities, as well as the status of the average community in metropolitan Toronto and in the province of Ontario.

Visits per annum during the second year of data collection (i.e., dependent variable time frame = June 1, 1997 to May 31, 1998) averaged 3.88 (SD = 5.15; range 0 - 69 visits; median = 2.0). The distribution, as illustrated in Figure 16, is positively skewed (skewness = 4.89; kurtosis = 44.31). Twelve percent of individuals did not visit the practice, while an additional 24 percent made one visit. Sixteen percent of individuals made two visits, 11 percent made three visits, and an additional nine percent made four visits, and six percent made 5 visits. A cumulative total of 79 percent of participants made less than five visits to the practice. The five largest outliers represented annual rates of 69, 37, 30, 29 and 26 visits per annum. As described in the methodology section entitled 'Data Quality', annual visit rates were highly correlated across time (Pearson $r = 0.723$; $p < .001$; $r^2 = 52.27$ percent).

Figure 16

Distribution of Visits Per Annum - All Participants ($N = 654$)[9]



Because a sizable proportion of individuals did not visit the practice within a one year term, the distribution of visits per annum was analyzed in two stages. Table I1 and I3 in Appendix I provides a profile of the characteristics of individuals who visited the practice at least once during the course of a year. For example, while 90 percent of adults between the age of 16 and 30 visited at least once, 95 percent of adults 76 years of age or older visited at least once. Eighty-six percent of males visited at least once, while 89 percent of females made one visit during the year.

The distribution of visits per annum among participants who visited the practice at least once in the year is illustrated in Figure 17. The average number of visits per annum, for those who made at least one visit during the year (n = 579), was 4.41 (s.d. = 5.27; range: 1 - 69). The distribution was positively skewed (skewness = 4.93, kurtosis = 43.88).

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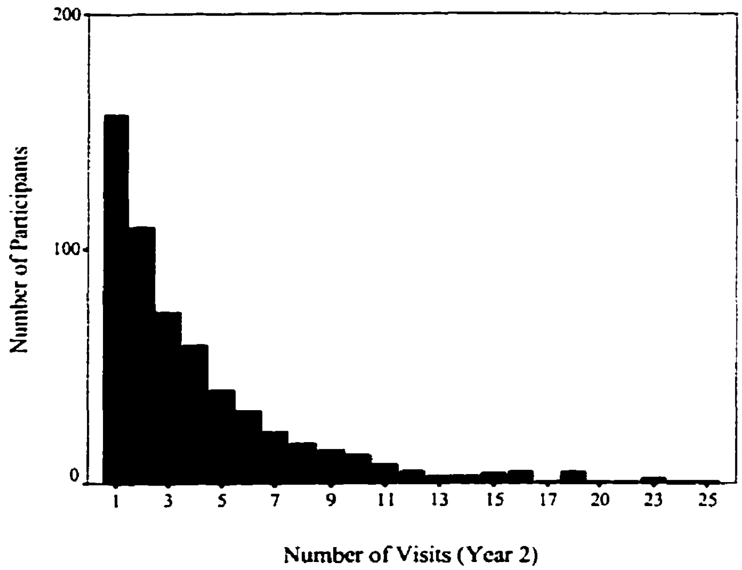
[9] Five of the high-cost cases have been removed from the sample - for illustrative purposes - in order to reduce the skewness of the distribution.

Figure 17

Distribution of Visits Per Annum for Individuals Who Visited At Least Once (n = 574)[10]



Due to the skewed distribution of these values, the dependent variable used for multivariate analysis equaled the logarithm (base 10) of the number of visits per annum (i.e., for those individuals who visited the practice at least once). Figure 18 illustrates the distribution of this dependent variable. The log transformation reduced the skewness score from 4.93 to .428 and the kurtosis score from 43.88 to -.466.

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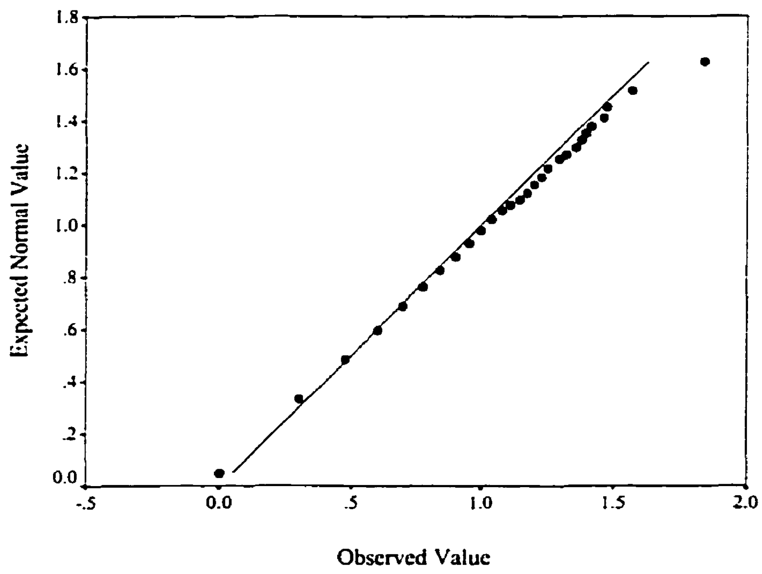
[10] Five of the high-use cases have been removed from the sample - for illustrative purposes - in order to reduce the skewness of the distribution.

Figure 18

Normal Q-Q Plot of Log(Visits Per Annum) for Individuals Who Visited At Least Once (n = 579)



The average, annual OHIP payments for participants during the first year of data collection (i.e., June 1, 1996 to May 31, 1997) was $139.73 (*SD* = $217.44; range: $0.00 - $2,810.75). The average number of visits was 4.12 (*SD* = 5.17; range = 0 - 51 visits; median = 2.0). The number of people who made less than five visits during this year was 153 (23 percent), while 506 individuals made six or more visits (77 percent). The distribution of information on this prior visit variable is located in Figure I4 and Table I5 in Appendix I.

During the second year of data collection (i.e., dependent variable time frame = June 1, 1997 to May 31, 1998) the average, annual OHIP payments were $132.17 (*SD* = $256.29; range: $0 to $5,101.20). The distribution, as illustrated in Figure 19, was positively skewed (skewness = 12.65; kurtosis = 224.34). [11] The five largest outliers represent annual OHIP payments of $5,101.20, $2,346.60, $1,402.90, $1,294.96 and $915.57. As described in Section 3.3.5., annual OHIP payments were highly correlated across time (Pearson $r = 0.72$; $p < .001$, $r^2 = 51.55$

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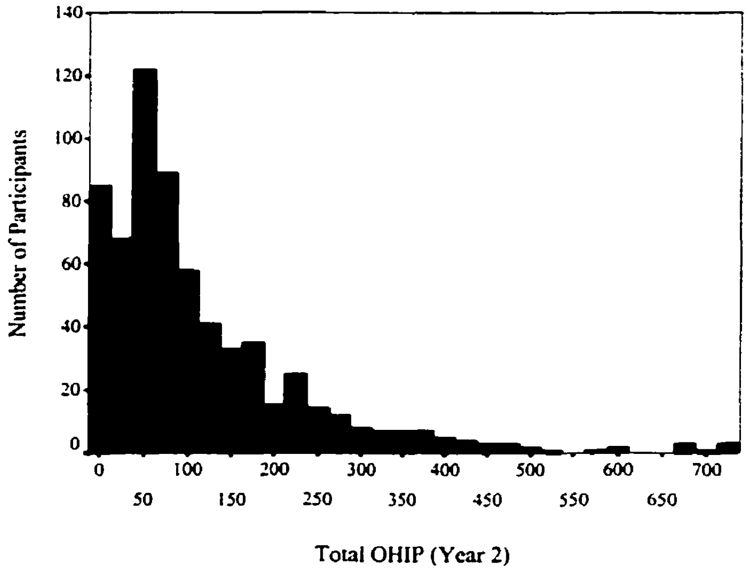
[11] A skewness value greater than 1 generally indicates a distribution that differs significantly from a normal distribution. In the normal distribution, the value of the kurtosis statistic is 0. Positive kurtosis indicates that the observations cluster more and have longer tails than those in the normal distribution (Norusis,1993).

percent). The sum of payments received from OHIP for these individuals during both time periods was similar (i.e., year 1 = $92,086.64; year 2 = $87,103.07). This measure of physician resource utilization was transformed prior to use as a dependent variable.

Figure 19

Distribution of Annual OHIP Payments (*n* = 654)[12]



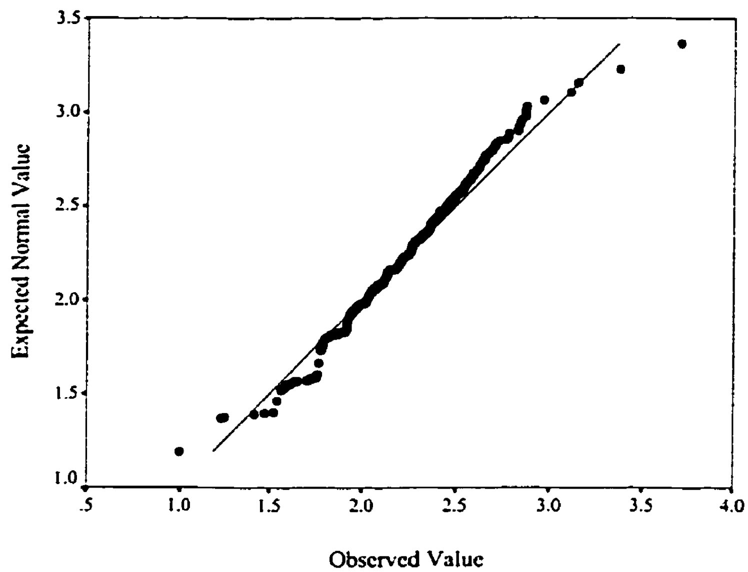
The dependent variable used for multivariate analysis equaled the logarithm (base 10) of the annual OHIP payment plus a value of 10.[13] The log transformation reduced the skewness score from 12.65 to -.30 and the kurtosis score from 224.34 to .18. Figure 20 illustrates the distribution of this dependent variable.

[12] Five of the high-cost cases have been removed from the sample - for illustrative purposes - in order to reduce the skewness of the distribution.

[13] The constant 10 was selected to ensure that a logarithm of the zero values could be obtained and that the smallest values in the distribution would be greater than or equal to one.

Figure 20

Normal Q-Q Plot of Log (Annual OHIP Payments) Plus 10 (N = 659)



3.4.2. Univariate Analyses

The following section summarizes results of analyses conducted to assess the strength of the relationship between variables. Table I3 in Appendix I provides a descriptive summary of the average amount of physician resources used by individuals who have different characteristics. Table 6 (located at the end of this chapter) provides a summary of the results of univariate analyses and Figures K1 to K21 (located in Appendix K) illustrate the interaction plots evaluated.

3.4.2.a. Determinants of at Least One Visit: Rostered Adults

Patient characteristics that demonstrated an association with whether or not an individual visited a physician within a one year period of time (alpha = .05) included:

1. Age ($\chi^2[4, N = 659] = 20.84, p < .001$).
2. The number of adults at home ($\chi^2[1, N = 652] = 4.56, p = .04$).
3. Work status ($\chi^2[1, N = 657] = 6.48, p = .04$).
4. Self-rated health ($\chi^2[1, N = 656] = 12.51, p = .01$).
5. Whether or not the individual was hospitalized in the preceding year ($\chi^2[1, N = 658] = 4.68, p = .03$).
6. The number of visits they made to the practice in the preceding year ($\chi^2[1, N = 659] = 16.95, p = .000$).

Interaction terms that demonstrated an association included:

1. Age and gender ($\chi^2[5, N = 659] = 12.78, p = .02$).
2. Marital and disability status ($\chi^2[1, N = 654] = 4.15, p = .04$).
3. Marital and health status ($\chi^2[1, N = 646] = 4.15, p = .04$).
4. The number of adults in the home and disability status ($\chi^2[1, N = 648] = 6.42, p = .01$).
5. The number of adults in the home and health status ($\chi^2[1, N = 649] = 11.86, p = .001$).

The designated primary provider was not associated with whether or not an individual visited a doctor during one year. None of the community-level enabling characteristics reached statistical significance in univariate analyses. Additional independent variables that demonstrated an association with incidence of use when the alpha-level was set at .10 included:

1. Self-rated disability ($\chi^2[1, N = 655] = 3.39, p = .07$).
2. Activity limitations ($\chi^2[1, N = 654] = 3.09, p = .10$).

3. The frequency of hospitalizations in the preceding year (χ^2[2, N = 658] = 5.22, p = .07).

4. Hospital days in the preceding year (χ^2[2, N = 658] = 4.68, p = .10).

The following interaction terms were also significant at a cut-off of .10:

1. Age (categorical measure) and gender (χ^2[1, N = 659] = 2.74, p = .10).

2. Education and health status (χ^2[1, N = 655] = 2.72, p = .09).

Table 7 summarizes the characteristics of individuals who visited a physician at least once, but profiles only the variables identified as significant in univariate analyses (alpha-level = .05).

Table 7

Patient Determinants of At Least One Visit

	n	Visited at Least Once			*n*	Visited at Least Once	
		No.	% of Cohort			No.	% of Cohort
Age (years)				Health Status			
16 - 30	98	88	90	Poor	22	21	95
31 - 45	189	150	79	Fair	77	70	91
46 - 65	228	204	89	Good	202	185	92
66 - 75	102	97	95	Very good	220	194	88
> 76	42	40	95	Excellent	135	108	80
No. of adults				Hospital Admission			
Lives alone	170	157	92	No admission	576	500	87
Not live alone	482	415	86	1 admission	61	59	97
				≥ 2 admits	21	19	90
Work Status				Prior Year Use			
Working	383	325	85	0 - 5 visits	506	430	85
Unable/Looking	332	312	94	≥ 6 visits	153	149	97
Other	41	37	91				

Note. No. = number. *n* = number of participants in the Visit/Payment Study.

3.4.2.b. Determinants of Minutes of Medical Services

Patient characteristics that reached statistical significance in univariate analyses as predictors (alpha = .05) of minutes per visit included:

1. Age (β = -.078, F (1,548) = 16.74, p <.001, R^2 = .029).
2. Gender (F[1,548] = 4.88, p <.05).
3. Educational status (F[1,491] = 5.60, p <.05).
4. Work status (F[2,489] = 6.01, p <.01).
5. Country of birth (F[1,497] = 3.92, p <.05).
6. Self-rated health (F[4,401] = 2.34, p =.05).
7. Self-rated disability (F[1,399] = 4.25, p <.05).
8. The number of hospital admissions in the past year (F[2,405] = 3.08, p <.05).

None of the interaction terms nor the community-level enabling characteristics reached statistical significance at an alpha-level of .05. Figures K1 to K7 in Appendix K illustrate the interaction plots evaluated.

The physician seen during the visit was also a statistically significant predictor (F[26,523] = 3.85, p <.001), as was the type of visit (F[16, 526] = 41.38, p < .001). A post hoc analysis[1] was not conducted using information regarding the physician who provided the medical services, as a number of doctors (namely physician residents) saw only one participant. Therefore, a post hoc analysis was conducting using information regarding the primary provider, as this variable was also a significant determinant of minutes per visits (F[10, 539] = 5.96, p <.001) and 94 percent of participants were seen by the physician designated as their primary provider. Results indicate that only one physician spent significantly more time rendering medical services during encounters with patients than other doctors.

There was evidence of a negative, linear relationship between the age of a patient (coded as a continuous measure) and the amount of time a physician spent providing medical services. The strength of this relationship can be appreciated by reviewing the average length of medical service time devoted to individuals of different ages. Table 8 summarizes the characteristics of individuals who visited a physician at least once, but profiles only the variables identified as significant in univariate analyses.

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[1] Bonferroni test for multiple comparisons assuming equality of variances.

Table 8

Patient Determinants of Medical Minutes Per Encounter

	n	Minutes per Encounter †		*n*	Minutes per Encounter †
Age (years)			Born in Canada		
16 - 30	74	22.39	Yes	322	20.28
31 - 45	153	20.68	No	177	18.82
46 - 65	194	19.57			
66 - 75	74	17.32	Disability Status		
> 76	55	17.91	LT disability	141	19.24
			No LT disability	260	20.96
Gender					
Male	199	18.80	Health Status		
Female	351	20.35	Poor	20	19.25
			Fair	65	19.77
Education			Good	134	19.08
≤ Secondary	174	28.80	Very good	123	21.29
Post-secondary	319	20.57	Excellent	64	22.22
Work status			Hospital Admission		
Working	271	21.04			
Unable/Looking	45	19.22	No admission	356	20.56
Other	176	18.45	1 admission	39	18.13
			≥ 2 admits	13	24.15

Note. † The mean amount of time physicians spent providing medical services was calculated by assigning each patient participant a value equal to the mid-point of their assigned time interval, summing these values for all individuals in the group, and dividing the sum by the number of people in each group. LT = long term.

The strength of the relationship between age (coded as a continuous variable) and medical service time did not improve when a quadratic equation was fit (R^2 = .030). The relationship remained negative and significant even after controlling for the physician seen and the type of visit (β = -.042, p <.05). As a negative correlation was not expected, a sensitivity analysis was conducted by using a cohort of individuals coded as receiving the most common type of service (i.e., an intermediate assessment)[2] to evaluate the relationship between age and minutes of

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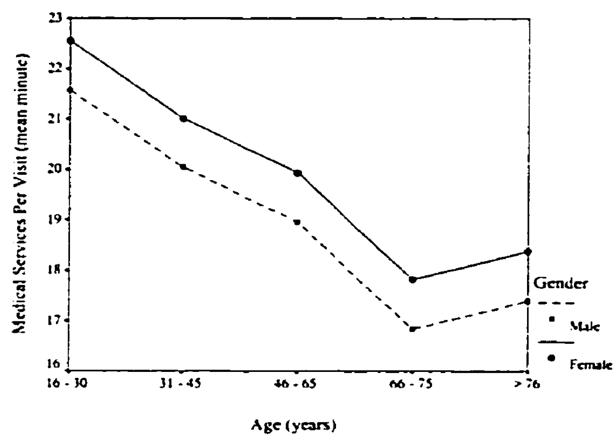
[2] Intermediate assessments were selected for a cohort, as this type of visit was most common at the practice (56 percent of visits in the sample). Physicians who bill Ontario for primary care assessments use the intermediate assessment billing code three times more often, on average, than the minor assessment code (Chan et al., 1998).

medical service per visit. Age was not a significant determinant of the amount of time physicians spent providing medical services to patients who were seen for intermediate visits ($F[1,305] = .55$, $p = .46$) whether or not the physician seen was entered as a control variable.[3]

Gender was identified as a significant determinant of minutes per visit as physicians spent more time with females than males.[4] Figure 21 illustrates the amount of time that physicians spent providing medical service for women and men of different ages. Physicians spent significantly more time with individuals who had secondary school education or less, or adults who had two or more hospital admissions than those with one admission in the preceding year.

Figure 21

Medical Services Per Visit for Women and Men by Age (n = 550)



Unexpectedly, a significantly longer period of time was spent providing medical service to individuals who were born in Canada, worked full-time, did not have a disability or who rated their health as excellent (versus good). These results were unexpected, as it was anticipated that physicians would spend more time providing medical service to individuals who were from abroad, unable to or looking for work, or those who had a long term disability.

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[3] During multivariable analyses with the full sample (n = 550) the negative relationship between age and time remained after controlling for characteristics of need and predisposing factors. However, once the type of visit was also controlled in multivariable analyses, the relationship between age and time became non-significant.

[4] The time values reported in text have been rounded to the nearest minute. Descriptive statistics reported to the second decimal place are available in Table I3 in Appendix I.

The only variables that reached statistical significance in univariate analyses when the alpha-level was set at .10 was the use of English as a home language (F[1, 492] = 3.24, p =.07)[5] and the interaction term of age (categorical measure) and gender (F[4, 550] = 2.24, p = .06). When age was measured as a continuous variable, which was the approach used in multivariable analyses, the interaction term (i.e., age * gender) was not significant (F[60, 550] = 1.05, p = .381).

3.4.2.c. Determinants of Visits Per Annum: Individuals Who Had At Least One Visit

Predisposing and enabling characteristics that reached statistical significance in univariate analyses as determinants (alpha = .05) of the number of visits per annum made by individuals who visited the practice at least once (i.e., log [annual visits >1]) included:

1. Age (β = .004; F[1,557] = 25.23; p <.001; R^2 = .042).
2. Marital status (F[1,647] = 9.26; p <.01).
3. The number of adults in the home (F[1, 570] = 3.88; p <.05).
4. Educational status (F[1, 576] = 38.67; p<.001).
5. Work status (F[2, 574] = 26.85, p <.001).
6. Country of birth (F[1,571] = 7.67, p <.01).
7. The use of English in the home (F[1, 572) = 13.31; p <.001).

All of the measures of need were statistically significant predictors as was the interaction term of marital and health status. In addition, all of the community-level enabling characteristics that described the economic environment and relative wealth of participants' communities were significant predictors. The designated primary provider was also a significant determinant of the number of visits per annum among adults who came to the practice at least once (F[10, 568] = 2.32, p <.01).[6] The variables that reached statistical significance when the alpha-level was set at .10 included the following interaction terms: marital and disability status (F[1,565] = 3.43, p = .06), the number of adults in the home and disability status (F[1,567] = 3.71, p = .055), and gender and work status (F[2,576] = .133, p = .09). Figures K8 to K14 in Appendix K illustrate

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[5] Physicians spent an average of 20 minutes with people who spoke English in their home and 18 minutes with those who did not.

[6] All F statistics and β coefficients reported in this section are derived using log (annual visits) for those who visited at least once as a dependent variable.

the interaction terms that were evaluated to determine their significance as determinants of annual visits among adults who visited at least once.

As expected, age was positively correlated with visits per annum. The strength of this relationship can be appreciated by reviewing the average, annual number of visits for individuals of different age groups who visited a physician at the practice at least once. Table 9 summarizes the characteristics of individuals and their mean number of annual visits, but profiles only the variables identified as significant in univariate analyses.[7]

Significantly more visits per annum were made by individuals who: (a) were single, divorced, separated, or widowed; (b) lived alone, or (c) had secondary school or less. Individuals who reported that they were unable to or looking for work made significantly more visits per annum than adults who had other main activities, or those who worked (full- or part-time). Individuals who were born abroad or spoke a language other than English at home made significantly more visits per annum than adults who were born in Canada or who spoke English in their home.

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[7] All visit rates in this section were calculated for the cohort of patients who visited the practice at least once during the year.

Table 9

Patient Determinants of Annual Visits Among Individuals Who Visit At Least Once (n = 579)

	n	Mean Visits (#)		n	Mean Visits(#)
Age (years)			Health Status		
16 - 30	98	3.64	Poor	22	10.48
31 - 45	189	4.10	Fair	77	7.63
46 - 65	228	4.17	Good	202	4.77
66 - 75	102	5.29	Very good	220	3.27
> 76	42	6.40	Excellent	135	2.62
Marital Status			Disability Status		
Single, divorced,			LT disability	206	6.43
separated,			No LT disability	449	3.42
widowed or other	265	5.31			
Married/partnered	384	3.82	Activity Limitation		
Adults at home			Limitations	167	6.96
Lives alone	265	5.31	No limitations	487	3.47
Not live alone	384	3.82			
Education			Hospital Admissions		
Secondary or less	192	6.05	No admission	576	4.00
Post-secondary	465	3.72	Admit	82	6.22
Work Status			No admission	576	4.00
Working	383	3.33	1 admission	61	5.37
Unable/Looking	33	9.45	≥ 2 admits	21	8.84
Other	241	5.31			
Born in Canada			Time in Hospital		
Yes	404	4.21	No nights	577	4.13
No	248	4.81	1 - 9 nights	67	5.39
			10 or more nights	15	10.0
English as Home language			Prior Year Use		
			0 - 5 visits	506	2.90
Yes	591	4.25	≥ 6 visits	153	8.77
No	62	5.95			

Note. * Frequency of annual visits among individuals who visited at least once.

Self-rated health status was a significant determinant of the frequency of visits per annum among adults who visited the practice at least once during the year ($F[4, 573] = 26.66$, $p < .001$). Individuals rated their health on a five-point scale - each category differed significantly from all other categories in terms of the average number of visits per annum. Self-rated disability status ($F[1, 573] = 51.67$; $p < .001$) and activity limitations ($F[1, 572] = 59.59$; $p < .001$) were both significant determinants of the frequency of visits per annum among adults who visited the practice at least once. Individuals who reported that they had a long-term disability or activity limitations visited the practice more often than those who did not have a long-term disability or any activity limitations.

Individuals who reported that they were admitted to a hospital in the preceding 12 months visited the practice more often than those who indicated that they were not admitted during this period of time ($F[1, 576] = 22.57$; $p < .001$).[8] The number of times an individual was admitted to a hospital was also a significant determinant of visits per annum among those who visited the practice at least once. Frequency of hospital admissions was measured using three categories - each group differed significantly in terms of the average number of visits to the practice per annum ($F[2, 575) = 14.87$; $p < .001$). The length of time patients stayed in the hospital was also a significant determinant of visits per annum among those who visited at least once. Again, individuals in each time category differed in terms of the average number of visits they made per annum to the family practice ($F[2, 576] = 14.07$; $p < .001$).

All area-based measures of earned income demonstrated a significant, negative relationship with the frequency of annual visits for patients who visited the practice at least once.[9] The most powerful predictor was the median income of private households ($\beta = -.0000062$; $F[1, 574] = 27.08$; $p < .001$, $R^2 = .045$). In addition, there was evidence of a negative relationship between female labour force participation rate and the number of visits per annum among adults who visited the practice at least once ($\beta = -.006$; $F[1, 574] = 6.17$; $p < .05$, $R^2 = .011$).

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[8] Both groups of adults must have visited the practice at least once in the preceding year.

[9] Average income, median income, average census family income, median census family income, average income of private households, median income of private households.

Lastly, there was a positive relationship between visit frequency among individuals who visited at least once and:

1. The proportion of total income in a community that was derived from government transfer payments (β = .001; F[1, 574] = 19.16; p <.001, R^2 = .032).
2. The incidence of low income in a community (β = .007; F[1, 574] = 30.32; p <.001, R^2 = .050).
3. The unemployment rate (β = .002; F[1, 574] = 28.97; p <.001, R^2 = .048).

Only one interaction term - marital by health status - was statistically significant and Figure K10 suggests that individuals who are single, divorced, separated or widowed make more visits per annum, unless they rate their health as good. Figures K8 to K14 illustrate the interaction terms evaluated to determine their significance as determinants of visit frequency.

3.4.2.d. Determinants of Total, Annual OHIP Payments

Predisposing and enabling characteristics that reached statistical significance as predictors (alpha = .05) of the total amount of OHIP payments received by the practice per annum (i.e., log [OHIP payments + 10]) included:

1. Age (β = .167; F[1,657] = 18.82; p <.001; R^2 = .028).
2. Marital status (F[1,647] = 8.04; p <.01).
3. The number of adults in the home (F[1, 650] = 9.27; p <.01).
4. Educational status (F[1, 655] = 13.03; p <.001).
5. Work status (F[2, 654] = 16.97; p <.001).
6. Country of birth (F[1, 650] = 4.98; p <.05).
7. The use of English in the home (F[1, 651] = 4.35; p <.05).

In addition, all of the measures of need were statistically significant predictors. All of the community-level enabling characteristics, with the exception of the measure of average family dwelling, were significant predictors of total, annual OHIP payments. Lastly, the designated primary provider was also a significant determinant of annual OHIP payments (F[10, 648] = 2.37, p <.01).[10] None of the interaction terms reached statistical significance when the alpha-level was set at .05. Figures K15 to K21 illustrate the interaction terms evaluated. The variable

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[10] All F statistics and β coefficients reported in this section are derived using log (OHIP payment + 10) as a dependent variable.

that reached statistical significance when the alpha-level was set at .10 included gender ($F[1, 657] = 2.91$; $p = .088$) and the interaction term for education and health status ($F[4, 654] = 2.14$; $p = .047$).

As expected, there was evidence of a positive, linear association between age (coded as a continuous measure) and total, annual OHIP payments. The strength of this relationship can be appreciated by reviewing the average, annual OHIP payments for individuals of different age groups. Higher annual OHIP payments were received for individuals who: (a) were single, divorced, separated or widowed, (b) did not live with another adult, (c) had secondary school education or less, (d) were unable or looking for work, (e) born outside of Canada, or (f) did not speak English in their home. Table 10 summarizes the characteristics of individuals and the total amount of OHIP payments made to the practice in a one year period, but only profiles the attributes identified as significant in univariate analyses.[11]

Self-rated health status was a significant determinant of total, annual OHIP payments ($F[4, 651] = 15.14$; $p < .001$). Payments received for individuals who rated their health as excellent, very good or good did not differ in size, while payments received for adults who rated their health as good, fair or poor did not differ in size. Payments for individual who rated their health as fair or poor, however, were significantly higher than adults who rated their health as excellent or very good.

Self-rated disability status was also a significant determinant of total, annual OHIP payments ($F[1, 653] = 26.78$; $p < .001$) as was the self-rated presence or absence of activity limitations ($F[1, 652] = 31.72$; $p < .001$). Annual OHIP payments received by the practice for individuals who reported that they had a long-term disability or activity limitation were significantly higher than payments for adults who reported that they did not have a long-term disability or an activity limitation.

[11] These dollar values were derived from unadjusted, total annual OHIP payments.

Table 10

Patient Determinants of Total, Annual OHIP Payments (N = 659)

	n	Mean Payment ($)		n	Mean Payment ($)
Age (years)			Health Status		
16 - 30	98	125.69	Poor	22	287.17
31 - 45	189	140.71	Fair	77	228.62
46 - 65	228	118.29	Good	202	141.44
66 - 75	102	141.97	Very good	220	106.93
> 76	42	160.41	Excellent	135	81.33
Marital Status			Disability Status		
Single, divorced, separated, widowed, other	265	170.22	LT disability	206	196.22
Married/partnered	384	106.99	No LT disability	449	102.57
Adults at home			Activity Limitations		
Lives alone	170	180.50	Limitations	167	208.97
Not live alone	482	115.05	No limitations	487	105.53
Education			Hospital Admissions		
Secondary or less	192	178.78	No admission	576	113.33
Post-secondary	465	133.34	Admit	82	203.91
Work Status					
Working	383	98.02	No admission	576	113.33
Unable/Looking	33	381.33	1 admission	61	174.83
Other	241	152.58	≥ 2 admits	21	288.36
Born in Canada			Time in Hospital		
Yes	404	125.15	No nights	577	121.98
No	248	146.36	1 - 9 nights	67	183.17
			≥ 10 nights	15	296.52
English as Home Language					
Yes	591	130.31	Prior Year Use		
No	62	155.54	0 - 5 visits	506	82.54
			≥ 6 visits	153	296.29

Note. LT = long term.

Total, annual OHIP payments were higher for individuals who were admitted to a hospital in the preceding 12 months (F[1, 656] = 22.87; p <.001), and for those who were admitted more often (F[2, 655) = 12.76; p <.001). The number of hospital admissions was rated using three categories - each group differed significantly in terms of the average, annual OHIP payments received by the practice. The length of time patients stayed in the hospital was also a determinant of total, annual OHIP payments (F[2, 576] = 14.07; p <.001).

The frequency with which individuals visited the practice in the preceding year was also a significant determinant of total, annual OHIP payments (F[1, 657] = 171.46; p <.001). Payments received for individuals who visited the practice six or more times in the preceding year were significantly higher than those received for adults who visited the practice five or less times. When the frequency of prior visits was evaluated using a continuous measured the relationship between historic use and total, annual OHIP payments was significant and positive (F[1,657] = 187.80, p < .001, R^2 = .22)

All area-based measures of earned income demonstrated a significant, negative relationship with total, annual OHIP payments with the exception of the variable that measured the average dwelling value of the communities within which individuals lived. The most powerful predictor of total, annual OHIP payments was the median income of private households (β = -.145; F[1, 654] = 14.03; p <.001, R^2 = .021). In addition, the proportion of total income that was derived from government transfer payments among individuals in a community was a significant determinant of total annual payments (β = .105; F[1, 654] = 7.29; p <..01, R^2 = .011), as was the incidence of low income (β = .133; F[1, 654] = 11.83; p =.001, R^2 = .018). There was evidence of a positive relationship between the unemployment rate and total annual payments (β = .137; F[1, 654] = 12.56; p <..001, R^2 = .019).

Table 6: Univariate Analyses

Independent Variables		Dependent Variables			
Individual-level Variables	Area-Based Measures	Visited the Practice (Yes/No)	Minutes Per Visit	Annual Visits log (# visits)§	Annual OHIP log (OHIP + 10)
		Predisposing Characteristics			
Age ♮ (Continuous variable)		**$\chi^2(4,659) = 20.84$ $p = .000$ (Categorical variable)**	**$\beta = -.078$ $F(1,548) = 16.74$ $p = .000$ $R^2 = .030$**	**$\beta = .004$ $F(1,557) = 25.23$ $p = .000$ $R^2 = .042$**	**$\beta = .167$ $F(1,657) = 18.82$ $p = .000$ $R^2 = .028$**
Gender †		$\chi^2(1,659) = 1.68$ $p = .227$*	**$F(1,548) = 4.88$ $p = .028$**	$F(1,557) = .03$ $p = .854$	$F(1,657) = 2.91$ $p = .088$
Marital status †		$\chi^2(1,649) = .63$ $p = .465$*	$F(1,486) = .608$ $p = .436$	**$F(1,647) = 9.26$ $p = .002$**	**$F(1,647) = 8.04$ $p = .005$**
Adult in home †		**$\chi^2(1,652) = 4.56$ $p = .041$***	$F(1,484) = .005$ $p = .942$	**$F(1,570) = 3.88$ $p = .049$**	**$F(1,650) = 9.27$ $p = .002$**
Education †		$\chi^2(1,657) = .66$ $p = .510$	**$F(1,491) = 5.60$ $p = .018$**	**$F(1,576) = 38.67$ $p = .000$**	**$F(1,655) = 13.03$ $p = .000$**
Work status †		**$\chi^2(1,657) = 6.48$ $p = .039$**	**$F(2,489) = 6.01$ $p = .003$**	**$F(2,574) = 26.85$ $p = .000$**	**$F(2,654) = 16.97$ $p = .000$**

Note. § Frequency of annual visits among individual who visited at least once. ♮ F statistic from ANOVA table derived from linear regression; the numbers reported in brackets equal the degrees of freedom between and within groups. † F statistic derived from ANOVA. * p statistic derived from Fisher's Exact Test. χ^2 = chi-square statistic; the numbers in brackets equal the degrees of freedom and the sample size. β = beta coefficient. **Bold** indicates $p < .05$.

Independent Variables		Dependent Variables			
Individual-level Variables	Area-Based Measures	Visited the Practice (Yes/No)	Minutes Per Visit	Annual Visits log (# visits)§	Annual OHIP log (OHIP + 10)
Born in Canada †		$\chi^2(1,652) = 1.56$ $p = .220$*	**$F(1,497) = 3.92$** **$p = .048$**	**$F(1,571) = 7.67$** **$p = .006$**	**$F(1,650) = 4.98$** **$p = .026$**
		<u>Enabling Resources</u>			
English as home language †		$\chi^2(1,653) = .38$ $p = .683$*	$F(1,492) = 3.24$ $p = .073$	**$F(1,572) = 13.31$** **$p = .000$**	**$F(1,651) = 4.35$** **$p = .037$**
		<u>Need Characteristics</u>			
Self-rated health †		**$\chi^2(4,656) = 12.51$** **$p = .014$**	**$F(4,401) = 2.34$** **$p = .054$**	**$F(4,573) = 26.66$** **$p = .000$**	**$F(4,651) = 15.14$** **$p = .000$**
Self-rated disability†		$\chi^2(1,655) = 3.39$ $p = .072$*	**$F(1,399) = 4.25$** **$p = .040$**	**$F(1,573) = 51.67$** **$p = .000$**	**$F(1,653) = 26.78$** **$p = .000$**
Activity limitations †		$\chi^2(1,654) = 3.09$ $p = .100$*	$F(1,405) = 1.83$ $p = .177$	**$F(1,572) = 59.59$** **$p = .000$**	**$F(1,652) = 31.72$** **$p = .000$**
Hospitalized in the past year (yes/no) †		**$\chi^2(1,658) = 4.65$** **$p = .030$***	$F(1,406) = .60$ $p = .439$	**$F(1,576) = 22.57$** **$p = .000$**	**$F(1,656) = 22.87$** **$p = .000$**
Hospital admissions in the past year (#) †		$\chi^2(2,658) = 5.22$ $p = .074$	**$F(2,405) = 3.08$** **$p = .047$**	**$F(2,575) = 14.87$** **$p = .000$**	**$F(2,655) = 12.76$** **$p = .000$**

<u>Note</u>. § Frequency of annual visits among individual who visited at least once. ♮ F statistic from ANOVA table derived from linear regression; the numbers reported in brackets equal the degrees of freedom between and within groups. † F statistic derived from ANOVA. * p statistic derived from Fisher's Exact Test. χ^2 = chi-square statistic; the numbers in brackets equal the degrees of freedom and the sample size. β = beta coefficient. **Bold** indicates $p < .05$.

Independent Variables		Dependent Variables			
Individual-level Variables	Area-Based Measures	Visited the Practice (Yes/No)	Minutes Per Visit	Annual Visits log (# visits)§	Annual OHIP log (OHIP + 10)
Days in hospital in the past year (#) †		$\chi^2(2,658) = 4.68$ $p = .096$	$F(2,547) = .727$ $p = .484$	**$F(2,576) = 14.07$ $p = .000$**	**$F(2,656) = 12.21$ $p = .008$**
Prior primary care use (0-5, ≥6 visits)†		**$\chi^2(1,659) = 16.95$ $p = .000$**	Not evaluated	**$F(1,577) = 222.88$ $p = .000$**	**$F(1,657) = 171.46$ $p = .000$**
Prior primary care use (0-2, 3-5, 6-8, ≥9 visits)†		**$\chi^2(3,659) = 22.12$ $p = .000$**	Not evaluated	**$F(1,577) = 102.72$ $p = .000$**	**$F(1,657) = 70.91$ $p = .000$**
Prior primary care use (continuous measure) ♮		**$\chi^2(1,659) = 16.95$ $p = .000$ (Categorical, 2-part variable)**	Not evaluated	**$\beta = .042$ $F(1,577) = 326.07$ $p = .000$ $R^2 = .361$**	**$\beta = .043$ $F(1,657) = 187.80$ $p = .000$ $R^2 = .222$**

Note. § Frequency of annual visits among individual who visited at least once. ♮ F statistic from ANOVA table derived from linear regression; the numbers reported in brackets equal the degrees of freedom between and within groups. † F statistic derived from ANOVA. * p statistic derived from Fisher's Exact Test. χ^2 = chi-square statistic; the numbers in brackets equal the degrees of freedom and the sample size. β = beta coefficient. **Bold** indicates $p < .05$.

Independent Variables		Dependent Variables			
Individual-level Variables	Area-Based Measures	Visited the Practice (Yes/No)	Minutes Per Visit	Annual Visits log (# visits)§	Annual OHIP log (OHIP + 10)
	<u>Community-Level Enabling</u>				
	Government transfer payments as a percent of total income ♮	$\chi^2(1,659) = .273$ $p = .601$	$\beta = -.055$ $F(1,533) = .806$ $p = .370$ $R^2 = .002$	**$\beta = .001$** **$F(1,574) = 19.16$** **$p = .000$** **$R^2 = .032$**	**$\beta = .105$** **$F(1,654) = 7.29$** **$p = .007$** **$R^2 = .011$**
	Average dwelling value ♮	$\chi^2(1,659) = .103$ $p = .748$	$\beta = -.0000041$ $F(1,533) = 1.544$ $p = .215$ $R^2 = .003$	**$\beta = -.0000002$** **$F(1,574) = 4.59$** **$p = .033$** **$R^2 = .008$**	$\beta = -.057$ $F(1,654) = 2.13$ $p = .145$ $R^2 = .003$
	Average income ♮	$\chi^2(1,659) = .011$ $p = .917$	$\beta = -.0000234$ $F(1,533) = .764$ $p = .382$ $R^2 = .001$	**$\beta = -.0000048$** **$F(1,574) = 17.15$** **$p = .000$** **$R^2 = .029$**	**$\beta = -.084$** **$F(1,654) = 4.66$** **$p = .031$** **$R^2 = .007$**
	Median income ♮	$\chi^2(1,659) = .001$ $p = .975$	$\beta = -.0000172$ $F(1,533) = .432$ $p = .512$ $R^2 = .001$	**$\beta = -.0000112$** **$F(1,574) = 3.50$** **$p = .000$** **$R^2 = .042$**	**$\beta = -.106$** **$F(1,654) = 7.41$** **$p = .007$** **$R^2 = .011$**

<u>Note</u>. § Frequency of annual visits among individual who visited at least once. ♮ *F* statistic from ANOVA table derived from linear regression; the numbers reported in brackets equal the degrees of freedom between and within groups. † *F* statistic derived from ANOVA. * p statistic derived from Fisher's Exact Test. χ^2 = chi-square statistic; the numbers in brackets equal the degrees of freedom and the sample size. β = beta coefficient. **Bold** indicates $p < .05$.

Independent Variables		Dependent Variables			
Individual-level Variables	Area-Based Measures	Visited the Practice (Yes/No)	Minutes Per Visit	Annual Visits log (# visits)§	Annual OHIP log (OHIP + 10)
	Average census family income ♮	$\chi^2(1,659) = .000$ $p = .993$	$\beta = -.0000101$ $F(1,533) = 1.045$ $p = .307$ $R^2 = .002$	**$\beta = -.00000168$** **$F(1,574) = 15.28$** **$p = .000$** **$R^2 = .026$**	**$\beta = -.084$** **$F(1,654) = 4.69$** **$p = .031$** **$R^2 = .007$**
	Median census family income ♮	$\chi^2(1,659) = .045$ $p = .833$	$\beta = -.0000103$ $F(1,533) = .389$ $p = .533$ $R^2 = .001$	**$\beta = -.0000035$** **$F(1,574) = 22.56$** **$p = .000$** **$R^2 = .038$**	**$\beta = -.106$** **$F(1,654) = 7.49$** **$p = .006$** **$R^2 = .011$**
	Average income of private households ♮	$\chi^2(1,659) = .263$ $p = .608$	$\beta = -.0000054$ $F(1,533) = .132$ $p = .717$ $R^2 = .000$	**$\beta = -.0000032$** **$F(1,574) = 20.85$** **$p = .000$** **$R^2 = .035$**	**$\beta = -.113$** **$F(1,654) = 8.38$** **$p = .004$** **$R^2 = .013$**
	Median income of private households ♮	$\chi^2(1,659) = 1.52$ $p = .217$	$\beta = -.0000118$ $F(1,533) = .225$ $p = .636$ $R^2 = .000$	**$\beta = -.0000062$** **$F(1,574) = 27.08$** **$p = .000$** **$R^2 = .045$**	**$\beta = -.145$** **$F(1,654) = 14.03$** **$p = .000$** **$R^2 = .021$**

Note. § Frequency of annual visits among individual who visited at least once. ♮ *F* statistic from ANOVA table derived from linear regression; the numbers reported in brackets equal the degrees of freedom between and within groups. † *F* statistic derived from ANOVA. * p statistic derived from Fisher's Exact Test. χ^2 = chi-square statistic; the numbers in brackets equal the degrees of freedom and the sample size. β = beta coefficient. **Bold** indicates $p < .05$.

Independent Variables		Dependent Variables			
Individual-level Variables	Area-Based Measures	Visited the Practice (Yes/No)	Minutes Per Visit	Annual Visits log (# visits)§	Annual OHIP log (OHIP + 10)
	Incidence of low income of population in private households ♮	$\chi^2(1,659) = .211$ $p = .645$	$\beta = -.005886$ $F(1,533) = .037$ $p = .847$ $R^2 = .000$	**$\beta = .007859$** **$F(1,574) = 30.32$** **$p = .000$** **$R^2 = .050$**	**$\beta = .133$** **$F(1,654) = 11.83$** **$p = .001$** **$R^2 = .018$**
	Unemployment rate ♮	$\chi^2(1,659) = .378$ $p = .539$	$\beta = -.035$ $F(1,533) = .117$ $p = .733$ $R^2 = .000$	**$\beta = .002$** **$F(1,574) = 28.97$** **$p = .000$** **$R^2 = .048$**	**$\beta = .137$** **$F(1,654) = 12.56$** **$p = .000$** **$R^2 = .019$**
	Female labour force participation rate ♮	$\chi^2(1,659) = .006$ $p = .936$	$\beta = .067$ $F(1,533) = 1.48$ $p = .224$ $R^2 = .003$	**$\beta = -.006$** **$F(1,574) = 6.17$** **$p = .013$** **$R^2 = .011$**	$\beta = -.052$ $F(1,654) = 1.80$ $p = .180$ $R^2 = .003$
		Individual-Provider Related			
Physician Seen*		-	**$F(26,523) = 3.85$** **$p = .000$**	-	-
Primary Provider*		$\chi^2(10,659) = 13.26$ $p = .210$	-	**$F(10,568) = 2.32$** **$p = .011$**	**$F(10,648) = 2.37$** **$p = .009$**

Note. § Frequency of annual visits among individual who visited at least once. ♮ *F* statistic from ANOVA table derived from linear regression; the numbers reported in brackets equal the degrees of freedom between and within groups. † *F* statistic derived from ANOVA. * p statistic derived from Fisher's Exact Test. χ^2 = chi-square statistic; the numbers in brackets equal the degrees of freedom and the sample size. β = beta coefficient. **Bold** indicates $p < .05$.

Independent Variables		Dependent Variables			
Individual-level Variables	Area-Based Measures	Visited the Practice (Yes/No)	Minutes Per Visit	Annual Visits log (# visits)§	Annual OHIP log (OHIP + 10)
Other					
Type of Visit		-	**F(16,526) = 41.38** **p = .000**	-	-
Interaction Terms					
Age (continuous) * Gender		**χ^2(1,659) = 3.93** **p = .047**	F(60, 550) = 1.05 p = .381	F(70, 578) = .878 p = .726	F(70, 658) = 1.07 p = .342
Age (interval) * Gender		χ^2(1,659) = 2.74 p = .097	F(4, 550) = 2.24 p = .064	F(4, 578) = 1.78 p = .131	F(4, 658) = 1.56 p = .182
Marital status * Disability status		**χ^2(1,654) = 4.15** **p = .041**	F(1,388) = .199 p = .656	F(1,565) = 3.43 p = .064	F(1,644) = .525 p = .469
# Adults * Disability status		**χ^2(1,648) = 6.42** **p = .011**	F(1, 393) = 1.32 p = .252	F(1, 567) = 3.71 p = .055	F(1, 644) = 2.38 p = .123
Marital status * Health status		**χ^2(1,646) = 4.15** **p = .041**	F(4, 393) = .165 p = .956	**F(4, 568) = 2.45** **p = .045**	F(4, 646) = .743 p = .563

Note. § Frequency of annual visits among individual who visited at least once. ♮ *F* statistic from ANOVA table derived from linear regression; the numbers reported in brackets equal the degrees of freedom between and within groups. † *F* statistic derived from ANOVA. * p statistic derived from Fisher's Exact Test. χ^2 = chi-square statistic; the numbers in brackets equal the degrees of freedom and the sample size. β = beta coefficient. **Bold** indicates $p < .05$.

Independent Variables		Dependent Variables			
Individual-level Variables	Area-Based Measures	Visited the Practice (Yes/No)	Minutes Per Visit	Annual Visits log (# visits)§	Annual OHIP log (OHIP + 10)
# Adults * Health status		**χ^2(1,649) = 11.86 p = .000**	F(4, 395) = .754 p = .556	F(4, 570) = .459 p = .765	F(4, 648) = .326 p = .860
Education * Health status		χ^2(1,655) = 2.72 p = .099	F(4, 400) = .335 p = .854	F(4, 576) = 1.71 p = .146	F(4, 654) = 2.14 p = .074
Work status * Gender		χ^2(1,657) = 1.90 p = .167	F(2, 491) = 2.01 p = .135	F(2, 576) = .133 p = .098	F(2, 656) = .788 p = .455

Note. § Frequency of annual visits among individual who visited at least once. ♮ *F* statistic from ANOVA table derived from linear regression; the numbers reported in brackets equal the degrees of freedom between and within groups. † *F* statistic derived from ANOVA. * p statistic derived from Fisher's Exact Test. χ^2 = chi-square statistic; the numbers in brackets equal the degrees of freedom and the sample size. β = beta coefficient. **Bold** indicates $p < .05$.

3.4.3. Multivariable Analyses

This section summarizes the results of multivariable models and is divided into the following sections - determinants of at least one visit, determinants of the amount of time physicians spent providing medical service for one encounter, determinants of visits per annum among individuals who visit at least once, determinants of annual OHIP payments and predictive ratios. Tables are provided at the end of each subsection to summarize findings. In addition, supplementary tables are located in Appendix L, and a more detailed profile of outlier cases is provided in Appendix M.

3.4.3.a. Determinants of At Least One Visit: Rostered Adults[1]

When age and gender were entered into a logistic regression model (Hypothesis 1), age was identified as a significant determinant of whether or not an individual visited a physician but gender was not (Table 11 - Model A). In fact, gender was not significant in univariate analyses ($\chi^2[1,659] = 1.68$ $p = .227$) and the addition of information on gender did not substantially improve a model with information on age.[2]

To test Hypothesis 2 - age and gender were entered into a logistic regression model followed by individual-level characteristics and interaction terms that were identified as significant predictors in univariate analyses at an alpha-level of .05. The addition of predisposing factors to a logistic model with age and gender only slightly improved the base model - Negelkere's R^2 value increased from .066 to .087.[3] Age remained significant after controlling for the number of adults and children in the home and the work status of the individual - no other variable reached significance.

The addition of need factors to a logistic model with age and gender resulted in an improvement of the base model - Negelkere's R^2 value increased from .066 to .142.[4] Age and

[1] Individual provider-related characteristics were not entered as a control variable in any of the logistic models described in this subsection as this variable was not significant in univariate analysis.

[2] Appendix L - Table L1 - Model 1A.

[3] Appendix L - Table L1 - Model 1B.

[4] Appendix L - Table L1 - Model 1C.

prior visits were identified as significant determinants of a visit after other characteristics of need were controlled.

The addition of need and predisposing factors (hierarchical, block entry) to a logistic model with age and gender resulted in an improvement of the base model.[5] Negelkere's R^2 value increased from .066 (base model) to .142 (base model plus characteristics of need) to .158 (base model plus characteristics of need and predisposing factors). The only significant determinants in the full model were age and prior visits (Table 11 - Model B). Only one outlier was identified - case number 6710. This participant made 10 prior visits, but did not visit the practice in the subsequent year. Information provided on the survey questionnaire, however, suggested that this individual visited a physician who did not work at the practice on two occasions.

To test Hypothesis 3 - age and gender were entered into a logistic model, then all variables identified as significant in univariate analyses were entered in a forward, stepwise procedure. The only variable that entered the model was the prior visit variable (binary measure).[6] Negelkere's R^2 value increased from .066 (base model) to .115.[7] If prior visits was measured using four categories instead of two, Negelkere's R^2 value increased to .124 (Table 11 - Model C). Age and prior visits remained significant in this multivariable model, but gender did not. Again, the only outlier identified was case number 6710.

This analysis was repeated to determine the impact of using an explanatory variable other than prior utilization, as the use of prior visits as an adjuster may be controversial.[8] Therefore, age and gender were entered into a logistic model, then all variables identified as significant in univariate analyses at an alpha-level of .05 were entered in a forward, stepwise procedure with the exception of the prior visit variable. The final model included age, gender and the number of

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[5] Individual-level enabling characteristics were also not entered, as the variable measuring the use of English in the home was not significant in univariate analyses.

[6] These results held true even when variables identified as significant in univariate analyses at an alpha-level of .10 were entered in a stepwise procedure.

[7] Appendix L - Table L1 - Model 1D.

[8] The use of information on prior visits as a rate-adjuster may be controversial for the following reasons: (a) providers may be able to induce-demand in a capitated environment with the intent of increasing subsequent resource allocations, and (b) the use of this adjuster during the first year of capitation would mean that any prior inappropriate demand and utilization would be reflected in resource allocations.

adults who lived in the home (i.e., live with other adults, not live with other adults).[9] The hospitalization variable (i.e., admitted/not admitted in the past year) did not enter the equation due to the criteria for entry - the p value of this measure as an excluded variable was .08.

Information on hospitalization status is available to the Ontario Ministry of Health, but information on the number of adults in the home would require a data infrastructure investment. Therefore, a logistic regression model of age, gender and hospitalization status (i.e., yes/no) was constructed (entry procedure) (Table 11 - Model D). The addition of information on prior year hospitalization (i.e., yes/no) slightly improved the base model - Negelkere's R^2 value increased from .066 to .079. Age was the only variable that retained significance in the equation, but hospitalization had a p value of .06.

Hypothesis 4 was not tested with this dependent variable, as no community-level enabling characteristics reached statistical significance in univariate analyses. Therefore, these variables would not have improved a base model with age and gender.

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[9] The addition of information on the number of adults in the home slightly improved the base model - Negelkere's R^2 value increased from .066 to .082. Appendix L - Table L1 - Model 1E.

Table 11: Odds Ratios (Confidence Intervals) for Population Characteristics Associated with At Least One Physician Visit

Variables		Model A Hypothesis 1 (n = 659)	Model B Hypothesis 2 (n = 647)	Model C Hypothesis 3 (n = 659)	Model D Hypothesis 3 (exclude prior visit variable) (n = 658)
Constant (B)		1.92***	1.92	1.67***	1.81***
Age (years)	16 - 30	1.00***	1.00*	1.00**	1.00**
	31 - 45	.46* (0.21-0.96)	.42* (.18-.96)	.44* (.21-.94)	.47 (.22-1.01)
	46 - 65	1.02 (.46-2.24)	1.08 (.48-2.50)	.97 (.44-2.14)	1.04 (.47-2.28)
	66 - 75	2.35 (.77-7.15)	2.32 (.71-7.58)	1.85 (.60-5.75)	2.34 (.77-7.16)
	≥76	2.52 (.52-12.14)	2.19 (.41-11.57)	1.87 (.38-9.19)	2.49 (.52-12.00)
Gender	Male	1	1	1	1
	Female	1.43 (.89-2.32)	1.39 (.84-2.32)	1.34 (.82-2.18)	1.46 (.90-2.37)
No. of Adults	Lives alone		1		
	Not live alone		.55 (.27-1.12)		
Work Status	Working		1		
	Unable to work		3.17 (.38-28.9)		
	Looking for Work		.75 (.38-1.46)		
Health Status	Poor		1		
	Fair		.94 (.09-10.17)		

Variables		Model A Hypothesis 1 (n = 659)	Model B Hypothesis 2 (n = 647)	Model C Hypothesis 3 (n = 659)	Model D Hypothesis 3 (exclude prior visit variable) (n = 658)
	Good		1.80 (.18-17.94)		
	Very Good		1.65 (.16-16.36)		
	Excellent		.88 (.08-8.82)		
Hospitalized in the past year	No admission		1		1
	Admitted		2.66 (.78-6.59)		2.69 (.95-7.64)
Prior visits	0 - 5		1		
	≥ 6		4.83** (1.68-13.86)		
Prior visits	0 - 2			1.00**	
	3 - 5			1.57 (.88-2.80)	
	6 - 8			10.73* (1.45-79.27)	
	≥ 9			5.33** (1.61-17.62)	
-2 log likelihood ratio		464.251	420.67	487.26	459.41
Model χ^2		23.01***	55.57***	44.06**	27.59***
Classification ‡		87.86%	87.94	87.86%	87.84%
Hosmer-Lemeshow (χ^2)		2.25^{NS}	4.82^{NS}	4.86^{NS}	$.89^{NS}$
Negelkere's R^2		0.066	0.158	0.124	0.079

Variables	Model A Hypothesis 1 (n = 659)	Model B Hypothesis 2 (n = 647)	Model C Hypothesis 3 (n = 659)	Model D Hypothesis 3 (exclude prior visit variable) (n = 658)
Outlier case number (standardized residual)	No outliers	6710 (-11.31)	6710 (-9.70)	No outliers

Note. Values in the table represent the adjusted odds ratios (confidence intervals) from the regression equation. χ^2 = chi-square value. ‡ Percent correctly classified. NS = not significant. * p<.05, ** p<.01, *** p<.001.

3.4.3.b. Determinants of Minutes of Medical Services

As the physician seen and the types of visits were significant predictors of the amount of time physicians spent providing medical services (F[26, 523] = 3.85, p <.001, and F[16, 526] = 41.38, p <.001 respectively), both of these measures were used as control variables in multivariable analyses. As the types of visits were influenced by both characteristics of the physician (i.e., service coded selected for billing purposes) and the patient (i.e., reason for the visit), the analyses described in this section were conducted with the inclusion and exclusion of this second control variable.[10]

To test Hypothesis 1 - the amount of time physicians' spent providing medical service was regressed on age and gender using multiple, linear regression. The addition of this information to a multivariable model with the two control variables did not significantly improve this model, as measured by the lack of significant change in the R^2 value (F[2, 538] = 2.56, p =.08) (Table 12 - Model E).[11] Age was identified as a significant predictor (negative relationship) when the physician seen and types of visits were controlled. Gender failed to retain significance in the multivariable model, although this variable reached significance in univariate analyses. When age and gender were entered into a linear regression model, age was identified as a significant predictor when the physician seen was entered as a single control variable.[12]

To test Hypothesis 2 - age and gender were entered into a linear model that included both control variables followed by individual-level characteristics that were identified as significant in univariate analyses at an alpha-level of .05.[13] The addition of information on predisposing characteristics into a multivariable model with age, gender and both control variables significantly improved this model, as measured by change in the R^2 value (F[4, 471] = 2.44, p

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[10] For reference purposes - the R^2 value of the regression equation with information on the physician seen was .012, while the R^2 value of a model with physician seen and type of visit was .104.

[11] The R^2 value of a model with the physician seen and the type of visit was .104, and the R^2 value of Model E (i.e., age, gender, the physician seen and the type of visit) was .112.

[12] Appendix L - Table L2 - Model 2A.

[13] None of the community-level enabling nor the interaction terms were significant at the .05 level, but the interaction term age*gender was significant at an alpha-level cut-off of .10.

=.05).[14] The addition of information on needs into a multivariable model with age, gender and both control variables did not significantly improve the base model, as measured by the lack of significant change in the R^2 value (F[3, 380] = 1.37, p =.25).[15]

The addition of need and predisposing characteristics (block entry, in hierarchical fashion) to a linear model with age, gender and both control variables did not result in improvements to the base model (Table 12 - Model F).[16] The variables that remained significant in the full model included work status, doctor seen and type of visit. Age was no longer significant.

Age and gender were entered into a linear model that included only one control variable - the physician seen - followed by individual-level characteristics that were identified as significant in univariate analyses at an alpha-level of .05. The addition of information on predisposing factors into a multivariable model with age, gender and one control variable - physician seen - did not significantly improve the base model as measured by the change in the R^2 value (F[4, 475] = 2.30, p =.057).[17] The addition of information on characteristics of need also did not improve the base model (i.e., age, gender and physician seen) as measured by the change in the R^2 value (F[3, 385], p = .29).[18] The addition of need and predisposing characteristics (block entry, in hierarchical fashion) to a linear model with age, gender and one control variable did not result in improvements to the base model. The only variable that retained significance in this full model was work status (Table 12 - Model G).

To test Hypothesis 3 - age and gender were entered into a linear model that included both control variables, then variables identified as significant in univariate analyses at an alpha-level of .05 were entered in a forward, stepwise procedure. No other predisposing factors or

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[14] Appendix L - Table L2 - Model 2B.

[15] Appendix L - Table L2 - Model 2C.

[16] The R^2 value increased from .114 (i.e., base model with control variables) to .124 with the addition of need characteristics (F[3, 370] = 1.39, p =.24), and to .141 with the subsequent addition of predisposing factors (F[4, 366] = 1.90, p =.11). Appendix XX - Table 2 - Model 2D.

[17] Appendix L - Table L2 - Model 2E.

[18] Appendix L - Table L2 - Model 2F.

characteristics of need entered the model when the training sample was used - work status remained out of the model with a p value of .059. When this forward, stepwise procedure was repeated using the full sample of participants - the addition of the work status variable improved the base model.[19] Once information on work status was entered into a linear model that included information on age, gender and both control variables, age became non-significant (Table 12 - Model H).

Age and gender were then entered into a model that included one control variable - the physician seen - and variables identified as significant in univariate analyses were entered in a forward, stepwise procedure. The addition of work status improved the base model, as measured by change in the R^2 value ($F[1, 376] = 5.60$, $p = .02$) (Table 12 - Model J). The only variable that reached significance was work status.

The last hypothesis (Hypothesis 4) was not tested with this dependent variable, as no community-level enabling characteristics reached statistical significance in univariate analyses.

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[19] Health status remained out of the model with a p value of .08.

Table 12

The Determinants of the Amount of Time Physicians Spend Providing Medical Services to Individuals During One Visit

Variables	Model E Hypothesis 1 (n = 542)	Model F Hypothesis 2 (two controls) (n = 377)	Model G Hypothesis 2 (one control) (n = 380)	Model H Hypothesis 3 (two controls) (n = 479)	Model J Hypothesis 3 (one control) (n = 380)
		Predisposing characteristics			
Age	-.09*	-0.04	-0.10	-0.07	-0.13
Gender	0.02	-0.02	0	0	.02
Work status		-.11*	-.12*	-.13*	-.13*
Educational status		0.05	0.02		
Country of birth		-0.05	-0.06		
		Need characteristics			
Health status		0.07	0.06		
Disability status		0.03	0.02		
Hospital admissions (# past year)		-0.02	0.01		
		Control variables			
Doctor seen	.13*	.13*	0.08	.13*	0.08
Type of visit	.28***	.28***		.27***	
R^2 (training sample)†	.104	.149	.067	-	.056
(test sample)‡	.132	.247	.187		.086
R^2 (full sample)	.112	.140	.068	.127	.058
R^2 (trimmed sample)	No outliers ♀	No outliers	No outliers	No outliers	No outliers

Note. Values in the table represent the standardized β coefficients from the regression equation with the full sample. # = number. † = training sample size is equal to 350. ‡ = test sample size is equal to 200. ♀= no outliers ~ identified using standardized residuals of three or more standard deviations as a cut-point. * p<.05, ** p<.01, *** p<.001.

3.4.3.c. Determinants of Visits Per Annum: Individuals Who Had At Least One Visit

As the primary provider was a significant determinant of the total number of visits per annum among individuals who visited the practice at least once (F[10, 568] = 2.32, p <.05, R^2 =.007), this variable was used as a control in multivariable analyses.

To test Hypothesis 1 - the frequency of annual visits among individuals who made at least one visit was regressed on age and gender using multiple, linear regression. Age was identified as a predictor of visit frequency (positive relationship) when the primary provider was controlled, and gender was non-significant (Table 13 - Model K). In fact, gender was not identified as a significant determinant in univariate analyses (F[1, 577] = .03, p =.85). Once information regarding age and gender was entered into a multivariable model: (a) these variables significantly improved the linear model with information on primary provider as measured by change in the R^2 value (F[2, 575] = 12.96, p <.001),[20] and (b) the statistical significance of information regarding the primary provider was marginal (i.e., p =.052).

Two outlier cases were identified for Model K - case number 162065 and case number 522838. The first participant had 38 prior visits and 69 visits in the subsequent year. Review of the diagnostic codes on the OHIP claims data indicated that this person received services for multiple, psychiatric conditions. The second participant had 51 prior visits and 37 visits in the subsequent year. The vast majority of visits were for allergy shots.

To test Hypothesis 2 - age and gender were entered into a linear model that included information on the primary provider followed by hierarchical, block entry of individual-level (predisposing, enabling and need) and community-level enabling characteristics that were identified as significant in univariate analyses. The addition of information on predisposing factors into a multivariable model with age, gender and primary provider (i.e., base model) significantly improved this model, as measured by change in the R^2 value (F [6, 548] = 6.78, p <.001).[21] The addition of information on enabling resources to the base model improved this model - as measured by change in the R^2 value (F[1, 569] = 8.56, p <.01).[22] The addition of

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[20] The R^2 value of a model with information on each individual's primary provider was .007, and the R^2 value of Model 3A (i.e., age, gender, primary provider) was .050.

[21] Appendix L - Table L3 - Model 3A.

[22] Appendix L - Table L3 - Model 3B.

information on characteristics of need to the based model also improved this model - as measured by change in the R^2 value ($F[5,560] = 54.0$, $p < .001$).[23] Lastly, the addition of information on community-level enabling characteristics into the base model significantly improved this model, as measured by change in the R^2 value ($F[4, 568] = 8.67$, $p < .001$).[24]

The addition of need, predisposing, enabling <u>and</u> community-level enabling characteristics into the base model (i.e., block entry, in hierarchical fashion) significantly improved the multivariable model at each stage. The entry of variables measuring characteristics of need improved the base model ($F[5, 534] = 52.11$, $p < .001$). The subsequent addition of predisposing characteristics significantly improved the base model with need variables ($F[6, 528) = 2.77$, $p = .01$). The subsequent addition of enabling characteristics did not improve the base model with need and predisposing variables ($F[1, 527] = 3.10$, $p = .08$). The subsequent addition of community-level enabling variables improved the base model with need, predisposing and enabling characteristics ($F[4, 523] = 3.30$, $p = .01$). The full model had an R^2 value of .392 (Table 13 - Model L).

The sign of each regression coefficient in the full model was as expected. Adults had more visits per annum if they: (a) were older, (b) reported lower self-rated health, (c) were admitted to a hospital in the prior year, (d) visited a physician at the practice more often in the preceding year, or (e) were from a community that had a higher incidence of low income. Information on prior visits with a physician at the practice made the largest contribution (i.e., standardized beta coefficient) in Model L,[25] followed - in descending order - by measures of relative wealth of the community (i.e., the incidence of low income), prior hospital admissions (i.e., yes/no), marital status, and health status. Marital status was not significant in Model L, age was significant but made the least contribution to the explanatory power. Lastly, measures of predisposing, need and community-level enabling characteristics all made an independent contribution to explaining variability in visits per annum among individuals who visited a physician at least once. Once individual-level and community-level characteristics were

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[23] Appendix L - Table L3 - Model 3C and 3D.

[24] Appendix L - Table L3 - Model 3E.

[25] In fact, the prior visit variable made the largest contribution, as measured by the standardized beta coefficient, to all multivariable models described in this sub-section.

controlled, individual provider-related factors were non-significant. In fact, once the age of a patient was controlled, individual provider-related factors were non-significant.

While Model L demonstrated the inclusion of a binary measure of visits to a physician at the practice in the preceding year, Model M illustrates the full model where the prior visit variable was measured using four categories (Table 13 - Model M). The goodness-of-fit of Model M (i.e., R^2 value of .43) is greater than Model L (i.e., R^2 value .40). Models L and M only had one outlier - case number 103245. This individual had 9 prior visits (year one) and one visit in the subsequent year (year two). Interestingly, this person was admitted to a hospital during year two. Review of diagnostic codes from OHIP data from both time periods indicated that this person had musculoskeletal and psychiatric disorders.

To test Hypothesis 3 - age and gender were entered into a linear regression model that included information on the primary provider - then all variables identified as significant in univariate analyses at an alpha-level of .05 were entered in a forward, stepwise procedure. The inclusion of information on prior visits to the base model made the most significant contribution to explanatory power, as evident by an increase in the R^2 value from .047 to .302 ($F[1, 542] = 198.10$, $p <.001$). The following variables also entered the stepwise model - the incidence of low income in an individual's community increased the R^2 value to from .302 to .338 ($F[1, 541] = 28.90$, $p <.001$), the variable measuring hospital admission in the past year subsequently increased the R^2 value to .355 ($F[1, 540] = 14.91$, $p <.001$), information on activity limitations increased the R^2 value to .366 ($F[1, 539] = 8.60$, $p <.01$), and information on educational status increased the R^2 value to .373 ($F[1, 538] = 6.01$, $p <.05$) (Table 13 - Model N).

Two outliers were identified for Model N - case number 103245 and case number 522838 - both participants have already been described. The first individual was identified as an outlier in Models L and M - this is the case that had nine prior visits, one visit in the subsequent year and was admitted to a hospital in year two. The second individual was identified as an outlier in the age and gender equation (Table 13 - Model K) - this person had 51 prior visits and 37 visits in the subsequent year. The majority of visits in both time periods were for allergy shots.

As the prior visit variable made the largest contribution to the explanatory power of the stepwise model, this adjuster was explored in more detail. The inclusion of information on prior visits to the base model increased the R^2 value from .045 to .302 (F[1, 547] = 211.17, p <.001).[26] The R^2 value increased to .366 when prior use was measured using four categories[27] and to .398 when a continuous measure was used.

This analysis was repeated to determine the impact of using an explanatory variable other than prior utilization, as the use of this adjuster may be controversial. Therefore, information on age and gender were entered into a linear equation that included data on the primary provider - followed by forward, stepwise entry of all variables identified as significant in univariate analyses (except the prior visit variable). The following variables entered the stepwise model - the health status of the individual increased the R^2 value from .046 to .154 (F[1,538] = 68.76, p <.001), hospital admission in the past year subsequently increased the R^2 value to .184 (F[1,537] = 19.76, p <.001), the incidence of low income in the communities of participants increased the R^2 value to .211 (F[1, 536] = 18.47, p <.001), and activity limitations increased the R^2 value to .220 (F[1,535] = 6.33, p <.05).[28]

The use of information on hospital admissions and the incidence of low income was explored in more detail due to the availability of this information. The addition of information on whether or not an individual was admitted to a hospital in the prior year increased the explanatory power of the base model, as measured by change in the R^2 value from .055 to .091 (F[1, 573] = 22.53, p <.001).[29] The addition of information on hospitalization (yes/no) and the incidence of low income to the base model increased the explanatory power from .057 to .146.[30]

To test hypothesis 4 - age and gender were entered into a linear regression model that included information on the primary provider - then measures of community-level enabling

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[26] Appendix L - Table L3 - Model 3F.

[27] Appendix L - Table L3 - Model 3G.

[28] Appendix L - Table L3 - Model 3H.

[29] Appendix L - Table L3 - Model 3J.

[30] Appendix L - Table L3 - Model 3K.

characteristics were entered in a forward, stepwise procedure.[31] Only one variable entered the model - the incidence of low income - and this measure of wealth significantly improved the base model ($F[1, 571] = 34.51, p < .001$) (Table 13 - Model P).

Two outliers were identified for Model P - case number 162065 and case number 522838. Both participants have already been described. The first individual had 38 prior visits and 69 visits in the subsequent year and was treated for psychiatric conditions. The second individual had 51 prior visits and 37 visits in the subsequent year - the vast majority of visits were for allergy shots.

[31] This forward, stepwise procedure included the following measures - the incidence of low income, government transfer payments as a proportion of total income, average census family income, and the female labour force participation rate. In fact, when the model was respecified to select from all of the measures of economic climate and relative wealth the only variable that improved the explanatory power of the base model was the incidence of low income.

Table 13

Determinants of Visits Per Annum Among Individuals Who Came to the Practice At Least Once

Variables	Model K Hypothesis 1 (n = 579)	Model L Hypothesis 2 (n = 542)	Model M Hypothesis 2 (n = 542)	Model N Hypothesis 3 (n = 546)	Model P Hypothesis 4 (n = 575)
		Predisposing characteristics			
Age	.21***	.11**	.10**	.13***	.23***
Gender	0.05	0.02	0.01	0.03	0.07
Marital status		-.05	-.06		
Education status		-0.05	-0.04	-.09*	
Country of birth		0.05	0.05		
		Enabling resources			
Language at home		0.06	0.05		
		Need characteristics			
Health status		-.12**	-.09*		
Disability status		-0.03	-0.02		
Activity limitations		-0.04	-0.05	-.10**	
Hospital admit (yes/no)		.13***	.12***	.13***	
Prior visits (0-5, ≥ 6)		.42***		.45***	
Prior year visits (0-2, 3-5, 6-8, ≥ 9)			.48***		
		Community-enabling resources			
Government transfer payments		-0.09	-0.06		
Average census family income		-0.03	-0.03		
Incidence of low income		.16**	.13*	.156***	.24***
Female labour force participation		-0.03	-0.03		

Variables	Model K Hypothesis 1 (n = 579)	Model L Hypothesis 2 (n = 542)	Model M Hypothesis 2 (n = 542)	Model N Hypothesis 3 (n = 546)	Model P Hypothesis 4 (n = 575)
			Control variables		
Primary provider	-0.08	0.008	0.01	-0.002	-0.04
R^2 (training sample)†	.062	.413	.444	.387	.124
R^2 (test sample)‡	.034	.404	.439	.359	.086
R^2 (Full sample)	.050	.392	.428	.373	.105
R^2 (Trimmed sample)♀	.060	.402	.441	.390	.119
Outlier case number (standardized residual)	522838 (3.31) 162065 (4.03)	103245 (-3.13)	103245 (-3.47)	103245 (-3.10) 522838 (3.13)	522838 (3.36) 162065 (4.25)

Note. Values in the table represent the standardized β coefficients from the regression equation. † = training sample size is equal to 350. ‡ = test sample size is equal to 229. ♀ Trimmed sample = outliers (standardized residuals three or more standard deviations from mean) removed. * p<.05, ** p<.01, *** p<.001.

3.4.3.d. Determinants of Total, Annual Payments

As the primary provider was a significant determinant of total, annual OHIP payments in univariate analyses (F[10, 648] = 2.37, p <.01, R^2 = .001), this variable was used as a control variable in multivariable analyses.

To test hypothesis 1 - total, annual OHIP payment was regressed on age and gender using multiple, linear regression. Once age and gender were entered into an equation with information on the primary provider: (a) these variables significantly improved the primary provider model as measure by change in the R^2 value (F[2, 655] = 12.46, p <.001), (b) age and gender remained significant as predictors of total payments, and (c) the primary provider variable was no longer significant (Table 14 - Model Q). Two outliers were identified for Model Q - case number 158480 and case number 162065. Both participants have similar clinical scenarios. OHIP payments for these individuals and the frequency with which they visited a physician were extremely high in comparison to the mean and appeared to be related to services received for psychiatric conditions.

To test Hypothesis 2 - age and gender were entered into a linear model that included information on the primary provider followed by hierarchical, block entry of individual-level (predisposing, enabling and need) and community-level enabling characteristics that were identified as significant in univariate analyses. The addition of information on predisposing factors into a multivariable model with age, gender and primary provider (i.e., base model) significantly improved this model, as measured by change in the R^2 value (F[6, 625] = 3.35, p <.01).[32] The addition of information on enabling resources to the base model did not improve this model, as measured by change in the R^2 value (F[1, 648] = 2.17, p = .14).[33] The addition of information on the characteristics of need to the base model improved this model, as measured by change in the R^2 value (F[5, 638] = 36.21, p <.001).[34] Lastly, the addition of information on

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[32] Appendix L - Table L4 - Model 4A.

[33] Appendix L - Table L4 - Model 4B.

[34] Appendix L - Table L4 - Model 4C. While Model 4C demonstrated the inclusion of a binary measure of total payments, Model 4D illustrates the multivariable model where the prior visit variable is measured using four categories. The goodness-of-fit of Model 4D (i.e., R^2 value of .276) is greater than Model 4C (i.e., R^2 value .253).

community-level enabling characteristics into the base model significantly improved this model as measured by change in the R^2 value (F[3, 649] = 4.97, p <.01).[35]

Characteristics of need, predisposing factors, enabling resources and community-level enabling variables were entered into an equation (i.e., block entry, in hierarchical fashion) that had information on age, gender and primary provider. The addition of information on characteristics of need significantly improved the base model, but the subsequent addition of other blocks of variables did not improve the multivariable model.[36] The full model had an R^2 value of .266 (Table 14 - Model R).

The only variables that retained significance in Model R were prior visits and admission to a hospital. The sign of each regression coefficient in the full model was as expected. The practice received higher payments per annum for individuals who were admitted to a hospital or visited a physician at the practice more often in the preceding year. Information on prior visits with a physician made the largest contribution in Model R (standardized beta coefficient = .38), followed by information on admission to a hospital (standardized beta coefficient = .12). The measure of self-rated health approached significance (p =.06).

Two outliers were identified for Model R - case number 6710 and case number 8978. Both had six or more visits in the preceding year but no visits in the subsequent year. Therefore, annual OHIP payments during year two were lower than expected. Although the first individual reported that she made two visits in year two to a physician who worked at another clinic, the second person reported no outside utilization of this type of service.

Model S was constructed to evaluate the use of a four-part categorical measure of prior visits (Table 14 - Model S). The goodness-of-fit of Model S (i.e., R^2 value of .283) is greater than Model R (i.e., R^2 value of .266). Case number 6710 was identified as an outlier - for the reasons described above. One additional outlier was identified - case number 177803. This

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[35] Appendix L - Table L4 - Model 4E.

[36] The entry of variables measuring characteristics of need improved the base model (F[5, 609] = 34.74, p <.001). The subsequent addition of predisposing characteristics did not improve the base model with need variables (F[6, 603] = 1.31, p =.25). The subsequent addition of enabling characteristics did not improved the base model with need and predisposing factors (F[1,602] = .91, p =.34). Finally, the subsequent addition of community-level enabling variables did not improve the base model with need, predisposing and enabling characteristics (F[3, 599] = 1.18, p =.32).

participant had 11 prior visits but no visits in the subsequent year, therefore OHIP payments in year two were lower than expected. This individual reported no outside use of a physician.

To test Hypothesis 3 - age and gender were entered into a linear regression model that included information on the primary provider - then all variables identified as significant in univariate analyses at an alpha-level of .05 were entered in a forward, stepwise procedure. The inclusion of information on prior visits into the base model made the most significant improvement contribution to explanatory power, as evident by an increase in the R^2 value from .037 to .220 (F[1, 613) = 144.11, p <.001). The following variables also entered the stepwise model - admission to a hospital in the preceding year subsequently increased the R^2 value from .220 to .237 (F[1, 612] = 13.33, p <.001), information on health status increased the R^2 value to .250 (F[1, 611] = 10.59, P <.001), and information on the median household income of all private households increased the R^2 value to .257 (F[1, 610] = 5.95, P =.01) (Table 14 - Model T). Two outlier cases were identified - case number 6710 and case number 8978. Both participants had six or more visits in the preceding year but did not visit in the subsequent year, therefore OHIP payments were lower than expected.

As the prior visit variable made the largest contribution to the explanatory power of the stepwise model, this adjuster was explored in more detail. The inclusion of information on prior visits to a base model increased the R^2 value of the base model from .038 to .223 with a binary measure to .254 with a four-part categorical variable.

This analysis was repeated to determine the impact of using an explanatory variable other than prior utilization, as the use of prior visits as an adjuster may be controversial. Therefore, information on age and gender were entered into a linear regression model that included data on the primary provider - followed by forward, stepwise entry of all variables identified as significant in univariate analyses (except the prior visit variable). The following variables entered the stepwise model - the health status of the individual increased the R^2 value from .037 to .089 (F[1,613] = 35.26, p <.001), hospital admission in the past year subsequently increased the R^2 value to .114 (F[1,612] = 17.50, p <.001), and the median income of all private households in the communities of participants increased the R^2 value to .127 (F[1,611] = 8.61, p <.01).[37]

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[37] Appendix L - Table L4 - Model 4K.

The use of information on the median household income of all private households and data on hospital admissions was explored in more detail. The addition of information on whether or not an individual was admitted to a hospital enhanced the explanatory power of the base model, as measured by change in the R^2 value from .037 to .069 (F[1,653] = 23.24, p <.001). The addition of information on hospital admission and median household income increased the R^2 value from .042 to .095 (F[2,649] = 18.84, p <001).[38] [39]

To test hypothesis 4 - age and gender were entered into a linear regression model that included information on the primary provider - then all measures of community-level enabling characteristics were entered in a forward, stepwise procedure.[40] Only one variable entered the model - median income of all private households - and this measure of earned income significantly improved the base model (F[1,651] = 14.96, p <.001) (Table 14 - Model U). Two outliers were identified for Model U - case number 162065 and case number 158480. Both participants were outliers in the age and gender model and have been described as using a high level of service for psychiatric conditions.

When the forward, stepwise procedure was respecified to select from all of the measures of economic climate and relative wealth identified in univariate analysis, the only variable that improved the explanatory power of the base model (i.e., age, gender, primary provider) was the unemployment rate.[41] The R^2 value of this model and Model U were identical - .061. As the incidence of low income was a significant predictor of annual visits among those who visited at least once, the explanatory power of this variable was also evaluated. The R^2 value of the multivariable model with information on the age, gender, provider, and incidence of low income was .060. The three measures of relative wealth and economic climate - median income of all

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[38] Appendix L - Table L4 - Model 4G.

[39] The use of the variable measuring the incidence of low income was evaluated as a substitute for median household income - as the former variable was identified as an explanatory variable in the analysis of visit frequency. The R^2 value of the equation with age, gender, primary provider, hospital admission (yes/no) and the incidence of low income was also .095.

[40] This forward, stepwise procedure included the following measures - median income of private households, government transfer payments as a proportion of total income, and average census family income.

[41] Appendix L - Table L4 - Model 4H.

private households, the incidences of low income, and unemployment rates - are all highly correlated (Appendix J - Table J7).

Table 14

Determinants of Total, Annual OHIP Payments

Variables	Model Q Hypothesis 1 (n = 659)	Model R Hypothesis 2 (n = 618)	Model S Hypothesis 2 (n =618)	Model T Hypothesis 3 (n = 618)	Model U Hypothesis 4 (n = 656)
		Predisposing characteristics			
Age	.18***	0.07	0.07	.10**	.18***
Gender	.10**	0.06	0.05	0.06	.10*
No. of adults		-0.02	-0.03		
No. of children		-0.03	-0.03		
Work status		0.01	0.01		
Country of birth		0.06	0.05		
		Enabling resources			
Language at home		0.03	0.03		
		Need characteristics			
Health status		-0.08	-0.06	-.11**	
Disability status		-0.01	0.01		
Activity limits		-0.02	-0.04		
Admitted (yes/no)		.12***	.11***	.13***	
Prior year visits (0-5 versus ≥6)		.38***		.38***	
Prior year visits (0-2, 3-5, 6-8, ≥ 9)			.41***		
		Community-enabling resources			
Median income private households		-0.07	-0.06	-0.09*	-.15***
Government transfer payments		-0.01	0.01		

Variables	Model Q Hypothesis 1 (n = 659)	Model R Hypothesis 2 (n = 618)	Model S Hypothesis 2 (n =618)	Model T Hypothesis 3 (n = 618)	Model U Hypothesis 4 (n = 656)
Average census family income		0.01	0.01		
		Control variable			
Primary provider	-0.05	.00	0.02	-.00	-0.09
R^2 (training sample)†	.031	.320	.350	.298	.148
R^2 (test sample)‡	.046	.248	.257	.248	.072
R^2 (Full sample)	.038	.263	.281	.257	.061
R^2 (Trimmed sample)♀	.043	.285	.303	.280	.066
Outlier case number (standardized residual)	158480 (3.30) 162065 (4.09)	8978 (-3.14) 6710 (-3.55)	177803 (-3.01) 6710 (-3.69)	8978 (-3.25) 6710 (-3.47)	158480 (3.21) 162065 (4.15)

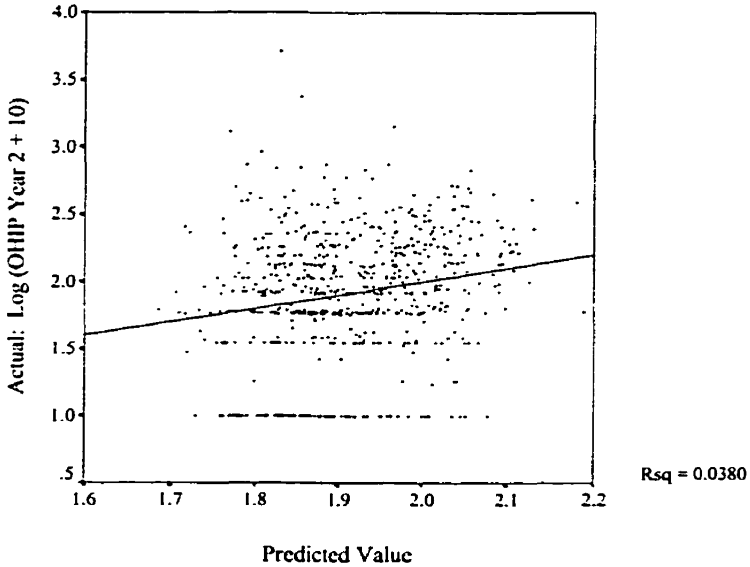
Note. Values in the table represent the standardized β coefficients from the regression equation. † = training sample size is equal to 400. ‡ = test sample size is equal to 259. ♀ Trimmed sample = outliers (standardized residuals three or more standard deviations from the mean). * p<.05, ** p<.01, *** p<.001.

3.4.3.e. Predictive Ratios: Group-Level Analysis of the Impact of Bias Selection

As predictive models are unable to explain 100 percent of the variability between-individuals in resource utilization, rate adjustment formula will always result in over- or under-compensation to providers or each enrollee. Figure 22 illustrates this point - cases plotted above the regression line used physician resources more than expected, and cases below the line use resources lower than expected. Predicted values were calculated from an age and gender rate adjustment formula, while expected values were based on what providers would have been paid under the current OHIP fee-for-service schedule if participants received the same volume and type of service. Therefore, predictive ratios were calculated to assess the predictive accuracy of a formula at the group-level, which is important when evaluating the net financial impact of a formula on providers who intentionally or unintentionally roster a bias selection of enrollees.

Figure 22

Predicted and Actual Values: Age and Gender as Predictors of Annual Payments[42]



The use of age and gender as adjusters results in an overpayment of three percent to providers who solely roster individuals who do not have disabilities, and an underpayment of six percent to providers who solely roster disabled populations.[43] This base model would also result in an overpayment of eight percent to rosters that only include individuals who rate their health as excellent, but underpayment of 17 percent to rosters that include individuals who rate their health as poor. Rosters that included populations of individuals that were not admitted to a hospital in the preceding year would be overpaid by two percent, but rosters that included individuals who had been admitted in the preceding 12 months would be underpaid 10 percent. Lastly, providers that solely roster individuals who visited a physician less than 3 times in the preceding year would be overpaid by nine percent, while providers who rostered individuals who visited nine or more times in the preceding year would be underpaid by 21 percent. Table 15

[42] Information on the primary provider was entered into the multivariable model as a control variable.

[43] The perspective of this analysis is the payer. Over- or under-compensation was calculated relative to what providers would have been paid under the current OHIP fee-for-service schedule if participants received the same volume and type of service.

summaries the predictive ratios for a variety of potential rate adjusters, and this table is located at the end of this subsection.

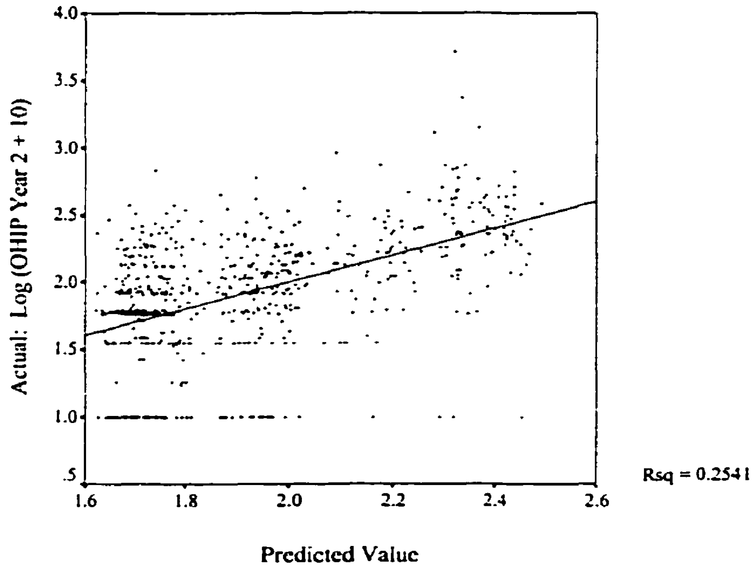
By comparison, use of age, gender and self-rated health status as rate adjusters results in an improvement over the use of the base model. While this formula also rewards providers who solely roster relatively healthy enrollees and penalizes providers who roster a population of relatively less-healthy individuals, the size of the rewards and penalties are not as extreme.

The use of age, gender and prior year visits or self-rated health status resulted in an improvement in group-level accuracy in comparison to the base model. The predictive ratios for the age, gender and prior visits approached a value of one for a variety of potential roster biases, suggesting minimal under- and over-payment. Although the result's presented here was derived from the four-part categorical measure of prior visits, the predictive ratios were almost identical when the two-part model was used. Differences in these ratios between the two models are specified in the notation at the bottom of Table 15.

The use of age, gender and prior visits as rate adjusters would result in one percent overpayment to providers who solely roster individuals who do not have a disability or have had no hospital admission in the preceding year. Providers who roster individuals who rate their health as excellent would be overpaid by four percent. Alternatively, providers would be underpaid by two percent for a roster of disabled individuals, eight percent for individuals who had been admitted to a hospital in the preceding year, and 12 percent for people who rated their health as poor. Figure 23 illustrates predicted and expected values for individuals when the age, gender and prior utilization adjusters were used to calculate rates for all participants.

Figure 23

Predicted and Actual Values: Age, Gender and Prior Visits as Predictors of Annual Payments



The use of age, gender and prior hospital admissions results in a marginal improvement of the base model. Similarly, age, gender and the incidence of low income results in a marginal improvement of the base model. Lastly, the use of age, gender, prior visits and hospital admission is not substantially better than the age, gender and prior visit formula.

The significance of a percentage over- or under-payment is appropriate to consider in terms of dollars and cents! Consider that the roster sizes per physician in capitated jurisdictions have been set at 1200 to 1600 individuals (Hutchison et al.., 1997), and the average OHIP billings per resident for general or family practitioner services was $150 in 1994/1995 (Chan & Anderson, 1996). If a physician rostered 1500 individuals with average billings of $150 per enrollee then total, annual payments would equal approximately $225,000. One percent of this value would represent $2,250. Therefore, a physician who selectively/inadvertently rostered a group of individuals who all rated their health as poor would receive an underpayment of 17 percent or approximately $38,250 if the capitation formula included age and gender adjusters. Alternatively, this same provider would receive an underpayment of 12 percent or approximately $27,000 for the same roster if the capitation formula included age, gender and prior use adjusters. By comparison, a physician selectively/inadvertently rostered a population who all rated their health as excellent would receive an overpayment of eight percent or approximately $18,000 if the capitation formula included age and gender adjusters. Alternatively, this provider would receive an overpayment of four percent or $9,000 for the same roster if the formula included age, gender and prior use adjusters.

Table 15: Predictive Ratios for Various Regression Equations*

		Age & Gender	Age, Gender & Health Status	Age, Gender & Prior Visits ♮	Age, Gender & Hospital Admit	Age, Gender & Incidence Low Income	Age, Gender, Prior Visits & Hospital Admits
R^2 value		*0.038*	*0.097*	*0.254*	*0.074*	*0.06*	*0.27*
Disability	**Yes**	0.94	0.97	0.98	0.95	0.95	0.98
	No	1.03	1.01	1.01	1.02	1.02	1
Health Status	**Excellent**	1.08	-	1.04	1.08	1.07	1.05
	Very Good	1.02	-	1	1.02	1	1
	Good	0.97	-	0.98	0.97	0.97	0.98
	Fair	0.95	-	1.01	0.94	0.96	1
	Poor	0.83	-	0.88	0.83	0.85	0.88
Hospital	**Admission**	0.9	0.9	0.92	-	0.88	-
	No Admit	1.02	1.01	1.01	-	1.01	-
Prior Visits	**0 - 2**	1.09	1.06	-	1.08	1.07	-
	3 - 5	1.01	1.01	-	1.01	1.01	-
	6 - 8	0.9	0.92	-	0.91	0.9	-
	≥ 9 visits	0.79	0.83	-	0.8	0.81	-

<u>Note</u>. * Regression equations were constructed by regressing adjusters on logarithm (annual OHIP payment + 10). ♮ Derived from the equation with four-part measure. Ratios using the two-part measure were identical, except excellent health status = 1.05 and fair health = 1.00. Predictive values were derived by dividing the sum of predicted by the sum of the observed values for all cases in the defined cohort. The predictive ratio equals one when predicted values are the same as observed values. Predictive ratios are less than one when predicted values are greater than observed (i.e., overpayment from payer perspective), and values are less than one when predicted values are smaller than observed (i.e., underpayment from the provider perspective).

3.4.3.f. Payment Schedules

Payment schedules were developed to demonstrate the redistributive effect of different formulae and these tables are presented in Appendix N. Tables N1 to N5 illustrate the amount of payment that would be paid to the practice by the Ontario MOH if the following capitation formulae were used to adjust the average payment made to the practice: age-gender, age-gender-prior visit, age-gender-health status, age-gender-hospital admission and age-gender-incidence of low income.

The age-gender formula would pay increasingly larger amounts for male and female participants who were increasingly older. This was also true for males for the age-gender-hospital admission and age-gender-incidence of low income formulae. The payments for both gender followed a "U-shape" for the age-gender-prior visit, and for women for the age-gender-health status, age-gender-hospital admission and age-gender-incidence of low income formulae. In other words, payments were higher for younger and older adults, relative to those for adults of middle-age.

Table 16 provides a correlation matrix to illustrate the level of association among the different formula in the amount of money that would be paid to the practice for each participant. The following findings are most noteworthy:

1. The correlation coefficients between the amount of OHIP payment received by the practice for each participant and that which would have been received under capitation are all below 0.50. Therefore, capitation funding would result in significant shifts in the amount of money paid to the practice for each participant.
2. Capitation rate adjustment based on age and gender would result in the largest shift in the amount of payment made to the practice for each participant, relative to what would be paid under other adjustment formulae. That is - the level of association between total OHIP payments received by the practice and that which would have been received under an age-gender formula was 0.195. Correlations between total payments and the amount of funds that would be received under other adjustment formulae are all higher than this value.
3. The resource allocation formula that would result in payments that most closely resemble the age-gender-health status model would be either the age-gender or age-gender-incidence of low income formula.

Table 16

Pearson Correlations Between Payments Made Under Different Methods of Payment (n = 659)

	Fee-for-Service Payment	Capitation Payment				
	Total OHIP Paid	Age & Gender	Age, Gender & Health Status	Age, Gender & Prior Visits ♮	Age, Gender & Hospital Admit	Age, Gender & Incidence Low Income
Total OHIP Paid	-	.195	.311	.504	.272	.245
Age & Gender	.195	-	.636	.387	.745	.806
Age, Gender & Health Status	.311	.636	-	.461	.503	.622
Age, Gender & Prior Visits	.504	.387	.461	-	.351	.399
Age, Gender & Hospital Admit	.272	.745	.503	.351	-	.610
Age, Gender & Incidence of Low Income	.245	.806	.622	.399	.610	-

Note. * All correlations significant at the 0.01 level (2-tailed). ♮ Prior visits as measured using a four-part categorical measure.

3.4.4. Results

3.4.4.a. Hypothesis Testing

Hypothesis 1: Age and gender (hereinafter referred to as the base model) will be significant determinants of physician resource utilization after controlling for provider-related characteristics.

Age was a significant determinant of physician resource utilization among participants, but gender was not. Age and gender, however, accounted for a small portion of between-individual variability. Therefore, the findings of this research project suggest that primary care, capitation formulae should adjust for age but the use of this type of basic demographic information is insufficient.

In this study, age was identified as a significant determinant of the incidence of an annual visit. Age was identified as a significant determinant of the amount of time that physicians spent providing medical services per encounter after statistically controlling for the physician seen and the type of visit. There was a strong, positive relationship between: (a) age and visits per annum among participants who visited a physician at least once, and (b) age and annual OHIP payments.[1]

Gender was not a significant determinant of the incidence of a visit among participants in this study, time spent or visits per annun among participants who made at least one. Gender was a significant determinant of total, annual OHIP payments in the age-gender and age-gender-socioeconomic context formulae. Female participants, however, were slightly more likely to visit a physician at the practice, spend more time with a physician, visited a physician more often and generated higher annual OHIP payments. Figures 24 and 25 illustrate age and gender differences in annual visits and payments.

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[1] Information on the primary provider or the physician seen during an encounter was identified as a significant determinant of time spent, visits per annum among participants who made at least one, and total, annual OHIP payments. Therefore, this variable was statistically controlled in multivariable models predicting these three measures of physician resource utilization.

Figure 24

Visits Per Annum Among Adults Who Visited At Least Once by Age and Gender (n = 659)

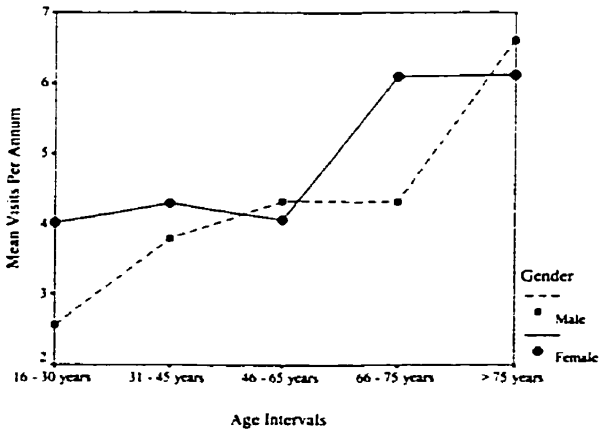
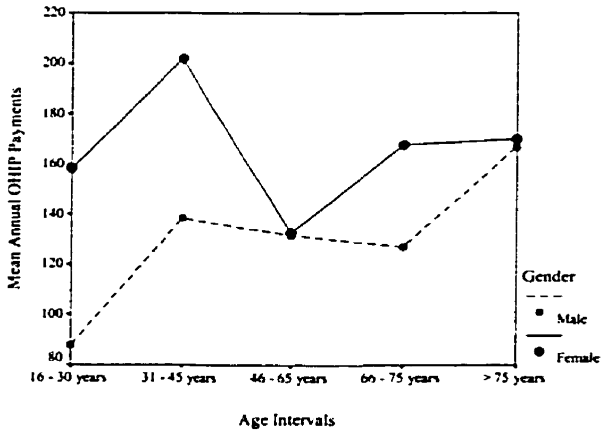


Figure 25

Total, Annual OHIP Payments by Age and Gender (n = 659)



At the group-level, the exclusive use of age and gender as rate adjusters may financially reward or penalize physicians. The amount of overpayment associated with bias selection of healthy enrollees appears to be greater than the amount of underpayment associated with bias selection of unhealthy people. Therefore, the sizes of the benefits of bias selection of healthy individuals do not appear to be as detrimental as the costs associated with selection of unhealthy people.

Hypothesis 2: Measures of need will explain more of the variability in the use of physician services than individual-level predisposing factors, enabling characteristics, and/or community-level characteristics.

Measures of need were identified as significant determinants of physician resource utilization among participants, and the explanatory power of each indicator varied among measures. Measures of need, when combined with information on age and gender, explained a sizable portion of between-individual variability in physician resource utilization. The findings of this research project suggest that primary care, capitation formulae should adjust for variability in needs.

In this study need factors were identified as significant determinants of whether or not an individual visited a physician during the year. Predisposing factors, however, were just as powerful as need factors in: (a) contributing to the discriminatory and explanatory power of the logistic model developed to identify determinants of the incidence of a visit, and (b) predicting the amount of time physicians spent providing medical services for one encounter. In addition, need variables were as powerful at predicting time spent as the variable identifying the individual physician who provided the care.

Characteristics of need made the most significant contribution to explaining variability in: (a) the frequency of visits per annum among those who visited at least once, and (b) annual OHIP payments. Furthermore, need factors remained significant after controlling for all other individual-level attributes and community-level characteristics.

The measure of need that made the largest contribution to the explanatory power of multivariable models and the discriminatory power of the logistic model was information on the frequency of prior visits. Participants in this study who visited a physician six or more times in the preceding year - compared to those who visited less often - were five times more likely to visit the practice in the subsequent year after controlling for age, gender and other measures of health status. Standardized beta coefficients for the prior visit variable indicated that this adjuster made the most powerful contribution to explaining variability in visit frequency and annual payments after controlling for other individual-level and community-enabling characteristics. For example, the standardized beta coefficient for the prior visit variable was four times larger than any other coefficient in the equation derived by regressing visit frequency or annual payments on all independent variables.

Once information on prior visits and other individual attributes and community characteristics were controlled in multivariable models, the variable that made the most significant contribution to explaining variability in visit frequency and annual payment was the occurrence of a hospital admission in the previous year. In fact, this measure of inpatient utilization was as powerful or more powerful than the age variable.

When measures of need were included in multivariable models with information on age, gender and primary provider, these equations explained approximately 40 percent of the variance in visits and 27 percent of the variance in payments. By comparison, when measures of need were included in multivariable models with all other information on individual attributes and community characteristics, these equations explained approximately 43 percent of variance in visits and 28 percent of variance in payments. Table 17 provides an overview of the explanatory power of various multivariable models, and highlights the importance of characteristics of need as determinants of physician resource utilization.

Table 17

Explanatory Power of Measures of Need in Comparison to Other Characteristics

Predictor Variables	R^2 Value of Multivariable Model	
	Visit Frequency Among Individuals Who Visited At Least Once	Total, Annual Payments
Primary Provider	< 1 %	< 1 %
Age & Gender & Primary Provider	~ 6 %	~ 4 %
Age & Gender & Primary Provider, Plus		
Predisposing Factors	~ 10 %	~ 6 %
Enabling Resources	< 1 %	< 1 %
Characteristics of Need	~ 40 %	~ 27 %
Community Attributes	~10 %	~ 6 %
Predisposing, Enabling and Need Characteristics & Community Attributes	~ 43 %	~ 28 %

Note. < = less than. ~ = approximately.

Hypothesis 3: The inclusion of individual-level (predisposing, enabling and need) and community-level enabling variables other than age and gender will significantly improve the performance of the base model.

There are measures of individual attributes and community characteristics that improved the predictive accuracy of multivariable models at the individual- and group-level, beyond the use of information on age, gender and provider-related characteristics. Therefore, the findings of this research project suggest that primary care, capitation formulae should adjust for variables other than age and gender to minimize: (a) opportunities for bias selection of enrollees in environments where providers compete to roster individuals, and (b) the net, financial gains or losses of rostering a bias selection of people.

The addition of information on the frequency of prior visits significantly improved the performance of an age and gender formula in predicting the incidence of a visit and explaining individual-level variability in visit frequency and annual payments. Furthermore, the Negelkere

R^2 value of the logistic model predicting the incidence of a visit increased two-fold from .066 (i.e., age and gender formula) to .124 with the addition of information on prior visits. The R^2 value increased from five percent (i.e., age and gender formula) to 37 percent with the addition of information on prior visits when predicting the frequency of annual visits among participants who visited at least once. The R^2 value increased from four percent (i.e., age and gender formula) to 25 percent with the addition of information on prior visits when predicting total, annual OHIP payments. These findings were similar when either the four-part or the two-part measure of prior visits was used in the multivariable models.[2]

The use of information on age, gender and prior visits as rate adjusters may financially reward providers who care for relatively healthy enrollees while penalizing those who have a relatively less-healthy roster. The sizes of the benefits or costs of bias selection are smaller relative to those that would be derived if the age-gender formula was used. Furthermore, the predictive accuracy of the age-gender-prior visit formula at the group-level was as good or superior to the age-gender-health status formula. These findings held true when either the four-part or the two-part measure of prior visits was used to calculate predictive ratios.

When these analyses were repeated without the measure of prior visits - due to the potential controversial nature of this adjuster - the addition of information on self-rated health status significantly improved the performance of an age and gender formula in explaining individual-level variability in the frequency of annual visits among participants who visited at least once and total, annual OHIP payments. The addition of information on self-rated health status into a multivariate model increased the R^2 value from five percent (i.e., age and gender formula) to 15 percent when predicting the frequency of annual visits among participants who visited at least once. The R^2 value increased from four percent (i.e., age and gender formula) to 10 percent when predicting annual OHIP payments. When the logistic regression model was respecified without the prior visit variable, the number of adults in the home enhanced the explanatory power of the equation predicting the likelihood of a visit. The predictive ratios for the age-gender-health status formula were superior to the age-gender model.

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[2] The R^2 value of the age-gender-prior visit model was 25.4 percent when utilization was measured using the four-part categorical variable and 22.3 percent with the two-part categorical measure.

Due to the potential controversial nature of using prior visits and the complexity and cost of acquiring and maintaining data on self-rated health status, the use of information on hospital admissions was also evaluated for its potential use as a rate adjuster. This variable was selected as it made the most significant contribution to the explanatory power of multivariable models predicting physician resource utilization, other than information on age, prior visits and health status. The addition of information on whether or not an individual was admitted to a hospital in the preceding year increased the R^2 value from five percent (i.e., age and gender formula) to nine percent when predicting the frequency of visits per annum among participants who visited at least once, and from four percent (i.e., age and gender formula) to seven percent when predicting annual payments. The predictive accuracy of the age-gender-hospital admission formula at the group-level was only marginally superior to the age and gender formula. Furthermore, the predictive accuracy of the age-gender-prior visit-hospital admission formula at the group-level was similar to the more parsimonious age-gender-prior visit formula.

Hypothesis 4: The inclusion of community-level enabling variables will significantly improve the performance of the base model.

There are measures of community attributes that improved the predictive accuracy of multivariable models at the individual-level (i.e., change in R^2 value), beyond the use of information on age, gender and provider-related characteristics. Therefore, the findings of this research project suggest that primary care, capitation formulae could adjust for community-level characteristics to reduce opportunities for bias selection. For example, in this study the addition of information on the incidence of low income improved the performance of the age and gender formula in explaining variability in visit frequency and annual payments. In fact, the addition of information on the median income of all private households, unemployment rates, <u>or</u> the incidence of low income significantly improved the performance of an age and gender formula in explaining variability in annual payments.

The addition of any of the above-mentioned measures of community-enabling characteristics increased the R^2 value from five percent (i.e., age and gender formula) to 10 percent when predicting the frequency of annual visits among participants who visited at least once, and from four percent (i.e., age and gender formula) to six percent when predicting annual payments. In summary, the addition of information on community attributes to a capitation formula with information on age and gender resulted in a two-fold increase in explanatory power at the individual-level. As these measures of relative wealth were highly correlated, they made comparable contributions to enhancing the explanatory power of the base model. The predictive accuracy of the age-gender-incidence of low income formula was marginally superior at the group-level (i.e., as measured by the predictive ratio) to the age and gender formula.

3.4.4.b. Determinants of Physician Resource Utilization

3.4.4.b.i. Determinants of at Least One Visit: Rostered Adults

The characteristics of participants identified as determinants of whether or not an individual visited a physician at the practice during one year included age, the frequency of utilization of physician services at the practice in the preceding year and whether or not the individual lived alone. Gender was not significant in univariate analysis and remained non-significant in multivariable modelling. The likelihood that a participant between 16 and 30 years of age would visit a physician during the course of one year was higher than the odds that an adult between 31 and 45 years of age would visit. In addition, the likelihood that a participant visited increased with age for adults over 46 years of age. It is unlikely that obstetrical cases accounted for differences in the likelihood of a visit between younger adults, as only five participants visited the practice for prenatal services.

Individuals who visited a physician six or more times in the preceding year were more likely to visit than those who visited less often, and people who lived alone were more likely to visit that those who lived with other adults. One of the measures of need used in this study (self-rated health status) improved the explanatory power of a multivariable logistic model as measured by Negelkere's R^2 value, but did not improve discriminatory power of the equation. None of the community-level enabling measures were identified as a determinant of the incidence of a visit. Lastly, the provider-related variable was not identified as a determinant of the incidence of a visit.

3.4.4.b.ii. Determinants of Time Spent

The characteristics of participants identified as determinants of the amount of time a physician spent providing medical services for one encounter included age, work status and the type of visit.[3] Age was identified as a significant determinant of the amount of time that

[3] Gender was significant in univariate analysis, but failed to retain significance in the multivariable models.

physicians spent providing medical services per encounter after statistically controlling for the physician seen and the type of visit. The direction of the age-time spent relationship was negative. Age and gender accounted for less than four percent of variability in time spent. When the association between age and time spent was tested using data from the most common type of visit (i.e., intermediate assessment), age was no longer a significant determinant.

Only one of the variables measuring individual-level characteristics of participants (i.e., work status) significantly improved the R^2 value of the age and gender model predicting time spent - once information on the primary provider and/or type of visit were controlled. Physicians spent significantly more time with adults who were working. While the addition of this variable significantly improved the explanatory power of the multivariable model from 11 percent (age and gender formula) to 13 percent, the clinical relevance of the variability in time between participants who had different work statuses was marginal.[4] None of the community-level enabling measures were identified as determinants of the incidence of a visit. Lastly, the provider-related variable was identified as a significant determinant of the incidence of a visit and was included as a statistical control in multivariable modelling.

3.4.4.b.iii. Determinants of Visits Per Annum Among Participants Who Visited At Least Once

The characteristics of participants identified as significant determinants of the frequency of annual visits among those who visited at least once included age, self-rated health status, hospital admission, the frequency of utilization of physician services at the practice in the preceding year, and the incidence of low income. Participants had more visits per annum if they: (a) were older, (b) reported lower self-rated health, (c) were admitted to a hospital in the prior year, (d) visited a physician at the practice more often in the preceding year, or (e) were from a community that had a higher incidence of low income. Information on prior visits with a physician at the practice made the largest contribution (i.e., standardized beta coefficient) to the explanatory power of the model, followed - in descending order - by the incidence of low income, prior hospital admissions and self-rated health status. Gender was not significant in

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[4] The R^2 values cited here were derived from the multivariable models that included physician seen and type of visit as control variables.

Physicians spent 21 minutes providing medical services to participants who worked, 19 minutes to adults who were unable or looking for work, and 18 minutes with those who had other main activities.

univariate analyses and remained non-significant in multivariable modelling. The primary provider was a significant determinant of visits per annum, therefore this variable was used as a control in multivariable analyses.

3.4.4.b.iv. Determinants of Total, Annual OHIP Payments

The characteristics of participants identified as significant determinants of total, annual OHIP payments included the frequency of utilization of physician services at the practice in the preceding year and hospital admission. The practice received higher payments per annum for individuals who visited a physician at the practice more often or and those who were admitted to a hospital in the preceding year. Information on prior visits with a physician at the practice made the largest contribution to the explanatory power of the full model, followed by the variable measuring the occurrence of a hospital admission. Other variables (e.g., age, self-rated health status) were identified as significant determinants after controlling for age and gender but these characteristics did not remain significant in the full model.

The inclusion of variables measuring community-level enabling characteristics increased the explanatory of the base model, but these indicators did not remain significant once individual-level characteristics other than age and gender were statistically controlled. The primary provider was a significant determinant of total, annual OHIP payments in univariate analysis, therefore this variable was used as a control in multivariable models.

3.5.0. Discussion

3.5.1. Hypothesis Testing

Hypothesis 1: Age and gender (hereinafter referred to as the base model) will be significant determinants of physician resource utilization after controlling for provider-related characteristics.

The findings of this study suggest that age was a significant determinant of physician resource utilization. The positive association between: (a) age and the likelihood of a visit, (b) age and the frequency of annual visits, and (c) age and total, annual payments parallels findings of other researchers who have studied populations in Ontario (Anderson et al., 1996; Chan, 1999; McIsaac et al., 1997), Canada (Birch et al., 1993; Broyles et al., 1993; Dunlop, 1998; Tataryn, Roos & Black, 1994) and other jurisdictions (Arling, 1985; Stoller, 1982; Wolinsky, 1978).

Gender was a significant determinant of total annual payments in the age-gender and age-gender-socioeconomic context formulae. In fact, gender remained significant as a determinant of annual payments when predisposing, enabling or need variables were entered into a regression equation but became non-significant once information on prior visits was included. Gender did not remain significant in the age-gender equation when calculating the odds of a visit or predicting time spent or visit frequency.

Research conducted using nation-wide or province-wide sampling strategies or population-based data have found age and gender differences in the incidence of a visit to a general practitioner, the frequencies of annual visits, and total annual billings per patient (Birch et al., 1993; Broyles et al., 1983; Chan, 1999; Dunlop, 1998; McIsaac et al., 1997). For example, researchers conclude that female residents of Canada were significantly more likely than males to visit a general practitioner in one year and see these physicians more often (Dunlop, 1998; Birch et al., 1993; Broyles et al., 1983; McIsaac et al.,1997). Among Canadians who saw a physician, females were more likely than males to make two or more visits. Over the course of one year (e.g., 1993-94), females averaged seven visits to a physician while males averaged five (Federal, Provincial and Territorial Advisory Committee on Population Health, 1999). Furthermore, annual OHIP billings for women in childbearing years (20 to 44 years old) were double the amount billed for men of the same age. These gender differences in annual billings were evident across different types of services - not just obstetrical services (Anderson et al., 1996). The gender differences documented in this study parallel these findings, but did not reach statistical significance.

Age and gender interaction terms were not significant in this study, but nation-wide and province-wide studies have found that gender differences vary by age. For example, Canadian females between the 15 and 64 years of age were about two to three times more likely to see a physician during the preceding year then their male counterparts (Federal, Provincial and Territorial Advisory Committee on Population Health, 1996). Conversely, OHIP billings for men over the age of 65 exceeded billings for females of the same cohort (Anderson et al., 1996; Chan, 1999). The lack of statistical significant interaction in the present study - in comparison to population-based observations - may relate to the bias of the sample that was introduced by the criteria used to establish eligibility.

In this study, age and gender explained less than five percent of the individual-level variability between participants in visit frequency per annum and annual payments. These findings are similar to evidence from the literature. Age and gender explained less than four percent of total, annual physician costs among adults (17 to 64 years old) and less than one percent of these costs among seniors (≥ 65 years) in Manitoba and British Columbia (Reid, MacWilliam, Verhulst, Roos & Atkinson, 1999). Studies conducted in other jurisdictions suggest that age and gender explained between 0.5 and 5.5 percent of the variability total expenditures (Fowles et al., 1996; Lubitz, Beebe & Riley, 1985; Ash et al., 1989; Newhouse, Manning, Keeler & Sloss, 1989; van Vliet & van de Ven, 1992), and three to six percent of variability in annual ambulatory charges and visits among adults who rostered in the United States (Weiner et al., 1991). Therefore, although age and gender may provide an appropriate 'starting point' for an adjustment formula, the exclusive use of this type of demographic information is insufficient and could result in different selection of enrollees.

Hypothesis 2: Measures of need will explain more of the variability in the use of physician services than individual-level predisposing factors, enabling characteristics, and/or community-level characteristics.

The findings of this project suggest that there are measures of individual attributes and community characteristics that improve the predictive accuracy of rate adjustment formula at the individual- and group-level, beyond the use of information on age and gender. These results are in accordance with evidence in the literature. Furthermore, the following measures have been recommended for inclusion in capitation rate formula in other jurisdictions:

1. Welfare status (e.g., Ash et al., 1989).
2. Employment status (e.g., van Vliet & van de Ven, 1992).
3. Health status (Fowles et al., 1996).
4. Diagnoses (Weiner et al., 1998).
5. Functional status (e.g., Schauffler et al., 1992).
6. Chronic disease (e.g., Schauffler et al., 1992).
7. Hospital admissions (e.g., Ash et al., 1989).
8. Prior costs (e.g., van Vliet & van de Ven, 1992).

In fact, capitation rate adjusters (other than age and gender) that have/are been used in jurisdictions where providers compete to roster enrollees include:

1. Welfare status (e.g., United States).
2. Disability status (e.g., United States).
3. Diagnoses (e.g., Primary Care Demonstration Project in British Columbia).
4. Insurance status (e.g., The Netherlands).
5. Prior utilization (e.g., New Zealand).
6. Location of residence (e.g., the Netherlands, United Kingdom, United States).

The findings of this study suggest that measures of individual attributes, particularly characteristics of need, significantly enhanced the predictive accuracy of primary care capitation formula (that included information on age and gender) at the individual- and group-level. These findings are in accordance with research conducted in Ontario or nation-wide: need factors were the strongest predictors of the incidence of a visit (Birch et al., 1993; Broyles et al., 1983; Dunlop, 1998; McIsaac et al., 1997), and explained variability in visit frequency and annual payments after controlling for all other individual-level attributes and community-level determinants (Bice & White, 1969; Birch et al., 1993; Dunlop, 1998; McIsaac et al., 1997; Sharp, Ross & Cockerham, 1983; Wan & Soifer, 1974; Wolinsky, 1978).

Researchers who have used the Behavioural Model to identify and evaluate determinants of physician resource utilization found that need factors explain more variability than predisposing and/or enabling factors. More specifically:

1. Predisposing factors explained from 9 to 12 percent of variance in the frequency of self-reported visits to a physician (Wolinsky, 1978).
2. Enabling characteristics explained one percent or less of variance in the frequency of self-reported visits to a physician (Wolinsky, 1978).
3. Characteristics of need explained from 3 to 15 percent of variance in the frequency of self-reported visits to a physician (Arling, 1985; Stoller, 1982; Wolinsky, 1978).
4. Predisposing, enabling and need characteristics explained from 9 to 22 percent of the variance in self-reported visits to a physician (Andersen & Aday, 1978; Arling, 1985; Birch et al., 1993; Stoller, 1982; Wan & Soifer, 1974; Wolinsky, 1978).

In this study, the R^2 values derived from multivariable models that included characteristics of need were higher than those reported by other researchers. There are likely a number of explanations for this difference. First, none of the researchers cited above evaluated the predictive potential of information on the frequency of prior visits. When multivariable models in this study were respecified without the use of the prior visit measure, characteristics of need explained 20 percent of the variance in visit frequency among participants who visited at least once and 13 percent of variance in annual payments. These R^2 values are more in line, although slightly higher, than those attained by these researchers. Second, the dependent variable in this study measured the frequency of visits among users, while others evaluated self-reported visits among users and nonusers. Third, two out of three research teams cited above as evaluating need factors assessed determinants of physician service utilization among the elderly (Arling, 1985; Stoller, 1982). Evidence suggests that multivariable models explaining variation in health service have higher R^2 values for younger adults in comparison to elderly cohorts (e.g., Reid et al., 1999; van Vliet & van de Ven, 1992; 1993). Fourth, the R^2 values in this study were derived from regression analyses conducted with dependent variables that had been transformed. Thomas and Lichtenstein (1986) observed that equations derived from log transformed dependent variables explain more variance in health service utilization than models constructed using unadjusted data. The log transformation, however, does not change ranking when comparing a number of different rate adjustment formulae that all use transformed dependent variables.

Hypothesis 3: The inclusion of individual-level (predisposing, enabling and need) and community-level enabling variables other than age and gender will significantly improve the performance of the base model.

As indicated above, need factors were the most powerful predictor of physician resource utilization among participants. The measure of need that made the largest contribution to the explanatory power of multivariable models and the discriminatory power of the logistic model was information on the frequency of prior visits. This variable was the strongest predictor of three of the four measures[1] of physician resource utilization. Similar findings have been documented in other Canadian jurisdictions (Roos, Carrière & Friesen, 1998; Roos & Shapiro, 1981).

The second, third and fourth most powerful predictors of annual rates of physician resource utilization in this study were self-rated health status, the occurrence of a hospital admission, and community-level measures of income. Results of research that was conducted using nation-wide or province-wide survey data in Canada and Ontario found that self-rated health status was a significant determinant of: (a) physician visits among those who visit at least once (Birch et al., 1993), and (b) high-use of physician services (McIsaac et al., 1997). In addition, researchers determined that health status was a significant determinant of annual visits to a physician and total expenditures on these services in other jurisdictions (Andersen & Aday, 1978; Fowles et al., 1996; Newhouse et al, 1989; Parkerson, Broadhead & Tse, 1995; Wolinsky, 1978). The incidence of a hospital admission during the preceding year has been identified as a significant determinant of: (a) ambulatory care visits among hypertensive adults in Manitoba (Roos et al., 1998), and (b) total health service expenditures among Medicare beneficiaries (Ash et al., 1989; Beebe et al., 1985; Lubitz et al., 1985; Schauffler, Howland & Cobb, 1992; Thomas Lichtenstein, 1986).

Hypothesis 4: The inclusion of community-level enabling variables will significantly improve the performance of the base model.

The findings of this study suggest that the addition of information on the socioeconomic climate of an enrollee's community enhanced the predictive accuracy of the age and gender formula at the individual-level and marginal improved predictive accuracy for bias rosters. The

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[1] Three measures include the incidence of a visit, the frequency of annual visits among participants who visited at least once, and total annual payments.

finding that socioeconomic context was a determinant of an individual's health service utilization is in accordance with evidence from research conducted in Toronto and Ontario by others (Locker et al., 1996; Locker & Ford, 1996).

Adjusters that account for the socioeconomic climate or place of residence are currently being used in other jurisdictions. The location of residence is used as an adjuster in the Netherlands, the United Kingdom and the United States. For example, since 1991 the basic practice allowance paid to general practitioners in the United Kingdom has been adjusted on the basis of whether an individual resides in a geographic location designated as a 'deprived area' (Carr-Hill & Sheldon, 1991; Delamothe, 1990; Hutchinson, Foy & Sandhu, 1989). Deprivation is measured using an 'underprivileged area score' calculated using the Jarman Index, and a threshold score is use to designate areas as deprived or not (Delamothe, 1990).

3.5.2. Determinant of Physician Resource Utilization

3.5.2.a. Determinants of at Least One Visit: Rostered Adults

Individual attributes identified as determinants of whether or not a participant visited a physician during one year included age, the frequency of primary care utilization in the preceding year and whether or not the individual lived alone. These results parallel those found by other researchers who have conducted this type of research in Canada and abroad (Broyles et al., 1983; Roos & Shapiro, 1981; Stoller, 1982). Although the number of adults in the home was associated with the incidence of a visit, marital status was not and this finding concurs with the results of recent studies conducted elsewhere in Ontario (Birch et al., 1993; McIsaac et al., 1997). Marital status, however, has been identified as a significant determinant in national samples - individuals who were single reported a lower propensity to visit a physician than those who are married, divorced or widowed (Broyles et al., 1983; Dunlop, 1998).

One of the measures of need used in this study (self-rated health status) improved the explanatory power of a multivariable logistic model as measured by Negelkere's R^2 value, but did not improve discriminatory power of the equation. This finding conflicts with evidence in the literature, as other researchers have consistently found that self-rated health status has been a significant determinant of the incidence of a visit among Canadians (Birch et al., 1993; Broyles et al., 1983; Dunlop, 1998; McIsaac et al, 1997). In this study, the confidence interval around the adjusted odds-ratios associated with each level of self-rated health was large suggesting that the small sample of participants did not allow for an appropriate evaluation of each level of this measure of need. In addition, the findings of this study may not concur with population-based research due to the geographic location of residents, the use of one family practice to recruit participants and the potential bias introduced by the eligibility criterion requiring adults to be considered rostered.[2]

Community-level enabling resources were not identified as significant determinants of the incidence of a visit. There is conflicting evidence in about the influence of the location of Canadian residents on the incidence of a visit, but other researchers have evaluated the explanatory power of variables that measure large geographic areas in Canada.[3] For example, Birch et al. (1993) and Dunlop (1998) found that the province of residence was a determinant of the incidence of a visit in their nation-wide study, and McIsaac et al. (1997) found that region of the province was not a determinant of the incidence of a visit when they conducted an analysis of residents in Ontario. Furthermore, urban dwellers were more likely to visit than individuals who lived in rural Canadian communities (Dunlop, 1998), and residents of larger cities were more likely to visit than individuals from smaller municipalities (Broyles et al., 1983).

The community-level income measures used in this study served as indicators of the economic context (e.g., unemployment rates) as well as proxies for individual-level attributes (e.g., measures of income). There was no significant relationship between any community-level measures of income and the incidence of a visit, which concurs with prior studies that have not found any relationship between the household income of Canadians and their propensity to visit a physician (Birch et al., 1993; Broyles et al., 1983).

3.5.2.b. Determinants of Time Spent

The characteristics of participants identified as determinants of the amount of time a physician spent providing medical services for one encounter included age, work status and the type of visit. Age accounted for less than four percent of variability in time spent - a finding that

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[2] In fact, having a regular medical doctor was a significant determinant of whether Canadians visited a general practitioner during the course of one year (Dunlop, 1998). Research conducted by Dunlop (1998), however, suggested that indicators of need were more powerful than predisposing factors in predicting the likelihood that a Canadian would visit a general practitioner after controlling for whether or not an individual reported having a 'regular doctor'.

[3] Phillips et al. (1998) would likely categorize these as measures of the external environment other than local communities - refer to Section 1.1.1. on the Behavioural Model of Health Service Utilization.

concurs with others (Kristiansen & Mooney, 1993).[4] The direction of the age-time spent relationship was negative. When the weak association between age and time spent was tested using data from the most common type of visit (i.e., intermediate assessment), age was no longer a significant determinant. These findings suggest that participants of different ages likely visit for different reasons - the types of visits made by older persons require less physician time. Once the type of visit was controlled, however, age was not a determinant of time spent.

Most of the literature regarding determinants of time spent by physicians for one encounter with a patient include descriptive statistics or the results of univariate analyses, and researchers who have conducted these studies document evidence of a positive relationship between age-time spent (Andersson & Mattsson, 1989; Gross et al., 1998; Smith et al., 1995) or no relationship between age-time spent (Raynes & Cairns, 1980). Researchers who tested this hypothesis (i.e., age-time spent) by conducting multivariable analyses to control for other determinants have documented a positive (but weak) relationship.[5] These researchers studied large samples of physicians in either a single university-affiliated setting in the United States (Smith et al., 1995) or rural communities in Norway (Kristiansen & Mooney, 1993). Unfortunately, research regarding time spent by family physicians in Canada have evaluated the amount of time one physician spent with a range of patients (Collyer, 1969), or the amount of time a range of physicians with four standardized patients (Woodward et al., 1997). Therefore, while the results of this study differ from those published by others, it is uncertain whether these results reflect practice patterns in Canada.

It may not be surprising that the type of visit rather than the relative health of individuals would be a significant determinant of time spent with FFS physicians. The analytic frameworks described in Section 2.0.1. suggest that the incomes of FFS physicians are a function of the volume of services provided. In addition, OHIP billings per patient are primarily determined by the type of visit. Therefore, one might expect that FFS physicians would have receptionists identify the reason a patient is requesting a visit and schedule an appointment for the amount of time that reflects this reason. The goal of the scheduling process would be to maximize the

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[4] In fact, age and gender both accounted for less than four percent of variability in time spent.

[5] Interestingly, Lasker & Marquis (1999) evaluated the determinants of work intensity for visits to a physicians of the same duration, and concluded that age was not associated with intensity for 15-minute encounters.

number of encounters per day and to allocate physician time to each encounter based on the reason for the visit rather than the overall health profile of the individual. In fact, there is no financial incentive in the FFS context to develop an information infrastructure to enable receptionists to understand an individual's overall health status when booking an appointment.

During the time period that this study was conducted, receptionists scheduled appointments using a default appointment time of 10 minutes. After this study was conducted, the physicians at the practice believed that receptionists were frequently booking two blocks (i.e., 20 minute appointments) because they estimated that patients needed more than 10 minutes. This happened so frequently that 20-minute appointments became routine. Therefore, the finding that the mean time spent was 19 minutes was not unexpected. The procedure at the practice now requires receptionist to use a default appointment time of 15 minutes and not to book two blocks (i.e., 30 minutes) unless specifically advised by the physician (personal communication, P. Ellison, January 2, 2000).

The finding that individual provider-related characteristics, rather than the attributes of patient populations, determined service time is in accordance with the results of other studies (Henke & Epstein, 1991; Kristiansen & Mooney, 1993; Smith et al., 1995). For example, Smith et al. (1995) described the importance of the 'physician factor' when understanding primary care physician productivity. Smith included multiple measures of an individual's need for medical care into a multivariable model to identify determinants of the amount of time physicians spent with patients. Patient characteristics accounted for seven percent of the variability in time spent, while the individual physician accounted for 23 percent. By comparison, Henke & Epstein (1991) estimated that patient characteristics accounted for 12 percent of variance in visit length, individual practice style accounted for 45 percent and practice incentives accounted for 20 percent. The finding that the physician seen and the type of visit were the most important determinants of time spent concur with the results of others (Lasker & Marquis, 1999).

3.5.2.c. Determinants of Visits Per Annum Among Participants Who Visited At Least Once

The characteristics of participants identified as significant determinants of the frequency of annual visits among those who visited at least once included age, self-rated health status, hospital admission, the frequency of utilization of physician services at the practice in the preceding year, and the incidence of low income. This is in accordance with evidence in the literature (Birch et al., 1993; Broyles et al., 1983, Roos & Shapiro, 1981; Roos et al., 1998; Stoller, 1982).

In this study, measures of need, predisposing features and community-level enabling characteristics all made independent contribution to explaining variability in visits per annum among participants who visited the practice at least once. The finding that the attributes of communities were significant determinants of physician resource utilization, after controlling for population characteristics and provider-related influences, is in accordance with the Behavioural Model (Andersen & Newman, 1973; Andersen, 1995; Phillips et al., 1998) and a popular theory regarding the determinants of population health (Evans & Stoddart, 1990).

Empirical research conducted by others supports the premise that individual characteristics and community context make independent contributions as determinants of health and/or service utilization (Kohen, Hertzman & Brooks-Gunn, 1998; Locker et al., 1996; Locker & Ford, 1996; Wan, 1981). Phillips et al. (1998) conducted a systematic review of the literature to identify articles whose authors used the Behavioural Model as a framework for identifying and evaluating determinants of health service use, and concluded that environmental and provider-related contextual variables accounted for up to 20 percent of the total variance explained by multivariable models.

3.5.2.d. Determinants of Total, Annual OHIP Payments

The characteristics of participants identified as significant determinants of total, annual OHIP payments included age and the frequency of utilization of physician services at the practice in the preceding year and hospital admission. These findings are in accordance with evidence in the literature (Ash et al., 1989; Anderson et al., 1990; Beebe et al., 1985; Lubitz et al., 1985; Schauffler et al., 1992; Thomas & Lichtenstein, 1986; van Vliet & van de Ven, 1993). Other variables (e.g., age, self-rated health status) were identified as significant determinants after controlling for age and gender but these characteristics did not remain significant in the full model.

3.5.3. Other Findings

3.5.3.a. Explanatory Power and Opportunities for Bias Selection

It has been suggested that predictive models will not be able to explain any more than 50 percent of the variance in outpatient expenditures (Newhouse et at., 1989; Welch, 1985). The multivariable models constructed as part of this research project explained up to 43 percent of the

individual-level variability in the frequency of visits among participants who made at least one and 28 percent of the variance in annual payments. These figures, therefore, provide a yardstick for evaluating and comparing rate adjusters and capitation formulae. More specifically, the narrower the gap between these 'maximal attainable' R^2 values
and the R^2 for a formula the smaller the possibilities for opportunistic selection among providers who are privy to information on prospective and current enrollees (van Vliet & van de Ven, 1992).

If the R^2 values derived from the full models[6] (i.e., 43 and 28 percent) represented 'potentially explainable' variance, age and gender accounted for 12 to14 percent of this potential.[7] In this study age and gender accounted for a small portion of 'potentially explainable' variability. The addition of information on the frequency of prior visits to a base model with age and gender resulted in a five- to six-fold increase in explanatory power at the individual-level. Furthermore, the use of information on the frequency of prior visits resulted in a formula that accounted for 70 to 90 percent of 'potentially explainable' variance.

Therefore, an age-gender-prior visit formula would substantially reduce opportunities for bias selection as these adjusters accounted for most of the between-participant variability that could be explained with all of the information available to this researcher. Table 18 summarizes the results of this type of analysis for different adjustment formulae to highlight the relative explanatory power of different models at the individual-level.

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[6] 'Full models' refer to the multivariable equations that include all predictor and control variables.

[7] Age and gender explained approximately five percent of the variance in visit frequency, and the multivariable model with all variables explained approximately 43 percent of variance. Therefore, five divided by 43 equals 12 percent of 'potentially explainable' variance.

Age and gender explained approximately four percent of the variance in annual payments, and the multivariable model with all variables explained approximately 28 percent. Therefore, four divided by 28 equals 14 percent of 'potentially explainable' variance.

Table 18

Relative Differences in the Explanatory Power of Various Rate Adjustment Formulae

Adjusters in Formula	Increase in Predictive Accuracy at the Individual-Level over the Base Model	Proportion of the Potentially Explainable Variability	
		Annual Visits*	Annual Payments
Age & Gender (Base Model)	-	12 %	14 %
Age, Gender & Prior Visits	5 - 6 fold	70 % [8]	90 % [9]
Age, Gender & Health Status	2 - 3 fold	37 %	36 %
Age, Gender & Hospital Admission	2 - fold	21 %	26 %
Age, Gender & Incidence of Low Income	1.5 - 2 fold	23 %	21 %

Note. OHIP = Ontario Health Insurance Plan. *Visit frequency among participants who visited at least once.

3.5.3.b. Predictive Accuracy at the Group-Level and Potential Financial Impact

While the predictive accuracy of rate adjustment formulae at the individual-level provided insight into the potential for bias selection in environments where providers compete to roster enrollees, the predictive accuracy at the group-level as measured by predictive ratios provided some insight into the potential net, financial impact of bias rosters.

At the group-level, the exclusive use of age and gender as rate adjusters may financially reward or penalize physicians. The amount of overpayment associated with bias selection of

[8] Age, gender and prior visits explained approximately 30 percent of the variance in visit frequency, and the multivariable model with all variables explained approximately 43 percent. Therefore, 30 divided by 43 equals 70 percent of 'potentially explainable' variance.

[9] Age, gender and prior visits explained approximately 25 percent of the variance in annual payments, and the multivariable model with all variables explained approximately 28 percent. Therefore, 25 divided by 28 equals 90 percent of 'potentially explainable' variance.

healthy enrollees appears to be greater than the amount of underpayment associated with bias selection of unhealthy people. The age-gender-prior visit formula significantly improved the predictive accuracy of the age-gender formula at the individual- and group-level. The predictive accuracy of the age-gender-prior visit formula at the group-level was superior to other rate adjustment formulae, which suggests that this formula [relative to the others] would minimize net financial gains or costs to providers who might intentionally or inadvertently enroll a bias selection of individuals. More specifically, the age-gender-prior visit formula improved the predictive accuracy of the age-gender model at the group-level, as it provided more accurate compensation for disabled populations, people of varying health status, and those who had been admitted to a hospital in the preceding year. Furthermore, the predictive accuracy of the age-gender-prior visit formula at the group-level was as good or superior to the age-gender-health status formula. These findings held true when either the four-part or the two-part measure of prior visits was used to calculate predictive ratios. Finally, the age-gender-prior visit formula: (a) outperformed the age-gender-hospital admission formula and the age-gender-incidence of low income formula, and (b) performed as well as the age-gender-prior visit-hospital admission formula.

The predictive accuracy of the age-gender-health status formula was superior to the age-gender formula at the individual-level and for bias groups. More specifically, this formula outperformed the age-gender equation at the group-level, as it provided more accurate compensation for disabled populations, people of varying health status, and those with different historic visit rates. The predictive accuracy of the age-gender-hospital admission and the age-gender-incidence of low income formula enhanced the predictive accuracy of the age-gender formula at the individual-level and marginal improved accuracy for bias rosters.

Although predictive ratios have been used to evaluate the performance of different capitation formula in jurisdictions where providers have assumed the responsibility for a full range of health care services, no articles could be found in the literature where this measure had been applied to ambulatory or primary care contexts. Researchers who used predictive ratios found that age-gender-prior year cost formula outperformed the age-gender formula in predicting total health plan expenditures for disabled populations, people of various health status and high-cost groups (van Vliet & van de Ven, 1992; 1993). The age-gender-health status formula outperformed the age-gender model for populations who had chronic health conditions (Fowles et al., 1996), but did not adequately estimated costs for disabled populations (Gruenberg, Kaganova & Hornbrook, 1996). The age-gender-prior visit-hospital admission formula outperformed the age-gender model for aged populations, individuals who do not use services, adults with cardiovascular disease or cancer and individuals who required at least two hospitalizations (Ash et al., 1989; Schauffler, Howland & Cobbs, 1992).

3.5.3.c. Determinants Depend on Measures of Physician Resource Utilization

The selection of rate adjusters should reflect relative differences between individuals or groups in their need for physician services and utilization of this resource. Theorists who developed the Behavioural Model, however, recognized that determinants of health service utilization varied depending on the type of service, the purpose of the service and the unit of analysis (Andersen & Newman, 1973). The results of the study support this theoretical proposition, as the determinants of physician resource utilization depended somewhat on the indicator used to measure the use of these services. For example, characteristics of need were not determinants of the amount of time physicians spent providing medical services during one encounter but these attributes were strong predictors of visit frequency and total payments.

The findings of this research project provide evidence of an association between-cross-sectional and between-longitudinal measures of physician resource utilization. Cross-sectional indicators included the amount of time physicians spent providing medical services during one encounter and OHIP payments for these visits. Longitudinal measures included visits per annum and total, annual OHIP payments. Furthermore, there was evidence to suggest that cross-sectional and longitudinal measures of use were not associated.

A strong, positive association was found between the amounts of time that physicians spent providing medical services and OHIP payments for the same encounter (i.e., two cross-sectional measures). This relationship was in the direction expected and suggests that either physicians are able to use the current OHIP Schedule of Benefits to levy charges that reflect their perceptions of the value of their time or the fees on the Schedule account for 'time spent'. These results do not enable a determination of whether the Schedule [and thereby a FFS service approach to payment] has been a driver of how physicians spend their time or whether the Schedule was designed to reflect how physicians spend or 'should be' spending their time.

The finding that time spent was an important factor when predicting charges per visit is in accordance with evidence derived elsewhere in Ontario (Woodward et al., 1997). Furthermore, researchers and policy analysts who have performed work for the Physician Review Commission in the United States have demonstrated that encounter time was the 'single most important predictor of the total amount of work performed during a visit' (Hsaio et al., 1992; Lasker & Marquis, 1999, p. 340).

A strong association was found between longitudinal measures of physician resource utilization that were captured either concurrently or sequentially. For example, the frequency of annual visits and annual payments (i.e., two concurrent, longitudinal measures) were highly correlated. In addition, analysis of data derived from the first and the second year of data collection provided evidence of a strong, positive relationship between: (a) visits per annum in years one and two[10], (b) total payments per annum in years one and two, and (c) total visits in year one and total payments in year two. Therefore, it is not surprising that the prior visit variable was a strong determinant of visits per annum among participants who visited at least once and total annual payments.

The observation that total, annual OHIP payments for each participant were strongly correlated across time supports the argument of researchers and policy analysts who have recommend the use of information on prior payments as rate adjusters (Anderson et al., 1986; Ash et al., 1989; Eggers, 1980; Newhouse et al., 1989; Thomas & Lichtenstein, 1986; van Vliet & van de Ven, 1992; 1993). While total, annual payments for each participant were correlated across time, the total amount of OHIP payments made to the practice for the entire sample of 659 participants in the Visit/Payment study was relatively stable. The practice received $92,086 in year one and $87,103 in year two in payments from OHIP for this cohort.

The amount of time that a physician spent providing medical services (i.e., cross-sectional measure) was not associated with longitudinal measures of physician service utilization. For example, one might expect that: (a) primary care physicians seek to understand the range of determinants of an individual's current condition and ongoing health status, and (b) the acquisition of this knowledge requires a significant amount of time. Translated as a hypothesis - physicians spent more time with individuals whom they see infrequently and less time with those

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[10] The Pearson correlation calculated from data derived from these participants was .723 (p <.001, r^2 = 52 percent). These results are similar to those found by Roos and Shapiro (1981) who fund that ambulatory visit rates for seniors were highly correlated between years (r = .64, p <.001).

they see more often. Alternatively, one might expect that individuals who are seen less frequently may be relatively healthy, only seek care for routine health examinations and require less time per encounter. People who visit more often may have complex health problems and thereby require more time per encounter. Translated as a hypothesis - physicians spent less time with people who visit less frequently and more time with patients who visit more often. Evidence derived from this project, however, does not support either hypothesis.

Lastly, the cross-sectional measure of resource use (i.e., minutes per encounter) was not associated with any longitudinal measure (i.e., annual visits or payments). Therefore, it was not surprising that the determinants of one were not the same as the determinants of the other.

3.5.3.d. Outliers

Only seven adults or one percent of participants were identified as outlier cases in all of the multivariable models described in Section 3.4.3. These individuals represented the extremes of use and their average utilization was high. Half of these individuals were high-users in one year, but did not visit or only visited once in the subsequent year. The remaining cases were extremely high-users in both time periods and received care for either multiple, psychiatric conditions or allergies. The descriptive profiles of these cases are provided in Appendix M.

The identification of outlier cases would provide a point of departure for discussion between payers and providers regarding the types of individuals or services that should be excluded from coverage under a capitation contract. The findings of this research project suggest that individuals with multiple psychiatric conditions or adults with extremely high-use rates (e.g., more than 25 visits per annum) might be considered exempt from capitation funding, as well as high-volume, preventative interventions such as allergy shots. In fact, Ettner et al. (1998) found that risk adjustment systems that have been developed for the general population were not sophisticated enough to account for expected spending for individuals receiving services for mental health and substance abuse treatment.

3.5.4. Strengths and Limitations

Design. The findings and result of this project must be understood in the context of the strengths and limitations of the research design. This project involved a cross-sectional research design that involved stratified sampling to explain variability in time spent (i.e., Medical Minutes study). A survey research method was used to predict the incidence of a visit and explain variability in: (a) the frequency of visits among participants who visited at least once, and (b) annual payments made to the practice by OHIP (i.e., Visit/Payment study). Both studies required linkage of individual-level data with administrative data and information from the 1996 Census.

The project involved an investigation of the determinants of cross-sectional and longitudinal measures of physician resource utilization. While the literature contained studies regarding individual-level attributes that contribute to variability in annualized rates of physician resource use in Ontario, no evidence could be found regarding the determinants of the amount of time physicians spent providing medical services to residents of Ontario or Canada.

By combining survey, administrative and census data it was possible to determine 'potentially explainable' variability in resource use and use this as a standard by which to compare different funding formula. By combining survey and administrative data, this investigator was also able to evaluate the predictive accuracy of an array of potential rate adjusters and assess the relative value of using primary and/or secondary data in a capitation formula. The linkage of individual-level data with census information enabled an analysis of the relative contribution of individual attributes and community-level enabling characteristics.

Methods. The findings of this project must be understood in the context of the research site - a large, academic, family practice in southwestern Toronto. Eleven physicians and the residents they supervised participated. Although many of the findings of this project are in accordance with evidence in the literature, the external validity of the results to other physician organizations or patient populations in Toronto and Ontario remain unknown. Although the characteristics of the sample of participants in the Visit/Payment and Medical Minutes studies were typical of the socioeconomic conditions in other communities, individuals were not sampled from these populations. Therefore, it would not be appropriate to extrapolate the findings to Toronto as a whole or to other geographic locations.

The recruitment of participants from one family practice and the use of an inclusion criterion regarding geographic proximity, however, provided a control for important environmental determinants (e.g., supply of practitioners, physician-population ratios) of physician resource utilization. In addition, the small number of physicians included in the study and the use of an identifier for each practitioner provided a statistical control for supply-side influences on service utilization. The lack of control (methodological or statistical) of supply-side influences is one of the main criticisms of a utilization-based approach to developing rate adjustment formulae.

This study involved the use of empirical modelling to identify significant determinants of physician resource use and measurement of some of the independent and dependent variables relied on utilization data. In fact, participants in the Visit/Payment study were randomly selected from a sample frame of adults who accessed care during the course of a two-year period as it has been determined that approximately 95 percent of individuals access care during a 2-year period (Tataryn et al., 1995). The exclusion of individuals who did not seek care during this time frame suggests that the sample of participants in the Visit/Payment study may have over-represented users.

As utilization data was only available from the family practice and individuals may have used primary care physician services from other organizations, eligibility criteria were established to ensure that participants were considered to be rostered to the practice. These eligibility criteria would likely result in a bias sample of participants that over-represents individuals who elect to use a regular source of care. Research conducted by Dunlop (1998) suggests that Canadians who have a 'regular doctor' are more likely to receive primary care and receive more care than those without. In fact, this finding is congruent with research conducted in other jurisdictions (Hayward, Bernard, Freeman & Corey, 1990; Lambrew et al., 1996). Therefore, the selection of individuals who elect to use a regular source of care may bias the same to over-represent users. Table 19 compares the proportion of participants - in terms of nonusers, users, and high-users - with people from across Ontario and Canada, and supports the hypothesis that the sample over-represented users.

Table 19

Annual Visits to General Practitioners by Participants and Residents of Ontario or Canada

	Males			Females			All		
	Study*	Ontario†	Canada‡	**Study***	Ontario†	Canada‡	**Study***	Ontario†	Canada‡
Mean No. of Visits (Median)	**3.65 (2.00)**	3.10 (2.00)	4.94 (1.00)	**4.04 (2.00)**	4.50 (2.00)	7.10 (2.00)	**3.88 (2.00)**	N/A	6.11 (2.00)
People With No Visit (%)	**14.1**	24.4	28.4	**10.7**	14	17.3	**12.1**	8.4	22.7
≥ 1 Visit	**85.9**	75.6	71.6	**89.3**	86	82.7	**87.9**	81.1	77.2
≥ 6 Visits	**22.7**	15	17.9	**20.4**	23.4	26.7	**21.4**	22	22.7

Note. * Participants in the Visit/Payment Study. † Data derived from the 1990 Ontario Health Survey (McIsaac et al., 1993; 1997). ‡ Data derived the 1994 National Population Health Survey (Dunlop, 1998). No. = number. ≥ = greater than or equal to. N/A = not reported, therefore, not available.

The fact that individuals were recruited from a large, academic family practice may have implications for the representativeness of patient and physician participants. Patients who seek care from physicians who work at academic group practices may differ from those who receive care elsewhere and physicians who elect to work in these settings may differ from other doctors. In fact, there is evidence to suggest that physicians may spend less time in patient-related activities and more time on student-centred tasks when they engage in teaching (Vinson, Paden & Devera-Sales, 1996).

The family practice was affiliated with a hospital network. As part of an initiative to plan a Comprehensive Health Organization in the late 1980s and early 1990s, the Department determined that the hospital network was a major source of referrals of new patients (personal communication, P. Ellison, December, 1999). Therefore, the context of the research site may have influenced the finding that hospital admission was a determinant of physician resource utilization.

There are several issues regarding the independent and dependent variables that require mention. First, participants in the Visit/Payment study completed the social-demographic-health questionnaire in 1998, measures of prior use were calculated using data from 1996-1997, the census was conducted in May 1996, and measures of physician resource utilization were derived from 1997-1998 data. Therefore, most of the individual-level attributes were evaluated as determinants of historic patterns of use. It is expected that some characteristics would remain relatively stable over the short term among adult participants (e.g., educational status), while others may change (e.g., health or marital status).

Second, measures of external use of physician and/or hospital services required recall and self-report. Neither of these measures could be verified. It is difficult to determine the accuracy of self-reported consultations with other doctors, but individuals may perceive that physicians at the practice would appreciate limited use. Therefore, the responses of participant to the measure of external use of physician services may have included a social desirability bias. Furthermore, it is difficult to determine the accuracy of self-reported admission to a hospital, however, research that has been conducted to evaluate the validity of self-reported contacts suggest that individuals recall more contacts than were evident in administrative data (Norrish, North, Kirkman & Jackson, 1994). This research evidence coupled with the observation that the hospital network affiliated with the family practice has historically been a referral source of new patients, would suggest that the findings of this study would be bias toward identifying hospital admission as a determinant of physician resource use. While the incidence of a hospital admission has been identified as a determinant of health service resource use in other jurisdictions, Anderson (1997) found that reductions in hospital utilization in Ontario did not translate to an increasing level of medical care in the community. Research to evaluate the link between inpatient use and physician resource utilization in Ontario appears warranted.

Third, the methods used to measure and analyze determinants of physician resource utilization address some of the criticisms directed at studies of physician resource utilization (Mechanic, 1979). For example, the measures of physician resource utilization that had a skewed distribution were transformed to confirm with one of the assumptions of linear regression modeling. The determinants of the incidence of a visit were evaluated separately from the determinants visit frequency among participants who visited at least once, as a two-part model allows for a better understanding of the determinants of initial use versus the volume of use among users and improves the robustness of estimates (Duan, Manning, Morris & Newhouse, 1984). In addition, interaction terms were evaluated for their contribution to explaining variability in resource use. These terms failed to make a significant contribution to the explanatory power of multivariable models, which is in accordance with the findings of others (Arling, 1985; Ronis & Harrison, 1988).

Fourth, the measures of socioeconomic context were measured at the level of the forward sortation area (FSA). Census data indicated that between 45 to 63,701 inhabitants lived in these geographic units in May 1996. While the FSA was used to define a local community for the reasons specified in Section 3.3.6., census data regarding income could be made available to the provincial government at smaller geographic units. In addition, Statistics Canada has software to translate geographic data from FSA to other small geographic units such as enumeration areas and the accuracy of this translation process is increasing (Wilkins, 1998). While researchers have begun to evaluate the impact of using information at different geographic levels for rate adjustment (e.g., Hutchison et al., 1997), further research in this area is warranted.

The postal code information used in this study was derived from an administrative database at the family practice and not from billing data, and the accuracy of this geographic information is unknown. The current postal code information held by the Ontario MOH in the Registered Persons Database is known to be of poor quality in comparison to other sources of this data (i.e., hospital discharge abstracts from the Canadian Institute for Health Information) (personal communication, A. Basinski, January 6, 2000). While the use of this type of data for rate adjustment may provide an incentive to providers to contribute to the accuracy of MOH data in the future, the current level of inaccuracy of FSA fields in the Registered Persons Database will impact researchers ability to test hypotheses at the population-level regarding associations between socioeconomic context in Ontario and individual-level utilization.

4.4.0. Policy Implications and Conclusions

Primary care has been identified as a key element in proposals to restructure health services. In the mid- and late-1990s various professional associations, health policy organizations, interest groups and physicians in Canada declared their vision of primary care reform and the vast majority of these proposals endorsed the use of full capitation or a blended mechanism that includes capitation. By 1997 the Health Transition Fund (HTF) was established as a joint effort between the federal, provincial and territorial governments to support innovations leading to a more integrated health system (Health Canada, 1999a). One of the designated priority areas of the HTF was primary care reform. Since that time a number of primary care demonstration projects have been initiated and funded. Capitation funding has been incorporated in primary care or integrated health system reform projects in Alberta, British Columbia, Nova Scotia, Ontario, Quebec and Saskatchewan (Health Canada, 1998; Health Canada, 1999b, Hutchison et al., 1999).

In 1998 the Ontario MOH and OMA announced the implemented and evaluation of a primary care model of delivery that incorporates enrollment-based capitation (Government of Ontario, 1998).[1] On April 1, 1999 this MOH-OMA project received $18.4 million from Health Canada under the Health Transition Fund (Health Canada, 1999d). As many as 200 physicians and 450,000 people are expected to participate (Graham, 1999). Furthermore, approximately 440,000 people in the province already receive primary care from capitated Health Service Organizations (AOHC, 1996).

Evidence derived from randomized and/or quasi-experimental, controlled trials generate evidence that capitated and FFS providers differ in some respects and not in others. For example, capitated health organizations tend to use less in-patient resources in comparison to FFS providers - as measured by rates of discretionary admission, lengths of stay, and hospital days per enrollee (e.g., Lurie et al., 1994; Manning et al., 1984; Brown et al., 1993). Research suggests that enrollees in prepaid plans receive equivalent service quality (e.g., Bernstein et al., 1991; Safran et al., 1994; Siu et al., 1988) and achieve comparable health outcomes (e.g., Lurie et

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[1] Capitated and fee-for-service physicians each roster or serve a sample of Ontario residents from seven designated communities.

al., 1992; 1994; Sloss et al., 1987; Ware et al., 1986). There is no consistent evidence that prepaid arrangements reduce the cost of care (e.g., Leibowitz et al., 1992; Wells et al., 1986).

There does not appear to be consistent evidence that enrollees have higher or lower utilization of physicians than individuals served by FFS providers (e.g., Wells et al., 1986; Lurie et al., 1992). It is difficult to interpret whether higher or lower ambulatory care visit rates among capitated enrollees are appropriate or unnecessary. Lower rates would be appropriate if capitated providers were: (a) rendering more complete care and/or more preventive care during a visit and thereby reduced the necessity for a subsequent visit, or (b) reducing unnecessary care. Alternatively, lower rates would be inappropriate if capitated providers were withholding appropriate services. Lastly, higher rates would be appropriate if providers were substituting ambulatory for in-patient care. There have not been any studies evaluating the appropriateness of ambulatory visits rates between capitated and FFS providers.

There is evidence to suggest that differential selection has occurred by capitated providers and/or residents in enrollment-based markets (Brown et al., 1993; Buchanan et al., 1996; Lichtenstein et al., 1991; 1992; Wilensky & Rossiter, 1986). Researchers and policy analysts have hypothesized that: (a) differential selection by enrollees occurs due to health plan benefits and conditions that encourage unhealthy individuals to enroll with FFS providers, and (b) differential selection of relatively health individuals by capitated providers occurs due to financial incentives that exist secondary to rate formulae that do not account for variability in need for or utilization of health services. Although providers are not able to alter health plan benefits in Canada, a condition requiring residents who receive care from capitated providers to exclusively seek services from a specific primary care organization may result in differential selection by residents.[2] Alternatively, a condition requiring capitated providers to provide services that are not available from FFS organizations may also result in bias selection.[3]

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[2] It is difficult to determine whether this condition may be more or less attractive to individuals who are relatively health or unhealthy.

[3] For example, physicians who participate in the primary care reform project in Ontario must provide enrollees with access to a health care provider on a 24-hour basis. This condition may be particularly attractive to individuals who are relatively unhealthy, due to increased opportunities for access which would result in differential selection of capitated providers by these people.

In the Canadian context, primary care capitation has been implemented on an enrollment basis where capitated and FFS physicians compete to roster and/or serve a selection of individuals from their community. In addition, rates are adjusted based on data derived from FFS billings. Because of differential selection, variability is likely to exist between providers in the case-mix of individuals for whom they service. An ideal capitation formula, therefore, would adjust for these differences and account for bias rosters.

Some have argued that expenditures by payers increase in markets where: (a) relatively healthy people are served by capitated providers, (b) capitation rates are adjusted on the basis of data derived from FFS billings, and (c) formulas do not adequately adjust for differences in case-mix between capitated and FFS providers (Freund et al., 1989; Leibowitz et al., 1992). This occurs because average expenditures in the FFS sector increase, and thereby inflate the reference values by which rates are adjusted.

The formula used to derive capitation rates paid to Health Service Organizations in Ontario and physician participants in primary care demonstration projects across Canada include age and gender adjusters.[4] The selection and utilization of this basic demographic information likely reflect the popularity, feasibility, face validity and lack of "game-ability" of these demographic adjusters. The findings of this project indicated that the predictive accuracy of age and gender at the individual- and group-level was low. In fact, the age-gender formula explained: (a) less than five percent of the variability in visits per annum among participants who visited at least once and total annual payments, and (b) less than six percent of 'potentially explainable' variability in visits and payments.[5]

Although age and gender may provide an appropriate 'starting point' for an adjustment formula, the exclusive use of this type of demographic information is insufficient as the age-gender formula will provide financial incentives for bias selection and will not account for differential selection by providers and enrollees. This could result in unnecessary financial rewards or penalties for physicians who roster bias groups. Furthermore, the findings of this

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[4] The pilot study being conducted in British Columbia is the only primary care reform project using any other form of case-mix adjustment (i.e., Ambulatory Care Groupings) (Hutchison et al., 1999).

[5] Recall that 'potentially explainable' variability was the R^2 value from the full multivariable models that included all independent variables.

study suggest that the amount of overpayment associated with relatively healthy rosters would be greater than the amount of underpayment associated with relatively unhealthy rosters. The magnitude of the potential financial gains or losses, however, ultimately depends on a number of factors including the actual case-mix, the size of a roster and the size of payments.

Policy-makers in Canada have "stressed the need for research to identify additional adjusters beyond age and sex" (Hutchison et al., 1999, p. 8). Evidence derived from this project and the literature indicate that there are measures of individual attributes and community characteristics that improve the predictive accuracy of rate adjustment formula at the individual- and group-level, beyond the use of information on age and gender. Need factors made the most significant improvement in the predictive accuracy of an age-gender formula, and the use of these measures to adjust funding allocations is in accordance with policy objectives as defined in the *Canada Health Act*. The finding that need characteristics were determinants of physician resource utilization is in accordance with research conducted elsewhere in Ontario and Canada (Birch et al., 1993; Broyles et al., 1983; Dunlop, 1998; McIsaac et al., 1993; 1997).

The measure of need that made the largest contribution to the explanatory power of multivariable models and the discriminatory power of the logistic model was information on the frequency of prior visits. This variable was the strongest predictor of the incidence of a visit, the frequency of annual visits among participants who visited at least once, and annual OHIP payments. In fact, the age-gender-prior visit formula accounted for 70 to 90 percent of variability in visits and payments (respectively) that was explained by all predictor and control variables. The predictive accuracy of a two-part (i.e., zero to five versus six or more visits) or four-part (i.e., zero to two, three to five, six to eight versus nine or more visits) prior utilization adjuster was comparable. At the group-level, the age-gender-prior visit formula: (a) significantly improved the predictive accuracy of the age-gender formula for bias groups, and (b) was as good or superior to the age-gender-health status formula.

The rationale for using information on prior utilization of physician services to adjust capitation rates is based on the following. First, there is evidence from nation-wide and province-wide survey research that need is a key determinant of the incidence of a visit to a general practitioner and utilization of primary care services among Canadians (Birch et al., 1993; Broyles et al., 1983; Dunlop, 1998; McIsaac et al., 1997). Arguably, it may therefore be appropriate to use measures of utilization as proxies for need. Second, evidence derived from controlled and population-based research suggests that measures of prior utilization are the most powerful predictors of expenditures on health services and more powerful than measures of health status (Ash et al., 1989; Newhouse, 1998; Thomas & Lichtenstein, 1986; van Vliet & van de Ven, 1994). The findings of this project are in accordance with this literature. Third, capitated organizations have this information and could financially benefit from selecting among their enrollees on the basis of past utilization and expenditure (van Vliet & van de Ven, 1994; Newhouse et al., 1997; Newhouse, 1998).[6] Lastly, it has been suggested that capitation arrangements be tied to actual use in order to avoid stinting (Newhouse, 1998).[7]

The explanatory power of information derived from historic utilization and the use of data on prior use for rate adjustment is controversial for a number of important reasons. First, measures of prior use can be influenced by demand-side factors (e.g., inappropriate utilization by individuals) and supply-side factors (e.g., variability in availability, inappropriate supplier-induced demand) that may not reflect need. One of the strengths of this research project was the inclusion of methodological and statistical control of supply-side influences, and the prior visit variable remained the most powerful determinant after controlling for provider-related characteristics.

Second, the use of information derived from historic utilization data is also controversial because there is evidence that these measures are subject to random variation. Some have argued that "a major weakness of the prior cost model is that it over-compensates for self-limiting diseases and under-compensates for chronic diseases" (van Vliet & van de Ven, 1992; 1993, p. 185). One strategy that has been recommended to avert this issue is to use retrospective adjusters - that is - the use of information from the year in which payment occurred rather than from the preceding year (Newhouse et al., 1997).

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[6] In essence, if capitation rates did not adequately compensate providers for rendering care to enrollees who visited on a frequent basis, provider organizations would be able to identify high-users and would have a financial incentive to de-roster these people.

[7] While rates could be adjusted to account for variability in actual use, researchers and policy analysts have also recommended the use of partial-capitation on the following grounds. Payment that is independent of utilization provides no additional revenue for services provided and methods of detecting under-use are less developed than those for detecting over-servicing (Newhouse, 1998; Kerr et al., 1996).

Third, some have argued that a utilization adjuster would result in funding allocations that are amenable to supply-side manipulation. For example, Starfield (1998, p. 795) argued "the problem with using prior use as a predictor, especially when resource allocations are based on it, is that it is highly amenable to manipulation by practitioners". Strategies that could be used to address this issue include the: (a) adoption of a utilization threshold (i.e., two-part adjuster) or numerous thresholds (e.g., four-part adjuster)[8], and/or (b) use of a blended payment system that combined capitation with a mechanism to monitor utilization.

The strategy of adjusting rates once enrollees reach a threshold number of visits has been implemented in New Zealand. In that country the capitation formula for primary care providers adjusts rates on the basis of whether or not an individual holds a 'High Use Health Card'. Eligibility for this card is based on the annual number of consultations with a general practitioner (Hutchison et al., 1999). The use of a two-part adjuster with a six-visit threshold would result in 23 percent of participants in this study receiving a 'high-use' designation.

Blended funding systems that include capitation and a mechanism to monitor utilization have been proposed by others (Newhouse, 1998; Newhouse et al., 1997; Rosenthal, Horwitz, Snyder & O'Connor, 1996). In fact, the approach proposed by the Ontario Medical Association (Graham, 1997) combines FFS billing and capitation. Under this proposal physicians would bill the OHIP on a utilization basis until they reached benchmark threshold determined by a capitation formula. Therefore, the threshold is determined prospectively according to the characteristics of the population serviced, but is not received until services are utilized.

The second, third and fourth most powerful predictors of annual rates of physician resource utilization were self-rated health status, self-reported hospital admission in the preceding year, and the socioeconomic context of residence. The findings of this study suggest that the age-gender-health status, the age-gender-hospital admission and the age-gender-socioeconomic context formula each resulted in a two-fold increase in the predictive accuracy of

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[8] In the current study two measures of the frequency of prior visits to a physician at the practice were evaluated - a dichotomous measure and a four-part, categorical variable. It was assumed that the use of a single threshold (i.e., dichotomous measure) that was set at a high rate of use would minimize the opportunity for physicians to inappropriately induce-demand, shift an enrollee's status to a 'high-user' and thereby obtain a higher rate during the next funding term. To avoid creating a large financial incentive 'at the margin' by using a single threshold, a four-part measure was also evaluated. As mentioned, both measures of prior utilization were comparable in terms of predictive accuracy at the individual- and group-level.

the age-gender formula at the individual-level. The age-gender-health status formula accounted for 37 to 36 percent of variability in visits and payments (respectively) that was explained by all predictor and control variables. The age-gender-hospital admission formula accounted for 21 and 26 percent of this 'potentially explainable' variance, and the age-gender-socioeconomic context formula accounted for 23 and 21 percent.

At the group-level, the age-gender-health status formula was superior (in terms of predictive accuracy) to the age-gender formula. The age-gender-hospital admission and the age-gender-incidence of low income formulae enhanced the predictive accuracy of the age-gender formula at the individual-level; however, they only marginally improved accuracy for bias rosters constructed as part of this analysis. Further investigation regarding the predictive accuracy of the age-gender-hospital admission and the age-gender-socioeconomic context formula in other jurisdictions in Ontario is warranted. This research could be conducted using population-based administrative data, which would allow more thorough testing of the predictive accuracy of these formula with bias rosters.

The rationale for using information on self-rated health status to adjust rates is based on the following. First, this measure would promote resource allocation in accordance with policy concerns as health status has been described as "the best available approximation of need for health services" (Hutchison et al., 1999, p. 15). The objective of Canadian health policy as espoused in the *Canada Health Act* is "to protect, promote and restore the physical and mental well-being of residents of Canada and to facilitate reasonable access to care on the basis of defined need" (Health Canada, 1997). Second, the use of self-rated health status in a capitation formula has been proposed as a reference standard for comparing and evaluating the validity of other rate adjusters (Hutchison et al., 1999). Third, the use of this type of information has face and predictive validity.

The use of self-rated health status as an adjuster is controversial, however, for a number of important reasons. First, the feasibility of collecting and maintaining this data is questionable, both financially and administratively. Routine, primary data collection from each resident in Ontario would require a huge financial investment in infrastructures, and the popularity of this approach to taxpayers is debatable. While it has been proposed that all residents provide information on health status as part of the census (Hutchison et al., 1999), these data are only be collected every five years. Second, it has been argued that subjective measures such as self-rated health status may be susceptible to "game-ability" and therefore could be considered as being subject to potential fraud. The administrative and financial expense of audits would be substantial (Newhouse et al., 1989; Newhouse, 1998).

Third, it is not clear whether a health service or medical intervention exists that might be appropriate to provide to an individual to alleviate or alter their self-rated health status (Curtis, 1990). Therefore, it is foreseeable that providers may be handsomely compensated for enrolling individuals who rate their health as poor but for whom medical services are not deemed to be appropriate (based on evidence from effectiveness research) and/or desired (from the patients perspective). Recent evidence from a quasi-experimental, controlled study suggests that individuals with arthritis who would benefit from a hip or knee replacement vary in their willingness to receive this surgery despite high-quality evidence on the effectiveness of this intervention. In fact, communities varied in their need for care (as measured by the incidence of arthritis), demands for intervention (as measured by regional differences in willingness) and utilization of services (as measured by surgical rates) (Hawker, 1999). In this context, the most desirable communities to locate a practice would be those that included individuals who rated their health as poor but were unwilling to receive primary care interventions deemed appropriate by medical practitioners. Whether providers would actually be able to assess this market characteristic, however, is debatable.

The rationale for adjusting rates on the basis of a hospital admission include the following. First, there is evidence from population-based research in Ontario that need is a determinant of hospital utilization (Anderson et al., 1996; Anderson, 1997). These results imply that hospital utilization could be used as a measure of need for medical services. Second, there is evidence that measures of inpatient use are predictors of utilization in other health service sectors, and therefore these measures have been recommended for use as rate adjusters in other jurisdictions (Beebe et al., 1985; Ash et al., 1989). Third, capitated primary care practitioners have this type of information and could financially benefit from identifying and de-rostering their enrollees on the basis of whether or not they were admitted to a hospital. Fourth, the use of this information for rate adjustment has face validity.

Conversely, the use of information on hospital admission for rate adjustment purposes is controversial. First, some have argued that this type of adjuster may be susceptible to inappropriate supplier-induced demand (Thomas & Lichtenstein, 1986). However, researchers in

Ontario have argued that community-based, primary care physicians[9] may have little influence on the decision-making process regarding whether a patient is admitted to a hospital or not (Hutchison et al., 1996). Second, despite evidence of a link between admission status and subsequence utilization of health services in other jurisdictions (Beebe et al., 1985; Ash et al., 1989), Anderson (1997) found that reductions in hospital utilization in Ontario did not translate to an increasing level of medical care in the community. Third, the feasibility of routine collection of primary data regarding self-reported incidence of a hospital admission would require a huge investment in infrastructures. An alternative to this strategy, however, would be to link hospital discharge abstracts with data from the Ontario Health Insurance Plan (i.e., the Registered Persons Database) to identify individuals for whom rates would be adjusted for a 365 day term following discharge.

The findings of this project suggest that the use of information on the frequency of admissions and number of days spent in hospital in the preceding year were not as powerful as determinants of physician resource utilization as the measure of the occurrence of a hospital admission. The recruitment of participants from a family practice in downtown Toronto and the fact that the practice was affiliated with a hospital network that served as a referral source may limit the external validity of these findings. Research to evaluate the link between various measures of inpatient use and primary care physician resource utilization appears warranted.[10] In addition, rates could be adjusted for different periods of time other than 365 days following admission (e.g., 30 days, 60 days, 90 days, etc.). Alternatively, adjusters could account for whether or not a person was admitted for day surgery or an overnight stay. Conceivably, primary care rates could be adjusted for different periods of time depending on the reason for admission. For example, a 30-day adjustment might be appropriate for conditions whereby a short period of recovery and primary care follow-up is expected. These policy options are also worthy of evaluation.

The rationale for using information on the socioeconomic climate of an enrollee's residential community for rate adjustment is based on the following. First, evidence from

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[9] In comparison to primary care physicians who work in emergency departments.

[10] The research that has been done in this area evaluates measures of the incidence of an admission and/or inpatient costs, but have been conducted in the American context where capitated providers assume responsibility for an array of services beyond primary care.

research conducted in Ontario suggests that socioeconomic context is a determinant of an individual's health service utilization (Locker et al., 1996; Locker & Ford, 1996). The findings of this research are in accordance with this evidence. Second, the use of this type of information may be feasible with a modest investment in data infrastructures. In fact, the size of the investment to link census and data from the Ontario Health Insurance Plan would likely be more feasible than the use of information on the frequency of prior visits[11], self-rated health status or the incidence of a hospital admission. Third, the use of information regarding socioeconomic context for rate adjustment has face validity.[12]

Adjusters that account for the socioeconomic context of residence have been used in other jurisdictions. For example, since 1991 the basic practice allowance paid to general practitioners in the United Kingdom has been adjusted based on the proportion of individuals on a roster who reside in a geographic location designated as a 'deprived area' (Carr-Hill & Sheldon, 1991; Delamothe, 1990; Hutchinson, Foy & Sandhu, 1989). Deprivation is measured using an 'underprivileged area score' calculated using the Jarman Index, and a threshold score is use to designate areas as deprived or not. Apparently, the selection of the cut-point has been a politically sensitive issue and approximately 5 percent of wards or 10 percent of individuals are designated as underprivileged (Delamothe, 1990). While this study used continuous rather than dichotomous measures of socioeconomic context, research regarding the feasibility, acceptability and predictive validity of using categorical measures is appropriate.

The use of the Jarman Index has been controversial as it: (a) was not originally designed as an adjuster for resource allocation purposes, (b) is not as powerful a predictor of morbidity, mortality and service utilization as other deprivation indices, and (c) relies on census data that is only collected every ten years. In addition, some have argued that the use of a threshold for designating areas as deprived or not presumes that people above and below the cut-point are qualitatively different (Carr-Hill & Sheldon, 1991; Hutchinson et al., 1989).

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[11] This would require longitudinal linkages for each beneficiary.

[12] Arguably, the adjusters discussed in this chapter vary in the degree of face validity. It is expected that some individual-level measures of need would have more face validity (e.g., self-rated health status or hospital admission) than others (e.g., the frequency of prior visits) and more face validity than socioeconomic contextual measures (e.g., incidence of low income).

The results of this study suggest that there are a number of measures of socioeconomic context that are equally predictive of individual-level variability in resource utilization including the incidence of low income, median income of all private households and unemployment rates. Some of these measures are only collected every five years as part of the Canadian census, while others are collected on a more frequent basis. The use of a measure that is collected more often, such as unemployment rates, may be more desirable from a validity perspective. In fact, Campbell et al. (1991) determined that current unemployment rates were more highly correlated with area-based measures of morbidity than historic unemployment rates or four different indices of deprivation.

It has been suggested that predictive models will not be able to explain any more than 50 percent of the variance in outpatient expenditures (Newhouse et al., 1989; Welch, 1985). The multivariable models constructed as part of the project explained up to 43 percent of the individual-level variability in the frequency of visits among participants who made at least one and 28 percent of the variance in annual payments. Furthermore, without information on prior utilization, the independent variables explained only 20 percent of variability in visits and 13 percent of variability in payments. Evidence from this project and the literature indicate that the utilization of primary care services is relatively unpredictable and requires risk management. While financial risk has historically been borne by the provincial government under FFS financing, capitation shifts risk to providers. Capitation ultimately requires risk-management as "any set of adjusters that explain 100 percent of the variance [in utilization] would be ... cost-based reimbursement" (Newhouse et al., 1989). Risk management strategies, however, can be planned and implemented jointly by payers and providers. Although physicians and their organizations assume financial risk under capitation, they can gain more control over the process by which care is provided. These trade-offs require careful consideration by providers.

In summary, primary care reform is occurring in jurisdictions across Canada and many demonstration projects include capitation financing. While population-based funding is being used in some jurisdictions, these funding envelopes do not include primary care physician services. Primary care capitation is being implemented on an enrollment-basis where capitated and FFS physicians and their organizations roster a sample of individuals from the community. Evidence derived from enrollment-based markets suggest that differential selection occurs by providers and enrollees, whereby individuals who are more healthy tend to receive services from capitated providers.

The use of a capitation rate formula that accounts for individual-level variability will not provide a financial incentive for bias selection. A formula that accounts for case-mix differences between rosters will compensate providers for relative differences in the populations they serve. Capitation requires the development, implementation and enforcement of a contractual agreement between payers and providers. While the formula used to derived rates is typically specified in this document, clauses that could limit the adverse consequence of an inadequate adjustment formula include: (a) the procedures by which enrollees roster and de-roster, (b) the conditions under which providers can dis-enroll an enrollee, (c) the population covered under the arrangment, and (d) the services included in the agreement.

The findings of this project suggest the use of age and gender as rate adjusters is insufficient, and that other measures of individual attributes and community characteristics improve the predictive accuracy of capitation formula. Furthermore, this information is available in existing administrative data. Rate adjusters other than age and gender have been used in other jurisdictions. However, the external validity of a capitation formula depends on the extent to which jurisdictions, enrollees and covered services are similar. Most of the evidence in the literature describes and evaluates rate adjusters used in other countries, and the services covered under these capitated contracts typically include primary and secondary care.

The evidence derived from this study describes and evaluates capitation rate adjusters for use at one family practice in Ontario, and is the first such study in Canada to specifically evaluate the determinants of multiple measures of physician resource utilization. While other studies have evaluated formula for use in allocating funds to geographically-defined populations, this study considers the policy option of enrollment-based capitation of physician services. Furthermore, it appears to be the first study conducted in Canada to evaluate the patient characteristics that influence the amount of time spent by physicians to provide medical services for one encounter. While the external validity of the important findings of this project to the provincial context can be tested using population-based administrative data, it is noteworthy that the results of this study concur with literature on the determinants of physician resource utilization conducted elsewhere in Ontario and Canada .

Many published studies evaluate the predictive accuracy of a capitation formula at the individual-level using the R^2 value. However, in enrollment-based markets an assessment of the net financial impact of bias rosters using different rate adjusters is required and this analysis was conducted as part of this project. The predictive accuracy of a formula, however, is only one of the criteria by which capitation rate adjusters should be selected. Consideration must also be given to policy objectives, face validity, feasibility, reliability, stability and 'game-ability'. The findings of this study, therefore, should stimulate and inform discussions regarding the utility of collecting and maintaining administrative and/or primary data to determine capitation rates for primary care services.

REFERENCES

Abelson, J., & Lomas, J. (1990). Do health service organizations and community health centers have higher disease prevention and health promotion levels than fee-for-service practices? Canadian Medical Assocation Journal, 142(6), 575-581.

Abelson, J., & Birch, S. (1993). Alternative funding and delivery models: Practice and prospects in Ontario. Journal of Ambulatory Care Management, 16(3), 19-29.

Adams, O.B. (1981). Health and economic activity: A time-series analysis of Canadian mortality and unemployment rates. Ottawa, ON: Health Division, Statistics Canada.

Aday, L.A., & Andersen, R. (1974). A framework for the study of access. Health Services Research, 9, 208-220.

Aday, L.A. (1993). Indicators and predictors of health service utilization. In S. J. Williams & S. J. Torrens (Eds.), Introduction to health services. (pp. 46-70). New York: Delmar Publishers Inc.

Alberta Health. (1996, June 24). New population-based funding model for regional health authorities. [Announcement posted on the World Wide Web]. Edmonton, AB: Author. Retrieved March 19, 1999 from the World Wide Web: http://www.gov.ab.ca/acn/199606/3918.html

Alberta Health. (1998, January). Population-based funding model manual: 1998-99 regional funding. [Announcement posted on the World Wide Web]. Edmonton, AB: Author. Retrieved March 17, 1999 from the World Wide Web: http://www.gov.ab.ca/rhas/popfund/index.htm

Alberta Health. (1999). Regional health funding manual. Edmonton, AB: Health Resourcing Branch.

Andersen, R., & Newman, J.F. (1973). Societal and individual determinants of medical care utilization in the United States. Milbank Memorial Fund Quarterly, 51, 95-124.

Andersen, R., & Aday, L.A. (1978). Access to medical care in the US: Realized and potential. Medical, 16, 533.

Andersen, R.M. (1995). Revisiting the behavioral model and access to medical care: Does it matter? Journal of Health and Social Behavior, 36, 1-10.

Anderson, G.F., Cantor, J.C., Steinberg, E.P., & Holloway, J. (1986). Capitation pricing: Adjusting or prior utilization and physician discretion. Health Care Financing Review, 8 (Winter), 27-34.

Anderson, G.F., Steinberg, E.P., Powe, N.R., Antebi, S., Whittle, J., Horn, S., & Herbert, R. (1990). Setting payment rates for capitated systems: A comparison of various alternatives. Inquiry, 27(Fall), 225-233.

Anderson, G.M. (1997). Hospital restructuring and the epidemiology of hospital utilization: Recent experience in Ontario. Medical Care, 35 (Supplement), OS93-OS101.

Anderson, G.M., Chan, B., Carter, J.A., & Axcell, T. (1996). An overview of trends in the use of acute care hospitals, physican and diagnostic services, and prescription drugs. In V. Goel, J. I. Williams, G. M. Anderson, P. Blackstien-Hirsh, C. Fooks, & C. D. Naylor (Eds.), Patterns of health care in Ontario: The ICES Practice Atlas. (pp. 27-42). Ottawa: Canadian Medical Association.

Andersson, S.O., & Mattson, B. (1989). Length of consultation times in general practice in Sweden: Views of doctors and patients. Family Practice, 6(2), 130-134.

Arling, G. (1985). Interaction effects in a multivariate model of physician visits by older people. Medical Care, 23, 361-371.

Ash, A., Porell, F., Gruenberg, L., Sawitz, E., & Beiser, A. (1989). Adjusting Medicare capitation payments using prior hospitalization data. Health Care Financing Review, 10(4), 17-29.

Association of Ontario Health Centres. (1995). Building on success: A blueprint for effective primary health care. Etobicoke, ON: Author.

Association of Ontario Health Centres. (February 1, 1996). Health centres: CHCs and HSOs. Etobicoke, ON: Author. Retrieved August 3, 1999 form the World Wide Web: http://www.aohc.org/centres.html

Association of Ontario Health Centres. (December, 1998). Investing in community primary health services: A proposal to help meet primary health service needs in Ontario. Etobicoke, ON: Author. Retrieved August 3, 1999 form the World Wide Web: http://www.aohc.org/pp98primary.html

Averill, R.F., Goldfield, N.I., McGuire, T.E., Bender, J.A., Mullin, R.L., & Gregg, L.W. (1990). Design and evaluation of a prospective payment system for ambulatory care. Wallingford, CT: 3M Health Information Systems.

Avison, W.R. (1998). The health consequences of unemployment. In Determinants of health: Adults and seniors. (pp. 3 - 41). Ottawa, Canada: Health Canada.

Bachmann, M.O., & Bevan, G. (1996). Determining the size of a total purchasing site to manage the financial risks of rare costly referrals: computer simulation model. BMJ, 313, 1054-1057.

Bailey, J.E., Van Brunt, D.L., Mirvis, D.M., McDaniel, S., Spears, C.R., Chang, C.F., & Schaberg, D.R. (1999). Academic managed care organizations and adverse selection under Medicaid managed care in Tennessee. Journal of the American Medical Association, 282, 1067-1072.

Baker, A.S. (1976). What do New Zealand general practitioners do in their offices. *New Zealand Medicine, 83*, 187-190.

Barer, M.L., Evans, R.G., & Labelle, R. (1988). Fee controls as cost control: Tales from the frozen north. Milbank Quarterly, 66, 1-64.

Barer, M.L., Lomas, J., & Sanmartin, C. (1996). Re-minding or Ps and Qs: Medical cost controls in Canada. Health Affairs, 15, 216-234.

Barnum, H., Kutzin, J., & Saxenian, H. (1995). Incentives and provider payment methods. International Journal of Health Planning and Management, 10, 23-45.

Beebe, J., Lubitz, J., & Eggers, P. (1985). Using prior utilization to determine payments for Medicare enrollees in health maintenance organizations. Health Care Financing Review, 6(3), 27-38.

Ben-Shlomo, Y., White, I., & McKeigue, P.M. (1992). Prediction of general practice workload from census based social deprivation scores. Journal of Epidemiology & Community Health, 46, 532-536.

Bernstein, A.B., Thompson, G.B., & Harlan, L.C. (1991). Differences in rates of cancer screening by usual source of medical care. Data from the 1987 National Health Interview Survey. Medical Care, 29, 196-209.

Bice, T.W., & White, K.L. (1969). Factors related to the use of health services: An international comparative study. Medical Care, 7, 124-133.

Birch, S., & Chambers, S. (1993). To each according to their needs: A community-based approach to resource allocation in health care. Canadian Medical Assocation Journal, 149, 607-612.

Birch, S., Eyles, J., & Newbold, K.B. (1993). Equitable access to health care: Methodological extensions to the analysis of physician utilization in Canada. Health Economics, 2, 87-101.

Birch, S., Goldsmith, L., & Makela, M. (1994). Paying the piper and calling the tune: Principles and prospects for reforming phyician payment methods in Canada. (Report No. 94-16). Hamilton, ON: Centre for Health Economics and Policy Analysis.

Birch, S., Eyles, J., & Newbold, K.B. (1996). Proxies for healthcare need among populations: validation of alternatives--a study in Quebec. Journal of Epidemiology and Community.Health, 50, 564-569.

Bredfeldt, R.C., Brewer, M.L., & Junker, J.A. (1990). Influences upon reported health promotion by family physicians. Family Practice Research Journal, 9(2), 85-94.

Brown, E.M., & Goel, V. (1993). Factors related to emergency department utilization: Results from the Ontario Health Survey, 1990. (Report No. 18). Toronto, ON: Institute for Clinical Evaluative Sciences.

Brown, R.S., Clement, D.G., Hill, J.W., Retchin, S.M., & Bergeron, J.W. (1993). Do health maintenance organizations work for Medicare? Health Care Financing Review, 15(1), 7-23.

Broyles, R., Manga, P., Binder, D., Angus, D., & Charette, A. (1983). The use of physician services under a National Health Insurance Scheme: An examination of the Canada health survey. Medical Care, 21, 1037-1054.

Buchanan, J.L., Leibowitz, A., & Keesey, J. (1996). Medicaid health maintenance organizations. Can they reduce program spending? Medical Care, 34, 249-263.

Buckingham, K., & Freeman, P.R. (1997). Sociodemographic and morbidity indicators of need in relation to the use of community health services: Observational study. BMJ, 315, 994-996.

Campbell, D.A., Radford, J., & Burton, P. (1991). Unemployment rates: An alternative to the Jarman index? BMJ, 303 , 750-755.

Canadian College of Health Service Executives. (1998). Health reform update 1997-1998 (5th edition). Ottawa, ON: Author.

Canadian Health Services Research Foundation. (1999). Integrated health systems in Canada: Three policy syntheses. Ottawa, ON, Author.

Canadian Institute for Health Information. (1999). National Consensus Conference on Population Health Indicators. Ottawa, ON: Author.

Canadian Institute for Health Information. (1999, May 14a). Private sector health expenditures by province and territory in Canada: 1975-1997. Ottawa, ON: Author. Retrieved May 14, 1999 from the World Wide Web: http://www.cihi.ca/facts/prvtpro1.htm

Canadian Institute for Health Information. (1999, May 14a). Public sector health expenditures by province and territory in Canada: 1975-1997. Ottawa, ON: Author. Retrieved May 14, 1999 from the World Wide Web: http://www.cihi.ca/facts/pubprov2.htm

Canadian Medical Association. (1994). Strengthening the foundation: The role of physicians in primary care in Canada. Ottawa, ON: Canadian Medical Association.

Canadian Public Health Association. (1996). The health impacts of unemployment: A position paper. Ottawa, ON: Author.

Canadian Taskforce on the Periodic Health Examination. (1979). The periodic health examination. Canadian Medical Association Journal, 121, 1193-1254.

Carlisle, R.D., Johnstone, S.P., & Pearson, J.C. (1993). Relation between night visit rates and deprivation measures in one general practice. BMJ, 306, 1383-1385.

Carr-Hill, R., & Sheldon, T. (1991). Designing a deprivation payment for general practitioners: The UPA(8) wonderland. BMJ, 302, 393-396.

Carr-Hill, R., & Sheldon, T. (1992). Rationality and the use of formulae in the allocation of resources to health care. Journal of Public Health Medicine, 4(2), 117-126.

Carr-Hill, R.A., & Jamison, J.Q. (1998). Basing resource allocation formulas on standardised mortality ratios would be wrong. BMJ, 316, 1169

Centre for Evidence-Based Medicine. (1998, September 17). Levels of evidence and grades of recommendations. [Announcement posted on the World Wide Web]. Oxford, England: Author. Retrieved January 8, 1999 from the World Wide Web: http://www.cebm.jr2.ox.ac.uk/docs/levels.html

Chan, B., & Anderson, G.M. (1996). Trends in physician fee-for-service billing patterns. In V. W. J. I. Goel, G. M. Anderson, P. Blackstien-Hirsh, C. Fooks, & C. D. Naylor (Eds.), Patterns of health care in Ontario: The ICES practice atlas. (pp. 247-264). Ottawa, ON: Canadian Medical Association.

Chan, B., Anderson, G.M., & Theriault, M. (1998). Fee code creep among general practitioners and family physicians in Ontario: Why does the ratio of intermediate to minor assessments keep climbing? Canadian Medical Association Journal, 158(6), 749-754.

Chan, B., Anderson, G.M., & Theriault, M. (1998). High-billing general practitioners and family physicians in Ontario: How do they do it? Canadian Medical Association Journal, 158(6), 741-746.

Chan, B., Anderson, G., & Theriault, M.E. (1998). Patterns of practice among older physicians in Ontario. Canadian Medical Association Journal, 159(9), 1101-1106.

Chan, B. (1999). Supply of physicians' services in Ontario. (Report No. 1). Toronto, Ontario: Institute for Clinical Evaluative Sciences.

Charles, C., Lomas, J., Giacomini, M., Bhatia, V., & Vincent, V.A. (1997). Medical necessity in Canadian Health Policy: Four meanings and ... a funeral? Milbank Quarterly, 75(3), 365-394.

Chen, J., Wilkins, R., & Ng, E. (1996). Health expectancy by immigrant status, 1986 and 1991. Health Report, 8(3), 29-38.

Clement, D.G., Retchin, S.M., Brown, R.S., & Stegall, M.H. (1994). Access and outcomes of elderly patients enrolled in managed care. Journal of the American Medical Association, 271(19), 1487-1492.

Coffey, E., Moscovice, I., Finch, M., Christianson, J.B., & Lurie, N. (1995). Capitated Medicaid and the process of care of elderly hypertensives and diabetics: results from a randomized trial. American Journal of Medicine, 98(6), 531-536.

College of Family Physicians of Canada. (1994). Proposal for a blended funding mechanism. Mississauga, ON: Author.

College of Family Physicians of Canada. (1995). Managing change: The family medicine group practice model. Ottawa, ON: Author.

College of Family Physicians of Canada. (October 1998). The CFPC National Family Physician Survey: Summary Report. Ottawa, ON: Author. Retrieved July 18, 1999 from the World Wide Web: http://www.cfpc.ca/janus.htm

Collyer, J.A. (1969). A family doctor's time. *Canadian Family Physician, 15*, 63-69.

Concato, J., Feinstein, A.R., & Holford, T.R. (1993). The risk of determining risk with multivariate models. Annals of Internal Medicine, 118, 201-210.

Coyte, P.C. (1995). Review of physician payment and service delivery mechanisms. Ontario Medical Review, April, 23-37.

Cummings, S.R., Stein, M.J., Hansen, B., Richard, R.J., Gerbert, B., & Coates, T.J. (1989). Smoking counseling and preventive medicine. A survey of internists in private practices and a health maintenance organization. Archives of Internal Medicine, 149(2), 345-349.

D'Arcy, C., & Siddique, C. (1985). Unemployment and health: An analysis of the Canada Health Survey. International Journal of Health Services, 15, 69-93.

D'Arcy, C. (1986). Unemployment and health: Data and implications. Canadian Journal of Public Health, 77, 124-131.

Davies, A., Ware, J., Brook, R., Peterson, J., & Newhouse, J. (1986). Consumer acceptance of prepaid and fee-for-service care: Results from a randomized trial. Health Services Research, 21, 429-452.

Delamothe, T. (1990). Deprived area payments. British Medical Journal, 300, 1609-1610.

Department of Health and Social Security. (1976). Sharing resources for health in England. London: Report of the Resource Allocation Working Party.

Duan, N., Manning, W.G., Morris, C.N., & Newhouse, J.P. (1984). Choosing between the sample-selection model and the multi-part model. Journal of Business and Economic Statistics, 2(3), 283-289.

Duncan, D., Jones, K., & Moon, G. (1996). Health-related behaviour in context: A multilevel modelling approach. Social Science & Medicine, 42(6), 817-830.

Dunlop, S. (1998). Socio-economic status and the utilization of physicians' services: results from the National Population Health Survey. Unpublished master's thesis, University of Toronto, Ontario, Canada.

Eggers, P. (1980). Risk differential between Medicare beneficiaries enrolled and not enrolled in a health maintenance organization. Health Care Financing Review, 1(3), 91-99.

Eisenberg, J.M. (1985). Physician utilization: The state of research about physicians' practice patterns. Medical Care, 23, 461-483.

Eliasoph, H. (1993). New initiatives in ambulatory care funding in Alberta. Journal of Ambulatory Care Management, 16(3), 30-39.

Ellis, R.P., & Ash, A. (1995). Refinements to the diagnostic cost group (DCG) model. Inquiry, 32, 418-429.

Ellis, R.P., Pope, G.C., Iezzoni, L., Ayanian, J.Z., Bates, D.W., Burstin, H., Ash, & AS. (1996). Diagnosis-based risk adjustment for Medicare capitation payments. Health Care Financing Review, 17(3), 101-128.

Epstein, A.M., & Cumella, E.J. (1988). Capitation payment: Using predictors of medical utilization to adjust rates. Health Care Financing Review, 10(1), 51-69.

Evans, R.G., & Stoddart, G.L. (1990). Producing health, consuming health care. Social Science and Medicine, 31(12), 1347-1363.

Eyles, J., Birch, S., Chambers, S., Hurley, J., & Hutchison, B. (1991). A needs-based methodology for allocating health care resources in Ontario, Canada: Development and an application. Social Science and Medicine, 33(4), 489-500.

Eyles, J., & Birch, S. (1993). A population needs-based approach to health-care resource allocation and planning in Ontario: a link between policy goals and practice? Canadian Journal of Public Health, 84(2), 112-117.

Federal/Provincial/Territorial Advisory Committee on Health Services. (1995). The Victoria report on physician remuneration: A model for the reorganization of primary care and the introduction of population-based funding (Kilshaw Report). Victoria: Queen's Printer for British Columbia.

Federal/Provincial/Territorial Advisory Committee on Population Health. (1999). Statistical report on the health of Canadians. Ottawa, ON: Health Canada.

Feldman, R., Dowd, B., & Gifford, G. (1993). The effect of HMOs on premiums in employment-based health plans. Health Services Research, 27(6), 779-811.

Ferris, L.E. & Norton, P.G. (1992). Basic concepts in reliability and validity. In M. Stewart, F. Tudiver, M.J. Bass, E.V. Dunn, & P.G. Norton. Tools for primary care research (pp. 64-76). London: Sage Publications.

Finkler, S.A. (1982). The distinction between costs and charges. Annals of Internal Medicine, 96, 102-109.

Flierman, H.A., & Groenewegen, P.P. (1992). Introducting fees for services with professional uncertainty. Health Care Financing Review, 14(1), 107-115.

Forest, P., Gagnon, D., Abelson, J., Turgeon, J., & Lamarche, P. (1999). Issues in the governance of integrated health systems. (Report No. PS-002-05). Ottawa, ON: Canadian Health Services Research Foundation.

Forster, J., Rosser, W., Hennen, B., McAuley, R., Wilson, R., & Grogan, M. (1994). New approach to primary medical care: Nine-point plan for a family practice service. Canadian Family Physician, 40, 1523-1530.

Fowler, E.J. & Anderson, G.F. (1996). Capitation adjustment for pediatric populations. *Pediatrics, 98*, 10-17.

Fowles, J.B., Weiner, J.P., Knutson, D., Fowler, E., Tucker, A.M., & Ireland, M. (1996). Taking health status into account when setting capitation rates: A comparison of risk-adjustment models. Journal of the American Medical Association, 276(16), 1316-1321.

Freund, D.A., Rossiter, L.F., Fox, P.D., Meyer, J.A., Hurley, R.E., Carey, T.S., Paul, & JE. (1989). Evaluation of the Medicaid competition demonstrations. Health Care Financing Review, 11(2), 81-97.

Fries, B.E., Schneider, D.P., Foley, W.J., Gavazzi, M., Burke, R., & Cornelius, E. (1994). Refining a case-mix measure for nursing homes: Resource Utilization Groups (RUG-III). Medical Care, 23, 668-685.

Frohlich, N., & Mustard, C.A. (1996). A regional comparison of socio-economic and health indices in a Canadian province. Social Science & Medicine, 42(9), 1273-1281.

Frohlich, N., & Carriere, K.C. (1997). Issues in developing indicators for needs-based funding. Winnipeg, Manitoba: Manitoba Centre for Health Policy & Evaluation.

Gabel, J.R., & Redisch, M.A. (1979). Alternative physician payment methods: Incentives, efficiency and national health insurance. Milbank Memorial Fund Quarterly, 57(1), 38-59.

Gosden, T., Pederson, L., Torgerson, D., Field, T.S., Perrone, C., Himmelstein, J. & Sachs-Leicher, E. (1999). How should we pay doctors? A systematic review of salary payment and their effect on doctor behavior. Quarterly Journal of Medicine, 92, 47-55.

Government of Alberta. (1998, September). Relative value commission appointed. [Announcement posted on the World Wide Web]. Edmonton, AB: Author. Retreived August 10, 1999 from the World Wide Web: http://www.edt.gov.ab.ca./acn/199809/6746.html

Government of Ontario. (1998, May 26). Government of Ontario Press Releases. Government and OMA launch new model for delivering patient care [Announcement posted on the World Wide Web]. Hamilton, ON: Author. Retrieved June 3, 1998 from the World Wide Web: http://newswire.ca/government/ontario/english/releases/May1998/c5994.html

Graham, W. (1997). Primary care reform: A strategy for stability. Toronto, ON: Author.

Graham, W. (1998). Update on primary care reform. Ontario Medical Review, October, 15-17.

Graham, W., Gamble, B., Gerred, K., Parsons, W., & Kidd, C. (1998). Update on primary care reform implementation. Ontario Medical Review, May, 14.

Graham, W. (1999). Primary care reform progress report. Ontario Medical Review, 66(99), 21-23.

Gray, J. (1998). PCR pilots endorsed. Ontario Medical Review, March, 7-8.

Green, L.W., & Lewis, F.M. (1986). Validity of measurement. In Anonymous, Measurement and evaluation in health education and health promotion. (pp. 101-115). Mountain View, CA: Mayfield Publishing Company.

Greenfield, S., Nelson, E.C., Zubkoff, M., & et al. (1992). Variations in resource utilization among medical specialties and systems of care: Results from the Medical Outcomes Study. Journal of the American Medical Association, 267, 1624-1630.

Greenfield, S., Rogers, W., Mangotich, M., Carney, M.F., & Tarlov, A.R. (1995). Outcomes of patients with hypertension and non-insulin dependent diabetes mellitus treated by different systems and specialties: Results from the Medical Outcomes Study. Journal of the American Medical Association, 274, 1436-1474.

Grimaldi, P.L. (1991). RBRVs: How new physician fee schedule will work. Healthcare Financial Management, 45(9), 58-75.

Gross, D.A., Zyzanski, S.J., Borawski, E.A., Cebul, R.D., & Stange, K.C. (1998). Patient satisfaction with time spent with their physician. Journal of Family Practice, 47(2), 133-137.

Groves, T. (1999). Reforming British primary care (again). British Medical Journal, 318, 747-748.

Gruenberg, L.Kaganova., E, Hornbrook, M.C. (1996). Improving the AAPCC with health-status measures from the MCBS. Health Care Financing Review, 17(3), 59-75.

Guyatt, G.H., Sackett, D.L., & Cook, D.J. (1993). Users guides to the medical literature: II. How to use an article about therapy or prevention. A. Are the results of the study valid? Journal of the American Medical Association, 270, 2598-2601.

Harada, N., Kominski, G., & Sofaer, S. (1993). Development of a resource-based classification scheme for rehabilitation. Inquiry, 30, 54-63.

Harrell, F.E., Lee, K.L., Matchar, D.B., & Reichert, T.A. (1985). Regression models for prognostic prediction: Advantages, problems, and suggested solutions. Cancer Treat Report, 69, 1071-1077.

Haslam, R.H.A., & Walker, N.E. (1993). Alternative funding plans: Is there a place in academic medicine? Canadian Medical Association Journal, 148, 1141-1146.

Hawker, G. et. al. (1999, October). Area variations: Should we be worried? Joint arthroplasty as an example. Paper presented at the Population Health Perspectives: Making Research Work. Winnipeg, Manitoba, Canada.

Hay, D.I. (1988). Socioeconomic status and health status: a study of males in the Canadian Health Survey. Social Science and Medicine, 27, 1317-1325.

Hayward, R.A., Bernard, A.M., Freeman, H.E., & Corey, C.R. (1990). Regular source of ambulatory care and access to health services. American Journal of Public Health, 81, 434-438.

Health Canada. (1997). Canada Health Act - Overview [Announcement posted on the World Wide Web]. Ottawa, ON: Author. Retreived November 25, 1997 from the World Wide Web: http://www.hwc.ca/medicare/chaover.htm

Health Canada. (1998). A demonstration project of a system of integrated care for frail elderly persons and the simulation of capitation [Announcement posted on the World Wide Web]. Ottawa, ON: Author. Retrieved April 9, 1999 from the World Wide Web: http://www.hc-sc.gc.ca/english/archives/releases/9824bke2.htm

Health Canada. (1999a). Health Transition Fund [Announcement posted on the World Wide Web]. Ottawa, ON: Author. Retrieved April 10, 1999 from the World Wide Web: http://www.hc-sc.gc.ca/htf-fass/english/about.htm

Health Canada. (1999b). Capitation project in the Regional County Municipality (RCM) of Haut-Saint-Laurent [Announcement posted on the World Wide Web]. Ottawa, ON: Author. Retrieved April 9, 1999 from the World Wide Web: http://www.hc-sc.gc.ca/english/archives/releases/9945ebk.htm

Health Canada. (1999c, April 1). Minister announces funding for primary care project [Announcement posted on the World Wide Web]. Ottawa, ON: Author. Retrieved April 9, 1999 from the World Wide Web: http://www.hc-sc.gc.ca/english/releases.99_38e.htm

Health Canada. (1999d). Primary care reform implementation and evaluation in Ontario [Announcement posted on the World Wide Web]. Ottawa, ON: Author. Retrieved April 9, 1999 from the World Wide Web: http://www.hc-sc.gc.ca/english/archieves/releases/9958ebk.htm

Henke, C.J., & Epstein, W.V. (1991). Practice variation in rheumatologists' encounters with their patients who have rheumatoid arthritis. Medical Care, 29, 799-812.

Henry, J. (1999). RBRVS Commissionn embarks on survey code evaluation. Ontario Medical Review, 66(10), 24.

Hintze, J.L. (1996). Power analysis and sample size. Kaysville, UT: Author.

Hlatsky, M., Lee, K., Botvinick, E., & Brundage, B. (1983). Diagnostic test use in different practice settings: A controlled comparison. Archives of Internal Medicine, 143, 1886-1889.

Holland, W. (1998). Lessons learnt many years ago have been forgotten (Letter). British Medical Journal, 316, 939

Hollander, M.J., & Deber, R. (1997). A typology of models of resource allocation. In M. J. Hollander, R. Deber, & P. Jacobs (Eds.), A critical review and analysis of health care related models of resource allocation and reimbursement in an Ontario context. (pp. 25-28). Victoria, British Columbia: Canadian Policy Research Networks, Inc.

Hornbrook, M.C., & Goodman, M.J. (1995). Assessing relative health plan risk with the RAND-36 health survey. Inquiry, 32(1), 56-74.

Hornbrook, M.C., & Goodman, M.J. (1996). Chronic disease, functional status and demographics: A multi-dimensional approach to risk adjustment. Health Services Research, 31(3), 283-307.

Horton, J., Romans, M., & Cruess, D. (1992). Mammography attitudes and usage study, 1992. Women's Health Issues, 2, 190-196.

Hosmer, D.W., Taber, S., & Lemeshow, S. (1991). The importance of assessing the fit of logistic regression models: A case study. American Journal of Public Health, 81, 1630-1635.

Hsiao, W.C., Braun, P., & et al. (1992). An overview of the development and refinement of the resource-based relative value scale. Medical Care, 30 (Supplement), NS1-12.

Hurley, J., Hutchison, B., Giacomini, M., Birch, S., Dorland, J., Reid, R., & Pizzoferrato, G. (1999). Policy considerations in implementing capitation for integrated health systems. (Report No. 99-01). Hamilton, ON: Centre for Health Economics and Policy Analysis.

Hutchinson, J.M., & Foley, R.N. (1999). Method of physician remuneration and rates of antibiotic prescription. Canadian Medical Association Journal, 160, 1013-1017.

Hutchison, A., Foy, C., & Sandhu, B. (1989). Comparison of two scores for allocating resources to doctors in deprived areas. British Medical Journal, 299, 1142-1144.

Hutchison, B., Hurley, J., Birch, S., Lomas, J., & Stratford-Devai, F. (1997). Defining the practice population in fee-for-service practice. Health Services Research, 32(1), 55-70.

Hutchison, B., Birch, S., Hurley, J., Lomas, J., & Stratford-Devai, F. (1996). Do physician-payment mechanisms affect hospital utilization? A study of Health Service Organizations in Ontario. Canadian Medical Assocation Journal, 154(5), 653-661.

Hutchison, B., Birch, S., & Gillett, J. (1996). Health service organizations: The evolution of capitation-funded physician care in Ontario. (Report No. 96-11). Hamilton, ON: Centre for Health Economics and Policy Analysis.

Hutchison, B., Birch, S., Walter, S.D., Stratford-Devai, F., Hurley, J., Lomas, J., & Eyles, J. (1997). Needs-based primary medical care capitation: Development and evaluation of alternative approaches. (Report No. 97-10). Hamilton, ON: Centre for Health Economics and Policy Analysis.

Hutchison, B., Hurley, J., Reid, R., Dorland, J., Birch, S., Giacomini, M., & Pizzoferrato, G. (1999). Capitation formulae for integrated health systems: A policy synthesis. (Report No. 99-02). Hamilton, ON: Centre for Health Economics and Policy Analysis.

Hutchison, B., Birch, S., Hurley, J., Lomas, J. & Stratford-Devai, F. (1994). Effect of financial incentive to reduce hospital utilization in capitated primary care practice. (Report No. 94-02). Hamilton, ON: Centre for Health Economics and Policy Analysis.

Iezzoni, L.I. (1995). Risk adjustment for medical effectiveness research: An overview of conceptual and methodological considerations. Journal of Investigative Medicine, 43, 136-150.

Jarman, B., Townsend, P., & Carstairs, V. (1991). Deprivation indices. British Medical Journal, 303, 523

Jenkins, K. (1997). Primary care reform: OMA membership survey results. Ontario Medical Review, December, 20.

Jin, R.L., Shah, C.P., & Svoboda, T.J. (1995). The impact of unemployment on health: a review of the evidence. Canadian Medical Assocation Journal, 153, 529-540.

Joint Policy and Planning Committee. (1998). Funding hospital based ambulatory care in Ontario. Toronto, ON: Author.

Joung, I.M.A., Van der meer, J.B.W., & Mackenbach, J.P. (1995). Marital status and health care utilization. International Journal of Epidemiology, 24, 569-575.

Kao, A.C., Green, D.C., Zaslavsky, A.M., Koplan, J.P., & Cleary, P.D. (1998). The relationship between method of physician payment and patient trust. Journal of the American Medical Association, 280, 1708-1714.

Kasper, J.D., & Riley, G. (1992). Satisfaction with medical care among elderly people in fee-for-service care and an HMO. [Review] [43 refs]. Journal of Aging & Health, 4, 282-302.

Katz, S.J., Hofer, T.P., & Manning, W.G. (1996). Physician utilization in Ontario and the United States: The impact of socioeconomic status and health status. American Journal of Public Health, 86, 520-524.

Kennedy, B.P., Kawachi, I., Glass, R., & Prothrow-Stith, D. (1998). Income distribution, socioeconomic status, and self rated health in the United States: Multilevel analysis. British Medical Journal, 317, 921

Kerr, E.A., Mittman, B.S., Hays, R.D., & et al. (1996). Quality assurance in capitated physician groups. Journal of the American Medical Association, 276, 1236-1239.

Kidd, C. (1997). Primary care reform: A progress report. Ontario Medical Review, March, 22-23.

Kohen, D.E., Hertzman, C. & Brooks-Gunn, J. (October, 1998). Neighbourhood income influences on children's school readiness [Announcement posted on the World Wide Web]. Ottawa, ON: Applied Research Branch, Human Resources Development Canada. Retrieved December 10, 1999 from the World Wide Web: http://www.hrdc-drhc.gc.ca/arb/publications/research/abw-98-15e.shtml

Kralj, B. (1998). Examining trends in medical services utilization. Ontario Medical Review, March, 17-21.

Krasnik, A., Groenewegen, P.P., Pedersen, P.A., Scholten, P., Mooney, G., Gottschau, A., Flierman, H.A., & Damsgaard, M.T. (1990). Changing remuneration systems: Effects on activity in general practice. British Medical Journal, 300, 1698-1701.

Kravitz, R.L., Greenfield, S., Rogers, W.H., & et al. (1992). Differences in the mix of patients among medical specialties and systems of care: Results from the Medical Outcomes Study. Journal of the American Medical Association, 267, 1617-1623.

Krieger, N. (1992). Overcoming the absence of socioeconomic data in medical records: Validation and application of a census-based methodology. American Journal of Public Health, 87, 703-710.

Kristiansen, I., & Mooney, G. (1993). The general practitioner's use of time: Is it influenced by the remuneration system? Social Science & Medicine, 37, 393-399.

Kristiansen, I., & Mooney, G. (1993). Remuneration of GP services: time for more explicit objectives? A review of the systems in five industrialized countries. Health Policy, 24, 203-212.

Kulkarni, P., Vernon, S., Jackson, G., Lairson, D., & Davis, B. (1989). Stage at diagnosis of breast cancer: Comparison in a fee-for-service and health maintenance organization. Medical Care, 27, 622

Lambrew, J.M., DeFriese, G.H., Carey, T.S., Ricketts, T.C., & Biddle, A.K. (1996). The effects of having a regular doctor on access to primary care. Medical Care, 34, 138-151.

Lasker, R.D., & Marquis, M.S. (1999). The intensity of physicians' work in patient visits. New England Journal of Medicine, 341, 337-341.

Lavis, J.N., & Anderson, G.M. (1996). Appropriateness in health care delivery: Definitions, measurement and policy implications. Canadian Medical Association Journal, 154, 321-328.

Leibowitz, A., Buchanan, J.L., & Mann, J. (1992). A randomized trial to evaluate the effectiveness of a Medicaid HMO. Journal of Health Economics, 11, 235-257.

Lichtenstein, R., Thomas, J.W., Watkins, B., & et al. (1992). HMO marketing and selection bias: Are TEFRA HMOs skimming? Medical Care, 30, 329-346.

Lichtenstein, R., Thomas, J.W., Adams-Watson, J. Lepkowski, J., & Simone, B. (1991). HMO marketing and selection bias: Are TEFRA HMOs skimming? Medical Care, 29, 318-331.

Locker, D., & Ford, J. (1996). Using area-based measures of socioeconomic status in dental health services research. Journal of Public Health Dentistry, 56(2), 69-75.

Locker, D., Payne, B., & Ford, J. (1996). Area variations in health behaviours. Canadian Journal of Public Health, 87(2), 125-129.

Lohr, K.N. (1997). How do we measure quality? Health Affairs, 16(3), 22-25.

Lomas, J., Fooks, C., Rice, T., & Labelle, R. (1989). Paying physicians in Canada: Minding our Ps and Qs. Health Affairs, 8(1), 80-102.

Lubitz, J., Beebe, J., & Riley, G. (1986). Improving the Medicare HMO payment formula. In R. Scheffler and L Rossiter (Eds.). Advances in Health Economics and Health Services Research (Volume 6). Greenwich, CN: JAI Press.

Luft, H.S. (1978). How do health maintenance organizations achieve their 'savings'? Rhetoric and evidence. New England Journal of Medicine, 298, 1336-1343.

Luft, H.S. (1981). Health maintenance organizations: Dimensions of performance. New York: John Wiley & Sons.

Lurie, N., Moscovice, I.S., Finch, M., Christianson, J.B., & Popkin, M.K. (1992). Does capitation affect the health of chronically mentally ill? Results from a randomized trial. Journal of the American Medical Association, 267, 3300-3304.

Lurie, N., Christianson, J., Finch, M., & Moscovice, I. (1994). The effects of capitation on health and functional status of the Medicaid elderly. A randomized trial [see comments]. Annals of Internal Medicine, 120(6), 506-511.

Manning, W.G., Leibowitz, A., Goldberg, G.A., Rogers, W.H., & Newhouse, J.P. (1984). A controlled trial of the effect of a prepaid group practice on use of services. New England Journal of Medicine, 310, 1505-1510.

Manton, K.G., Newcomer, R., Vertrees, J.C., Lowrimore, G.R., & Harrington, C. (1994). A method of adjusting capitation payments to managed care plans using multivariate patterns of health and functioning: The experience of social/health maintenance organizations. Medical Care, 32, 277-297.

Marriott, J., & Mable, A.L. (1999). Summary: Integrated models: International trends and implications for Canada [Announcement posted on the World Wide Web]. Ottawa, ON: Health Canada. Retreived April 9, 1999 from the World Wide Web: http://www.hc.sc.gc.ca/main.nfh/web/pubhcat/issuesum/marriott.htm

Mauldon, J., Leibowitz, A., Buchanan, J.L., Damberg, C., & McGuigan, K.A. (1994). Rationing or rationalizing children's medical care: Comparison of a Medicaid HMO with fee-for-service care. American Journal of Public Health, 84(6), 899-904.

Mays, N. (1995). Geographic resource allocation in the English national health service 1971 - 1994: The tension between normative and empirical approaches. International Journal of Epidemiology, 24, 96-102.

McIsaac, W.J., Goel, V., & Naylor, C.D. (1993). The utilization of physician services in Ontario by adults: Results from the Ontario Health Survey. Report No. 20. Toronto, ON: Institute for Clinical Evaluative Sciences.

McIsaac, W., Goel, V., & Naylor, C.D. (1997). Socio-economic status and visits to physicians by adults in Ontario, Canada. Journal of Health Services Research & Policy, 2, 94-102.

Mechanic, D. (1979). Correlates of physician utilization: Why do major multivariate studies of physician utilization find trivial psychosocial and organizational effects? Journal of Health and Social Behavior, 20, 387-396.

Miller, R.H., & Luft, H.S. (1994). Managed care plan performance since 1980: A literature analysis. Journal of the American Medical Association, 271, 1512-1519.

Miller, T.E., & Sage, W.M. (1999). Disclosing physician financial incentives. Journal of the American Medical Association, 281, 1424-1430.

Minister of Health. (1999). Primary care network agreement: Global. Toronto, ON: Author.

Morgan, R.O., Virnig, B.A., DeVito, C.A., & Persily, N.A. (1997). The Medicare-HMO revolving door--the healthy go in and the sick go out. New England Journal of Medicine, 337(3), 169-175.

Moscovice, I., Lurie, N., Christianson, J., Finch, M., Popkin, M., & Akhtar, M.R. (1993). Access and use of health services by chronically mentally ill Medicaid beneficiaries. Health Care Financing Review, 14(4), 75-87.

Muhajarine, N., Mustard, C.A., Roos, L.L., Young, T.K., Gelskey, D., & Reeder, B. (1997). Socioeconomic status and cardiovascular disease-related health service use in Manitoba. American Journal of Epidemiology, 145(11), S83

Murray, J., Greenfield, S., Kaplan, S., & Yano, E. (1992). Ambulatory testing for capitation and fee-for-service patients in the same practice setting: Relationship to outcome. Medical Care, 30, 252-261.

Mustard, C.A., & Frohlich, N. (1995). Socioeconomic status and the health of the population. Medical Care, 33(12 Supplement), DS43-54.

Mustard, C.A., Derksen, S., Berthelot, J.M., Wolfson, M., & Roos, L.L. (1997). Age-specific education and income gradients in morbidity and mortality in a Canadian province. Social Science and Medicine, 45(3), 383-397.

Mustard, C.A., & Derksen, S. (1997). A needs-based funding methodology for regional health authorities: A proposed framework. Winnipeg, Manitoba: Manitoba Centre for Health Policy & Evaluation.

Mustard, C.A., Kaufert, P., Kozyrskyj, A., & Mayer, T. (1998). Sex differences in the use of health care services. New England Journal of Medicine, 338, 1678-1683.

Mustard, C.A., Kozyrskyj, A., Barer, M.L., Sheps, S. (1998). Emergency department use as a component of total ambulatory care: A population perspective. Canadian Medical Association Journal, 158, 49-55.

Mustard, C.A., Derksen, S., Berthelot, J.M., & Wolfson, M. (1999). Assessing ecological proxies for household income: A comparison of household and neighbourhood level income measures in a study of population health status. Health & Place, 5, 151-171.

National Forum on Health. (1997). Mandate of the National Forum on Health [Announcement posted on the World Wide Web]. Ottawa, ON: Author. Retrieved November 25, 1997 from the World Wide Web: http://www.nfh.hwc.ca/about/mandate.htm

Newcomer, R., Preston, S., & Harrington, C. (1996). Health plan satisfaction and risk of disenrollment among Social/HMO and fee-for-service recipients. Inquiry, 33, 144-154.

Newhouse, J.P. (1986). Rate adjusters for Medicare under capitation. Health Care Financing Review, Annual Supplement, 45-55.

Newhouse, J. (1998). Risk adjustment: Where are we now? Inquiry, 35, 122-131.

Newhouse, J.P., Buntin, M.B., & Chapman, J.D. (1997). Risk adjustment and Medicare: Taking a closer look. Health Affairs, 15, 27-43.

Newhouse, J.P., Manning, W.G., Keeler, E.B., & Sloss, E.M. (1989). Adjusting capitation rates using objective health measures and prior utilization. Health Care Financing Review, 10(3), 41-53.

Newhouse, J.P., Sloss, E.M., Manning, W.G., & Keeler, E.B. (1993). Risk adjustment for a children's capitation rate. *Health Care Financing Review, 15*, 39-54.

Norrish, A., North, D., Kirkman, P., & Jackson, R. (1994). Validity of self-reported hospital admission in a prospective study. American Journal of Epidemiology, 140(10), 938-942.

Norusis, M.J. (1993). SPSS for Windows: Base System User's Guide (Release 6.0). Chicago, IL: SPSS Marketing Department.

Oleske, D.M., Branca, M.L., Schmidt, J.B., Ferguson, R., & Linn, E.S. (1998). A comparison of capitated and fee-for-service Medicaid reimbursement methods on pregnancy outcomes. Health Services Research, 33, 55-73.

Ontario College of Family Physicians. (1995). Bringing the pieces together: Planning for future health care. Mississauga, ON: Author.

Ontario College of Family Physicians. (March 22, 1999). *Examples of excellence in family medicine: A report prepared for the Health Services Restructuring Commission* [Announcement posted on the World Wide Web]. Toronto, ON: Author. Retrieved May 18, 1999 from the World Wide Web: http://www.cfpc.ca/ocfp/commun/example.html

Ontario Medical Review. (1999). OMA-MOH Agreement Update. Ontario Medical Review, 66(9), 16.

Ontario Ministry of Health. (1992). *Highlights Report, Ontario Health Survey, 1990.* Toronto, Ontario: Author.

Ontario Ministry of Health. (October 19, 1998). *Ontario Health Insurance Plan Bulletin Number 4319* [Announcement posed on the World Wide Web]. Toronto, ON: Author. Retrieved July 21, 1999 from the World Wide Web: http://www.gov.on.ca/health/english/program/ohip/bulletin/bul2020.html

Ontario Ministry of Health. (May 11, 1999). *Ontario Health Insurance Plan Bulletin Number 4335* [Announcement posted on the World Wide Web]. Toronto, ON: Author. Retrieved August 3, 1999 from the World Wide Web: http://www.gov.on.ca/health/english/program/ohip/bulletin/bul4335.html

Park, R.E. (1993). Does inappropriate use explain small area variations in the use of health care services? A reply. Health Services Research, 28, 401-409.

Parkerson, G.R., Broadhead, E., & Tse, C.J. (1995). Health status and severity of illness as predictors of outcomes in primary care. Medical Care, 33, 53-66.

Peter, I., Tate, J.B., & Catchpole, P.J. (1989). Practice activity analysis: Collaboration between general practitioners and a family practitioner committee. *Journal of the Royal College of General Practitioners, 39,* 297-299.

Phillips, K.A., Morrison, K.R., Andersen, R., & Aday, L.A. (1998). Understanding the context of healthcare utilization: Assessing environmental and provider-related variables in the behavioral model of utilization. Health Services Research, 33(3), 571-596.

Pink, G.H., & Bolley, H.B. (1994). Physicians in health care management. Case mix groups and resource intensity weights: An overview for physicians. Canadian Medical Association Journal, 150, 889-894.

Potosky, A.L., Merrill, R.M., Riley, G.F., Taplin, S.H., Barlow, W., Fireman, B.H., & Ballard-Barbash, R. (1997). Breast cancer survival and treatment in health maintenance organization and fee-for-service settings. Journal of the National Cancer Institute, 89, 1683-1691.

Preyra, C., & Deber, R. (1997). Physician services. In M. J. Hollander, R. Deber, & J. Jacobs (Eds.), A critical review and analysis of health care related models of resource allocation and reimbursement in an Ontario context. (pp. 38-70). Victoria, BC: Canadian Policy Research Networks Inc.

Provincial Co-ordinating Committee on Community and Academic Health Science Centre Relations, M.o.H. (1996). New directions in primary health care. Toronto, ON: Author.

Raftery, J. (1993). Capitation funding: population, age, and mortality adjustments for regional and district health authorities in England. British Medical Journal, 307, 1121-1124.

Raynes, N., & Cairns, V. (1980). Factors contributing to the length of general practice consultations. Journal of the Royal College of General Practitioners, 30, 496-498.

RBRVS Commission of Ontario. (1997). *Phase 1 Report: Principles and process for RBRVS.* Toronto, Ontario: Author.

Reid, F.D.A., Cook, D.G., & Majeed, A. (1999). Explaining variation in hospital admission rates between general practices: Cross-sectional study. British Medical Journal, 319, 98.

Reid, R., McWilliam, L., Verhulst, L., Roos, N.P. & Atkinson, M. (1999). *Performance of the ACG case-mix system in two Canadian provinces.* Manuscript in preparation.

Reijneveld, S. (1996). Predicting the workload in urban general practice in The Netherlands from Jarman's indicators of deprivation at the patient level. Journal of Epidemiology & Community Health, 50, 541-545.

Retchin, S.M., Clement, D.G., Rossiter, L.F., Brown, B., Brown, R., & Nelson, L. (1992). How the elderly fare in HMOs: outcomes from the Medicare competition demonstrations. Health Services Research, 27, 651-669.

Riley, G.F., Potosky, A.L., Lubitz, J.D., & Brown, M.L. (1994). Stage of cancer at diagnosis for Medicare HMO and fee-for-service enrollees. American Journal of Public Health, 84, 1598-1604.

Romeis, J.C., Gillespie, K.N., Virgo, K.S., & Thorman, K.E. (1991). Female veterans' and nonveterans' use of health care services. Medical Care, 29, 932-936.

Ronis, D., & Harrison, K. (1988). Statistical interactions in studies of physician utilization. Medical Care, 26, 361-372.

Roos, N.P., & Shapiro, E. (1981). The Manitoba Longtitudinal Study on Aging: Preliminary findings on health care utilization by the elderly. Medical Care, 19, 644-657.

Roos, N.P., Fransoo, R., Carriere, K.C., Frohlich, N., Bogdanovic, B., Kirk, P., & Wantanabe, M. (1997). Needs-based planning: The case of Manitoba. Canadian Medical Association Journal, 157(9), 1215-1221.

Roos, N.P., Carriere, K.C., & Friesen, D. (1998). Factors influencing the frequency of visits by hypertensive patients to primary care physicians in Winnipeg. Canadian Medical Association Journal, 159(7), 777-783.

Rossiter, L.F., Langwell, K., Wan, T.T., & Rivnyak, M. (1989). Patient satisfaction among elderly enrollees and disenrollees in Medicare health maintenance organizations. Results from the National Medicare Competition Evaluation. Journal of the American Medical Association, 262(1), 57-63.

Rundall, T. (1980). A suggestion for improving the behavioral model of physician utilization. Journal of Health and Social Behavior, 21, 103

Safran, D.G., Tarlov, A.R., & Rogers, W.H. (1994). Primary care performance in fee-for-service and prepaid health care systems: Results from the Medical Outcomes Study. Journal of the American Medical Association, 271, 1579-1586.

Saskatchewan Health. (1994). Introduction of needs-based allocation of resources to Saskatchewan District Health Boards for 1994/1995. Regina, Saskatchewan: Author.

Saskatchewan Health. (1995). Addendum to: Introduction of needs-based allocation of resources to Saskatchewan District Health Boards 1994/1995. Regina, Saskatchewan: Author.

Schauffler, H.H., Howland, J., & Cobbs, J. (1992). Using chronic disease risk factors to adjust Medicare capitation payments. Health Care Financing Review, 14(1), 79-90.

Schlenker, R.E., Shaughnessy, P.W., & Hittle, D.F. (1995). Patient-level cost of home health care under capitated and fee-for-service payment. Inquiry, 32, 252-270.

Serediak, M.S. (1993). Fee setting in Canada: Controversy and solutions. Journal of Ambulatory Care Management, 16 (3), 8-18.

Sharp, K., Ross, C., & Cockerham, W. (1983). Symptoms, beliefs and the use of physician services among the disadvantaged. Journal of Health and Social Behaviour, 24, 255-263.

Sheldon, T.A., Smith, G.D., & Bevan, G. (1993). Weighting in the dark: resource allocation in the new NHS. British Medical Journal, 306, 835-839.

Sheldon, T.A. (1997). Formula fever: Allocating resources in the NHS. British Medical Journal, 315, 964.

Shortell, S.M., & Richardson, W.C. (1978). *Health program evaluation.* St. Louis, MO: Mosby.

Simborg, D.W. (1981). DRG creep: A new hospital-acquired disease. New England Journal of Medicine, 304, 1602-1604.

Siu, A., Leibowitz, A., Brook, R., Goldman, N., Lurie, N., & Newhouse, J. (1988). Use of the hospital in a randomized trial of prepaid care. Journal of the American Medical Association, 259, 1343-1346.

Sloss, E.M., Keeler, E.B., Brook, R.H., & et al. (1987). Effect of a health maintenance organization on physiologic health: Results of a randomized trial. Annals of Internal Medicine, 106, 130-136.

Smith, D.M., & Martin, D.K. Langefeld, C.D. Miller, M.E., & Freedman, J.A. (1995). Primary care physician productivity. *Journal of General Internal Medicine, 10*, 495-503.

Smith, P., Sheldon, T.A., Carr-Hill, R.A., Martin, S., Peacock, S., & Hardman, G. (1994). Allocating resources to health authorities: Results and policy implications of small area analysis of use of inpatient services. British Medical Journal, 309, 1050-1054.

Smith, P., Sheldon, T., & Martin, S. (1996). An index of need for psychiatric services based on inpatient utilization. British Journal of Psychiatry, 169, 1059-1064.

Smith, N.S., & Weiner, J.P. (1994). Applying population-based case mix adjustment in managed care: the Johns Hopkins ambulatory care group system. Managed Care Quarterly, 2, 21-34.

Starfield, B. (1998). Primary care visits and health policy. Canadian Medical Assocation Journal, 159, 795-796.

Statistics Canada. (1994). Health status of Canadians: Report of the 1991 General Social Survey (Statistics Canada Cat. No. 11-612E. No. 8). General Social Survey Analysis Series. Ottawa, ON: Minister of Industry, Science and Technology.

Statistics Canada. (1995). National Population Health Survey - Questionnaire. Ottawa, ON: Author.

Statistics Canada. (1997). 1996 Census Handbook. Ottawa: Industry Canada.

Statistics Canada. (1999). The Canadian Community Health Survey (CCHS): extending the wealth of health data in Canada. [Announcement posted on the World Wide Web]. Ottawa, ON: Author. Retrieved December 3, 1999 from the World Wide Web: http://www.statcan.ca/english/concepts/health/ccshinfo.htm

Stearns, S.C., Wolfe, B.L., & Kindig, D.A. (1992). Physician responses to fee-for-service and capitation payment. Inquiry, 29, 416-425.

Stineman, M.G., Escarce, J.J., Goin, J.E., Hamilton, B.B., Granger, C.V., & Williams, S.V. (1994). A case-mix classification system for medical rehabilitation. Medical Care, 32, 366-379.

Stineman, M.G., Tassoni, C.J., Escarce, J.J., Goin, J.E., Granger, C.V., Fiedler, R.C., & Williams, S.V. (1997). Development of Function-Related Groups Version 2.0: A classification system for medical rehabilitation. Health Services Research, 32(4)

Stoddart, G.L., & Barer, M.L. (1992). Toward integrated medical resource policies for Canada: Physician remuneration and global expenditure policy. Canadian Medical Association Journal, 147, 33-38.

Stoddart, G.L., & Barer, M.L. (1981). Analyses of demand and utilization through episodes of medical service. In J. Van Der Gaag, M. Perlman (Eds.). Health, Economics, and Health Economics (pp. 149-170). New York. North Holland.

Stoller, E.P. (1982). Patterns of physician utilization by the elderly: A multivariate analysis. Medical Care, 20, 1080-1089.

Tarlov, A.R., Ware,J.E., Greenfield,S., Nelson,E.C., Perrin,E. & Zubkoff, M. (1989). The Medical Outcomes Study: An application of methods for monitoring the results of medical care. Journal of the American Medical Association, 262, 925-930.

Tataryn, D.J., Roos, N.P., & Black, C.D. (1995). Utilization of physician resources for ambulatory care. Medical Care, 33(12 Supplement), DS84-99.

Tenan, P.M., Fillmore, H., Caress, B., Kelly, W.P., Nelson, H., Graziano, D., & Johnson, S.C. (1988). PACs: Classifying ambulatory care patients and services for clinical and financial management. Journal of Ambulatory Care Management, 13(3), 36-53.

Thomas, J.W., & Lichtenstein, R. (1986). Functional health measure for adjusting health maintenance organization capitation rates. Health Care Financing Review, 7(3), 85-95.

Thorne, S. (1994). Queen's approves alternative funding arrangement. Canadian Medical Association Journal, 151, 1637-1638.

Tudor, C.G., Riley, G., & Ingber, M. (1998). Satisfaction with care: Do Medicare HMOs make a difference? Health Affairs, 17, 165-176.

Turner, J.B. (1995). Economic context and the health effects of unemployment. Journal of Health and Social Behavior, 36, 213-229.

Udvarhelyi, I.S., Jennison, K., Phillips, R.S., & Epstein, A.M. (1991). Comparison of the quality of ambulatory care for fee-for-service and prepaid patients. Annals of Internal Medicine, 115, 394-400.

University of Toronto. (1998). Census of Canada, 1996: Profile series. [Announcement posted on the World Wide Web]. Toronto, ON: Author. Retrieved November 23, 1998 from the World Wide Web: http://www.chass.toronto.ca/datalib/cc96/profil96.htm

van de Ven, W.P.M.M., van Vliet, R.C., van Barneveld, E.M., & Lamers, L.M. (1994). Risk-adjusted capitation: Recent experiences in The Netherlands. Health Affairs, 13, 120-136.

van Vliet, R.C.J.A., & van de Ven, W.P.M.M. (1992). Towards a capitation formula for competing health insurers: An empirical analysis. Social Science and Medicine, 34(9), 1035-1048.

van Vliet, R.C.J.A., & van de Ven, W.P.M.M. (1993). Capitation payments based on prior hospitalizations. Health Economics, 2, 177-188.

Vayda, E. (1994). Physicians in health care management: Payment of physicians and organizations. Canadian Medical Assocation Journal, 150, 1583-1588.

Vinson, D.C., Paden, C., & Devera-Sales, A. (1996). Impact of medical student teaching on family physicians' use of time. Journal of Family Practice, 42(3), 243-249.

Wade, J. (1998). The development of a resource-based relative value schedule. Ontario Medical Review, February, 13-17.

Wan, T.T.H., & Soifer, S.J. (1974). Determinants of physician utilization: A causal analysis. Journal of Health & Social Behavior, 15, 100-108.

Ware, J., Brook, R., Rogers, W., Keeler, E., Davies, A., Sherbourne, C., Goldberg, G., Camp, P., & Newhouse, J. (1986). Comparison of health outcomes at a health maintenance organization with those of a fee-for-service care. Lancet, May(1017), 1022

Ware, J.E., Bayliss, M.S., Rogers, W.H., Kosinski, M., & Tarlov, A.R. (1996). Differences in 4-year health outcomes for elderly and poor, chronically ill patients treated in HMO and fee-for-service systems: Results from the Medical Outcomes Study. Journal of the American Medical Association, 276, 1039-1047.

Weiner, J.P., Starfield, B.H., Steinwachs, D.M., & Mumford, L.M. (1991). Development and application of a population-oriented measure of ambulatory care case-mix. Medical Care, 29, 452-472.

Weiner, J.P., Dobson, A., Maxwell, S.L., Coleman, K., Starfield, B., & Anderson, G.F. (1996). Risk-adjusted Medicare capitation rates using ambulatory and inpatient diagnoses. Health Care Financing Review, 17, 77-99.

Weiner, J.P., Tucker, A.M., Collins, A.M., Fakhraei, H., Lieberman, R., Abrams, C., Trapnell, G.R., & Folkemer, J.G. (1998). The development of a risk-adjusted capitation payment system: The Maryland Medicaid model. Journal of Ambulatory Care Management, 21(4), 29-52.

Welch, W.P. (1985). Health care utilization in HMOs: Results from two national samples. Journal of Health Economics, 4, 293-308.

Wells, K.B., Manning, W.G., & Benjamin, B. (1986). Use of outpatient mental health services in HMO and fee-for-service plans: Results from a randomized controlled trial. Health Services Research, 21, 453-474.

Wells, K.B., Hays, R.D., Burnam, M.A., Rogers, W., Greenfield, S., & Ware, J.E. (1989). Detection of depressive disorder for patients receiving prepaid or fee-for-serive care: Results from the Medical Outcomes Study. Journal of the American Medical Association, 262, 3298-3302.

Wells, K.B., Manning, W.G., & Valdez, R.O. (1989). The effects of a prepaid group practice on mental health outcomes of a general population: Results from a randomized trial. Health Services Research, 21, 453-474.

Wen, S.W., Goel, V., & Williams, J.I. (1994). Utilization of health care services by immigrants and other ethnic/cultural groups in Ontario. Toronto, ON: Institute for Clinical Evaluative Sciences in Ontario.

Wexler, H.R. (1999). Negotiations process begins. Ontario Medical Review, 66(10), 9

Wilensky, G.R., & Rossiter, L.F. (1986). Patient self selection in HMOs. Health Affairs, 5, 66-80.

Wilkin, D., & Metcalfe, D.H. (1984). List size and patient contact in general medicine practice. *British Medical Journal, 289*, 1501-1505.

Wilkins, R. (November 1998). Geocodes/PCCF Version 3 User's Guide. Automated geographic coding based on the Statistics Canada postal code conversion files. Health Statistics Division, Statistics Canada. Ottawa.

Williams, J.I., & Young, W. (1996). Inventory of studies of the accuracy of Canadian Health Administrative Databases . (Report No. 96-03). Toronto, ON: Institute for Clinical Evaluative Sciences in Ontario.

Wolfson, M., Rowe, G., Gentleman, J.F., & Tomiak, M. (1993). Career earnings and death: a longitudinal analysis of older Canadian men. Journal of Gerontology: Social Sciences, 47(4), S167-S179

Wolfson, M., Kaplan, G., Lynch, H., Ross, N., & Backlund, E. (1999). Relation between income inequality and mortality: Empirical demonstration. British Medical Journal, 319, 953-957.

Wolinsky, F. (1978). Assessing the effects of predisposing, enabling and illness-morbidity characteristics on health service utilization. Journal of Health and Social Behaviour, 19, 384.

Woodward, C., Hutchison, B., Norman, G., Brown, J., & Abelson, J. (1997). What factors influence primary care physicians' charges for their services? An exploratory study using standardized patients. (Report No.97-05). Hamilton, ON: Centre for Health Economics and Policy Analysis.

Woodward, R.S., & Schnitzler, M.A. (1996). Care-related financial risks assumed by providers: measuring one component of managed care [abstract]. AHSR & FHSR Annual Meeting Abstract Book, 13, 13a

Wynia, M.K., Picken, H.A., & Selker, H.P. (1997). Physicians' views on capitated payment for medical care: Does familiarity foster acceptance? American Journal of Managed Care, 3, 1497-1502.

Yamey, G. (1999). Primary care groups frustrated by variations in funding. British Medical Journal, 319, 1026.

Appendix A: Studies Evaluating the Impact of Fee-For-Service Versus Capitation

Table A1

Comparing the Impact of Fee-For-Service Versus Capitation on Health Service Utilization & Expenditures

Authors	Research Design	Independent Variables	Dependent Variables	Sample Size	Results (Risk-adjusted)
Brown, Clement, Hill, Retchin & Bergeron, 1993	• Summary report of a national, longitudinal, observational, comparison study (Medicare Competition Demonstration)	• Capitated HMO enrollment versus the receipt of care from FFS providers	• Hospital admits • Length of stay • Hospital days per beneficiary • Service intensity • Total provider costs	• 12,000 Medicare beneficiaries	• No significant differences in number of hospital admissions • HMO had significantly shorter hospital stay (i.e., average = 17% less; colon cancer = 18%; stroke = 23%); and significantly less hospital days per 1,000 beneficiaries • HMO enrollees receive less intensive in-patient and post-discharge services (e.g., 50% less home health) • HMO plans spent about 10.5% less
Buchanan, Leibowitz & Keesey, 1996	• Randomized, controlled trial with 2 month follow-up (Medicaid Demonstration Competition Project, Florida)	• Four groups: capitated staff-model HMO (1) self-selected, and (2) randomized versus FFS providers (3) self-selected, and (4) randomized, new beneficiaries	• Probability of use • Probability of hospitalization • Outpatient expenditures • Inpatient expenditures	• Medicaid beneficiaries (*n*=6,500)	• HMO enrollees had significant lower probability of any use, but higher outpatient expenditures • No significant differences in hospital admissions or in-patient expenditures

Authors	Research Design	Independent Variables	Dependent Variables	Sample Size	Results (Risk-adjusted)
Clement, Retchin, Brown & Stegall, 1994	• National, longitudinal, observational, comparison study via 1990 telephone survey (Medicare Competition Demonstration)	• Established capitated HMO sites versus receipt of care from FFS providers	• Likelihood of physician visit, diagnostic procedures, therapeutic intervention, and follow-up	Stratified, random sample of HMO/FFS beneficiaries with joint pain (*n*=2,243/2,009) or chest pain (*n*=556/524)	• HMO enrollees with chest or joint pain are significantly more likely to visit a physician and to receive medication and physiotherapy • HMO enrollees with chest or joint pain are significantly less likely to be referred to a specialist, receive a recommendation for follow-up or have their progress monitored • *Refer to Table XX regarding health outcomes*
Greenfield et al., 1992	• Observational, comparison, multi-site, cross-sectional study (Medical Outcomes Study)	• FFS versus capitated IPA or HMO providers • Controlled for patients', provider, location, setting and design variables	• Self-report hospitalization, time since last physician visit • Tests, procedures, and prescriptions per physician visit • Costs per visit	• 20,000 adults from the general population	• No significant differences in the proportion of patients who received a test per visit, mean financial value of tests per visit, or mean value of tests per patient per year • HMO enrollees significantly higher rate of office visits but fewer tests per physician visit • Solo/single specialty FFS have hospitalization rates 40% higher and were taking 12% more prescriptions than HMO enrollees; but these enrollees have 8% more physician visits per year • Significant interaction effect between payment and organizational features for physician visits and prescriptions

Authors	Research Design	Independent Variables	Dependent Variables	Sample Size	Results (Risk-adjusted)
Greenfield, Rogers, Mangotich, Carney & Tarlov, 1995	• Observational, comparison, multi-site, longitudinal study (2, 4 and 7 years) (Medical Outcomes Study)	• FFS versus capitated IPA or HMO providers • Controlled for patients', provider, location, setting and design variables	• Physiological, functional and health status • Mortality • Summary clinical outcomes index • Summary functional status index	• Patients with hypertension at 2 & 4 years (n=532, 1044) or diabetes at 2 & 4 years (n=170, 317). • Mortality (n=1296)	• No significant differences in medications or physician visits per year for hypertensives or diabetics in capitated or FFS plans • Hypertensives in FFS plans significantly more likely (24%) to be treated by sub-specialist than HMO (2%) or IPA (8%) enrollees
Leibowitz, Buchanan & Mann, 1992	• Randomized, controlled trial for 9 months (Medicaid Demonstration Competition Project, New York)	• Four groups: capitated staff-model HMO (1) self-selected, and (2) randomized versus FFS providers (3) self-selected, and (4) randomized, new beneficiaries	• Likelihood of medical use • Likelihood of in-patient admission • Total ambulatory expenditures • Total in-patient expenditures	• Medicaid beneficiaries (n=4,670)	• HMO enrollees less likely to make use of medical services, to have in-patient admissions, and to cost less ... however, these indicators of lower use are entirely accounted for by selection effects • Those who assigned to HMO but don't enroll are significantly more expensive than enrollees and those who randomly assigned to FFS or the average FFS recipient

Authors	Research Design	Independent Variables	Dependent Variables	Sample Size	Results (Risk-adjusted)
Lurie, Christianson, Finch & Moscovice, 1994	• Randomized, controlled trial (i.e., capitated versus FFS for 1year) (Medicaid Demonstration Evaluation)	• Capitated versus FFS health plans	•Likelihood of physician visit or in-patient admission	• Medicaid recipients who were over 65 years (*n*=800)	• HMO enrollees had a significantly lower likelihood of having a physician visit or in-patient admission relative to FFS beneficiaries
Lurie, Moscovice, Finch, Christianson & Popkin, 1992	• Randomized, controlled trial (i.e., capitated versus FFS for 1 year) with cross-over back to FFS (Medicaid Demonstration Evaluation)	• One of four capitated health plans versus FFS	• Likelihood of outpatient treatment • Likelihood of in-patient admission • In-patient stay • Annual visits	• Chronically, mentally ill Medicaid recipients (*n*=739)	• HMO enrollees significantly less likely to receive outpatient or in-patient chemical dependency treatment, or in-patient admission for physical health problems • HMO enrollees significantly more likely to have shorter in-patient stays, less out-patient care for physical health care or chemical dependency, and fewer annual visits

Authors	Research Design	Independent Variables	Dependent Variables	Sample Size	Results (Risk-adjusted)
Manning, Leibowitz, Goldberg, Rogers & Newhouse, 1984	• Longitudinal, randomized control trial with stratified recruitment and random assignment (RAND Health Insurance Experiment)	• One of four FFS plans with different levels of deductibles and co-payments versus enrollment in a capitated, staff-model HMO	• Number of visits, admissions, hospital days and service intensity per admission or visit • Ambulatory costs using relative value units	• FFS (*n*=431) • HMO (*n*=1,149)	• HMO enrollees has significantly fewer (i.e., 40%) hospital admissions and hospital days • HMO enrollees had significantly more preventative visits • Total cost per enrollee in the capitated group was 28% less than FFS recipients • No significant differences in face-to-face visits • Lower hospitalization rates due to less provision of discretionary care (Refer to Sui et al., 1988).
Mauldon, Leibowitz, Buchanan, Damberg & McGuigan, 1994	• Randomized, controlled trial, 2 month follow-up (Medicaid Competition Demonstration Project, New York)	• Four groups: capitated hospital-based HMO (1) self-selected, and (2) randomized versus FFS providers (3) self-selected, and (4) randomized, new beneficiaries	• Likelihood of a "regular" or check-up visit • Likelihood of an acute care visit • Likelihood of an emergency room visit	• Children in Medicaid households (*n*=1,685)	• No significant differences in primary care visits or emergency room use • HMO enrollees had slightly lower acute care visits • No significant differences in primary or acute care utilization among Medicaid children who had chronic health conditions

Authors	Research Design	Independent Variables	Dependent Variables	Sample Size	Results (Risk-adjusted)
Moscovice, Lurie, Christianson, Finch, Popkin & Akhtar, 1993	• Randomized, controlled trial (i.e., capitated versus FFS for one year) (Medicaid Demonstration Evaluation)	• Capitated versus FFS health plans	• Utilization of inpatient and outpatient services	• Chronically, mentally ill Medicaid beneficiaries (*n*=739)	• No significant differences in the use of inpatient or outpatient services for
Schlenker, Shaughnessy & Hittle (1995)	• National cohort sample, longitudinal, primary data on episode of care	• Medicare beneficiaries who received home health from FFS or capitated HMO providers • HMO either owned a home health agency or contracted services via discounted FFS	• Utilization rates and estimated costs	• Stratified, random national sample of Medicare beneficiaries (*n*=1,260)	• HMO enrollees had significantly lower home health utilization and costs • Significantly lower utilization and cost among beneficiaries who receive care from HMO that own home health versus organizations that purchase this service via discounted FFS • Evidence of higher use of emergency room & outpatient visits among HMO that own home health; may be substitute for lower home health utilization • No evidence of differences in use inpatient care

Authors	Research Design	Independent Variables	Dependent Variables	Sample Size	Results (Risk-adjusted)
Stearns, Wolfe & Kindig, 1992	• One group pre-test post-test design, with 1year follow-up • Control for selection bias: same patients, physicians and health plan benefits	• FFS with transition to a capitated, hospital-based group practice with a reduced fee schedule for specialists	• Utilization and practice patterns • Hospitalization rates, length of stay • Outpatient visits • Primary care visits & referral patterns	• Enrollees (n=1,987) and physicians (n=446)	• Reduction in hospital admits but longer length of stay (no change in severity of admissions) • Higher in-patient charges per stay due to longer length, but overall reduction in hospital expenditures due to reduced admits • Increase in primary care visits from an increase in cross-referrals from other primary care practitioners per enrollee • Decrease intensity per primary care visit • Increase in outpatient clinic services

Authors	Research Design	Independent Variables	Dependent Variables	Sample Size	Results (Risk-adjusted)
Wells, Manning & Benjamin, 1986	• Longitudinal, randomized control trial with stratified recruitment and random assignment (RAND Health Insurance Experiment)	• One of four FFS plans with different levels of deductibles and co-payments versus enrollment in a capitated, staff-model HMO	• Mental health outpatient visits • Imputed costs to assess service intensity per visit	• 3,095 individuals for approximately 9,900 person years	• HMO enrollees had significantly higher probability of outpatient mental health visit • No significant differences in probability of visiting a mental health specialist, but average number of visits by FFS recipients to specialists are three times more than HMO enrollees • FFS recipients significantly more likely to have 11 or more mental health visits • FFS recipients 50 times more likely to visit psychiatrist and psychologist, HMO enrollee three times more likely to visit another therapist • Expenditures per individual are three times higher among FFS enrollees

Note. FFS = fee-for-service; HMO = health maintenance organization; ~ = approximately.

Table A2

Comparing the Impact of Fee-For-Service Versus Capitation on the Quality of Care: Process Indicators and Health Outcomes

Authors	Research Design	Independent Variables	Dependent Variables	Sample Size	Results (Risk-Adjusted)
Brown, Clement, Hill, Retchin & Bergeron, 1993	• National, longitudinal, observational, comparison study via medical records data abstraction (Medicare Competition Demonstration)	• 19 different capitated HMOs versus the receipt of care from FFS providers	• Re-admissions (i.e., 31, 61, 91 days), in-patient complications and mortality	• Medicare beneficiaries with either stroke or colon cancer (*n*=1,200)	• No significant differences in mortality, hospital re-admits or post-admission complications
Clement, Retchin, Brown & Stegall (1994)	• National, longitudinal, observational, comparison study via 1990 telephone survey (Medicare Competition Demonstration)	• Established capitated HMO sites versus receipt of care from FFS providers	• Still experiencing pain symptoms, for those still experiencing ... any reduction in pain after treatment	Stratified, random sample of HMO/FFS beneficiaries with joint pain (*n*=2,243/2,009) or chest pain (*n*=556/524)	• No significant differences in pain experience at follow-up for individuals with joint or chest pain who receive care from HMO or FFS providers • No significant differences in symptom improvement for those with chest pain, but HMO enrollees with joint pain less likely to experience improvements in symptoms

Authors	Research Design	Independent Variables	Dependent Variables	Sample Size	Results (Risk-Adjusted)
Coffey, Moscovice, Finch, Christianson & Lurie, 1995	• Randomized, controlled trial (i.e., capitated versus FFS for one year) (Medicaid Demonstration Evaluation)	• Capitated versus FFS health plans	• Quality of the process of care	• Medicaid recipients who were over 65 years with hypertension (*n*=291) or diabetes (*n*=96)	• No significant differences in type of therapy, access to medications or monthly medication costs
Greenfield, Rogers, Mangotich, Carney & Tarlov, 1995	• Observational, longitudinal (2, 4 and 7 years) comparison study (Medical Outcomes Study)	• FFS versus capitated IPA or HMO providers • Controlled for patients', provider, location, setting and design variables	• Physiological, functional and health status • Mortality • Summary clinical outcomes index • Summary functional status index	• Patients with hypertension at 2 years (*n*=532) & 4 years (*n*=1044) • Patients with diabetes at 2 years (*n*=170) & 4 years (*n*=317). • Mortality (*n*=1296)	• No significant difference in physiological, functional or health status outcomes among individuals who received care from capitated (i.e., IPA & HMO) or FFS providers

Authors	Research Design	Independent Variables	Dependent Variables	Sample Size	Results (Risk-Adjusted)
Lurie, Moscovice, Finch, Christianson & Popkin, 1992	• Randomized, controlled trial (i.e., capitated versus FFS for 1 year) with cross-over back to FFS (Medicaid Demonstration Evaluation)	• Capitated versus FFS health plan	• Self-rating of general health; physical, social, role, and community functioning, as well as change in psychiatric symptoms	• Chronically, mentally ill Medicaid recipients (n=739)	• No significant differences in changes in health status for average Medicaid beneficiary or those with schizophrenia; except HMO enrollees with schizophrenia had greater declines in community functioning
Lurie, Christianson, Finch & Moscovice, 1994	• Randomized, controlled trial (i.e., capitated versus FFS for 1 year) (Medicaid Demonstration Evaluation)	• Capitated versus FFS health plans	• Health and functional status and level of impairment • General health, physical functioning, functional status and physiological measures	• Medicaid recipients who were over 65 years (n=800)	• No significant differences in physical functioning, functional status and physiological measures

Authors	Research Design	Independent Variables	Dependent Variables	Sample Size	Results (Risk-Adjusted)
Mauldon, Leibowitz, Buchanan, Damberg & McGuigan, 1994	• Randomized, controlled trial, 2 month follow-up (Medicaid Competition Demonstration Project)	• Four groups: capitated staff-model HMO (1) self-selected, and (2) randomized versus FFS providers (3) self-selected, and (4) randomized, new beneficiaries	•Likelihood of receiving diagnostic tests during an acute or well care visit	• Children in Medicaid households (n=1,685)	• No significant differences in the content of acute or well care visit
Oleske, Branca, Schmidt, Ferguson & Linn (1998)	• Population-based, non-equivalent control group design. Counties matched based on socio-demographics and proximity	• Receipt of care in a country that offered Medicaid via FFS or capitation	• Pregnancy outcomes including birth weight, delivery method, adverse maternal or child outcomes.	• Deliveries in the FFS group (n=13,453) and the capitated group (n=6,122)	• HMO enrollee had lower likelihood of low-birth-weight infants • No significant differences in other adverse maternal or newborn outcomes

Authors	Research Design	Independent Variables	Dependent Variables	Sample Size	Results (Risk-Adjusted)
Retchin, Clement, Rossiter, Brown, Brown & Nelson, 1992	• Longitudinal, observational, multi-site, comparison study using telephone survey data (Medicare Competition Demonstration)	• Enrollment in an HMO (17 different IPA, staff-model, group-model, and mixed-model) or FFS system in 10 matched communities	• Change in functional status (i.e., binary variable for each basic & instrumental activity of daily living).	• HMO enrollees (n=2,098); and FFS beneficiaries (*n*=1,059)	• No significant differences in likelihood of decline in functional status over the course of one year
Safran, Tarlov & Rogers, 1994	• Observational, cross-sectional, comparison, multi-site, longitudinal study (Medical Outcomes Study)	• FFS versus capitated IPA or HMO providers • Controlled for patients', provider, location, setting and design variables	• Financial & organizational accessibility • Continuity • Comprehensiveness • Coordination • Interpersonal & technical accountability	• 1,208 patients who saw 303 physicians	• HMO & IPA enrollees reported higher financial accessibility, but lower clinical continuity • HMO enrollees reported higher ratings regarding coordination of care than IPA or FFS recipients of care • HMO enrollees reported lower organizational access & comprehensiveness • No significant differences in accountability

Authors	Research Design	Independent Variables	Dependent Variables	Sample Size	Results (Risk-Adjusted)
Schlenker, Shaughnessy & Hittle (1995)	• National cohort sample, longitudinal, primary data on episode of care	• Medicare beneficiaries who received home health from FFS or capitated HMO providers	• Improvement or stabilization of functional status or medical conditions, mortality, and hospitalization	• Stratified, random sample of Medicare beneficiaries (n=1,260)	• Significantly better functional outcomes for FFS beneficiaries in terms of improvement and stabilization of basic activities of daily living • No significant differences in improvement of instrumental activities of daily living
Siu et al., 1988.	Longitudinal, randomized control trial with stratified recruitment and random assignment (RAND Health Insurance Experiment) • Blind review by FFS and HMO physicians of randomly selected hospitalization records	• One of four FFS plans with different levels of deductibles and co-payments versus enrollment in a capitated, staff-model HMO	• Hospital admissions and rates of discretionary and non-discretionary medical and surgical admits • Appropriateness of setting • Medical or clinical appropriateness	• Hospitalized individuals with FFS (n=122) or capitated (n=122) providers	• HMO had significantly lower medical and surgical admissions (45% lower for all admits) • HMO had lower rates of discretionary surgical admissions and discretionary and nondiscretionary medical admissions • No significant differences in non-discretionary surgical admissions

Authors	Research Design	Independent Variables	Dependent Variables	Sample Size	Results (Risk-Adjusted)
Ware et al., 1986	• Longitudinal (i.e., 3 and 5 years), randomized control trial with stratified recruitment and random assignment (RAND Health Insurance Experiment)	• One of four FFS plans with different levels of deductibles and co-payments versus enrollment in a capitated, staff-model HMO	• Physiological health, general health and health habits (13 indices)	• Adults age 62 or older (*n*=1,673)	• No significant differences in health outcomes among FFS recipients with different deductibles and co-payments • No significant differences in 9 of 11 health outcomes between FFS and HMO; but insignificant trends favoured HMO • Low-income HMO enrollees deemed at-risk have significantly higher number of days sick in bed and report more serious symptoms; high-income HMO enrollees deemed at-risk had significantly better health habits relative to FFS recipients
Ware, Bayliss, Rogers, Kosinski & Tarlov (1996)	• Observational, longitudinal (i.e., 4 years), comparison, multi-site, longitudinal study (Medical Outcomes Study)	• FFS versus capitated IPA or HMO providers • Controlled for patients', provider, location, setting and design variables	• General physical and mental health using the SF-36	• Adults from the general population (*n*=2,235)	• No significant differences in changes in health status for the <u>average</u> HMO and FFS patient • Elderly and poor HMO enrollees report significant declines in physical and mental health (twice as likely) • Analysis on data collected at 4 year follow-up explain twice as much variance in health outcomes as the same models at 1 & 2 years

Authors	Research Design	Independent Variables	Dependent Variables	Sample Size	Results (Risk-Adjusted)
Wells, Hays, Burnam, Rogers, Greenfield & Ware, 1989	• Observational, comparison, multi-site, cross-sectional and longitudinal study (Medical Outcomes Study)	• FFS versus capitated IPA or HMO • Sub-group analysis: general practitioners & mental health specialists	• Likelihood of detecting depression in patients with current depressive disorder • Appropriateness of care for depression (i.e., detection and counsel or referral)	• Adults over 62 years of age (*n*=650)	• Individuals who received care from general medical clinicians were less likely to be detected and receive appropriate care for depression if they saw a capitated versus FFS provider • No significant differences in detection or appropriateness of care for depression among individual who saw mental health specialists in capitated or FFS systems

Note. FFS = Fee-for-service; IPA = Independent Practice Association; HMO = health maintenance organizations; SF-36 = Medical Outcomes Study 36-Item Short-Form Health Survey.

Table A3

Comparing the Impact of Fee-For-Service Versus Capitation on Consumer Satisfaction

Authors	Research Design	Independent Variables	Dependent Variables	Sample Size	Results (Risk-Adjusted)
Brown, Clement, Hill, Retchin & Bergeron, 1993	• National, longitudinal, observational, comparison study (Medicare Competition Demonstration) • Threats to validity: non-equivalent groups	• Capitated HMO enrollment versus the receipt of care from FFS providers	• Global satisfaction • Satisfaction with the process and structure care, costs, as well as perceptions of quality and outcomes • Dis-enrollment in first year	• 12,000 Medicare beneficiaries	• No significant differences in overall satisfaction • HMO enrollees significantly less likely to rate their care (process, structure, quality and outcomes) as excellent • HMO enrollees much more likely to rate out-of-pocket costs and coverage as excellent • HMO enrollees more likely to dis-enroll during their first year with a plan

Authors	Research Design	Independent Variables	Dependent Variables	Sample Size	Results (Risk-Adjusted)
Davies, Ware, Brook, Peterson & Newhouse, 1986	Longitudinal, randomized control trial with stratified recruitment and random assignment (RAND Health Insurance Experiment)	• Three groups: (1) FFS recipients, (2) enrollees in a staff-model (i.e., physicians on salary), capitated health plan; and (c) individuals assigned to this capitated plan	• Global satisfaction • Satisfaction with accessibility, availability, cost, quality and continuity of care • Patient Satisfaction Questionnaire*	• Adults over 62 years of age (n=2,023)	• No significant differences in overall satisfaction; but a significantly larger proportion of HMO enrollees are 'dissatisfied' overall relative to FFS recipients • No significant differences in accessibility, except HMO enrollees more satisfied with emergency care and office waits • No significant differences in availability of family doctors; but a significantly larger proportion of HMO enrollees are 'dissatisfied' with the availability of specialists and hospitals • No significant differences in perceived technical quality; but a larger proportion of HMO enrollees are 'dissatisfied' with interpersonal • FFS recipients more satisfied with continuity; HMO enrollees are more satisfied with costs of care

Authors	Research Design	Independent Variables	Dependent Variables	Sample Size	Results (Risk-Adjusted)
Kasper & Riley (1992)	• Observational, comparison study	• Medicare beneficiaries who were enrolled in an HMO or received care from a FFS provider	• Satisfaction with access/quality or cost of care	• Stratified, random sample of HMO enrollees (*n*=302) and FFS recipients (*n*=318)	• No significant differences in overall satisfaction or perceptions of caregiver competence. • Significantly higher levels of satisfaction with access and quality among FFS beneficiaries • Significantly higher levels of satisfaction with cost of care among HMO enrollees
Newcomer, Preston & Harrington (1996)	Cross-sectional, telephone survey.	• Medicare beneficiaries who: (a) were enrolled in a HMO over one year, (b) dis-enrolled, (c) never enrolled, and (d) enrolled after receiving care via FFS. • Controlled for differences in sociol-demographics, site, plan and health status.	• Global satisfaction • Satisfaction with quality of care, interpersonal relations, finances and benefits, access/convenience • Patient Satisfaction Questionnaire*	~ 3000 respondents	• Standardized health plan satisfaction slightly lower among HMO than FFS in all domains except finances and benefits where HMO enrollees are significantly more satisfied. • Levels of satisfaction are similar to those found by Rossiter et al. (1989)

Authors	Research Design	Independent Variables	Dependent Variables	Sample Size	Results (Risk-Adjusted)
Tudor, Riley & Ingber (1998)	• Longitudinal, controlled, national survey	• Enrollment of beneficiaries in HMO versus receipt of care from FFS providers. • Controlled for differences in sociol-demographics, health and functional status, and medical impairment.	Level of satisfaction (5-point scale) in eight dimensions	• HMO enrollees (n=851) and beneficiaries receiving FFS care (n=4,337)	• No significant differences in overall satisfaction between HMO enrollees and FFS beneficiaries • Satisfaction slightly higher among HMO enrollees regarding the cost and convenience of care (i.e., structure of care). • Satisfaction slightly lower among HMO enrollees regarding their perceived competence of physicians (i.e., process of care).
Rossiter, Langwell, Wan & Rivnyak (1989)	• Quasi-experimental design, national, random selection	• Select HMO or FFS care providers	Overall satisfaction. Satisfaction with quality of care, interpersonal relations and access/convenience using the Patient Satisfaction Questionnaire*	• Medicare beneficiaries who enrol in HMOs (*n*=2.091) or with FFS health providers (*n*=1,000)	• No significant differences in overall satisfaction between Medicare beneficiaries who receive care via HMO or FFS providers. • HMO enrollees less satisfied than FFS beneficiaries in the following areas: competence of caregivers and willingness to discuss problems. • HMO enrollees more satisfied with waiting times and claims processing.

Note. d/c = discharge; FFS = fee-for-service; HMO = health maintenance organizations. * Davies, A.R. & Ware, J.E. (1988). *GHAA's Consumer Satisfaction Survey and User's Manual.* Newton, MA: GHAA.

Appendix B: Research Protocol for Submission to Ethics

Proposed Dissertation Study in Family and Community Medicine (FCM-TTH)

Dissertation Project Title

Identifying Capitation Rate Adjusters for Primary Care: A Case Study

Principal Investigator

Diane Watson Landry, PhD Candidate, MBA, BScOT(c)

Doctoral Student in the Department of Health Administration, University of Toronto

Research Coordinator, Department of Rehabilitation Services - TTH

603-5800 ext. 2407

Co-Investigators/Dissertation Supervisors

Dr. Phil Ellison M.D., C.C.F.P., DOHS
Family and Community Medicine - TTH
603-5789

Dr. Anthony Basinski, M.D., PhD
Family and Community Medicine - TTH
Institute for Clinical Evaluative Sciences

Dr. George Pink, PhD
Department of Health Administration
University of Toronto

Dr. Jan Barnsley, PhD
Department of Health Administration
University of Toronto

Background: Capitation has been proposed a funding alternative to stimulate primary care reform. The current capitation rate formula used in Ontario to pay Health Service Organizations adjusts the provincial average per capita rate in the fee-for-service sector by the age and gender mix of a rostered practice. Empirical research that has been conducted in the United States and the Netherlands suggests that this type of formula accounts for less than 1% of the variance in physician resource utilization. The validity of these findings to the Canadian primary care context is unknown. Unless an alternative capitation formula is developed in Ontario, physicians who serve populations who require more/less health services than their age and gender cohort may face under/over payment.

Objective: The purpose of this dissertation research project is to assess the predictive validity of capitation rate adjusters that could be included in a formula to pay for primary care services for adults rostered to a family practice. Independent variables include: demographic, socioeconomic and health status characteristics of patients. These characteristic will be assessed for their ability to predict physician resource utilization. Therefore, the dependent variables will include: annual charges, charges per visit, annual visits and minutes per visit. Control variables: physician characteristics.

Study participants: The study will involve two samples. *Sample 1*: a stratified, random sample of approximately 1200 rostered adults will be surveyed to identify characteristics of these individuals that predict their annual charges, charges per visit and frequency of visits. *Sample 2*: a cross-section of approximately 600 rostered adults will be surveyed to identify determinants of the amount of time they spend with their physician during a visit. To be considered 'rostered' adults must use other primary care providers to a limited extent and this information on 'external use' will be collected from a questionnaire.

***Methods*:** A socio-demographic questionnaire has been completed by all patients who received care at FCM-TTH since early 1997 and the information obtained from this form has been entered into a clinical database at the practice. This questionnaire was modified in early 1998 and all patients who receive care at FCM-TTH now complete a new version of this questionnaire (See attached). This information is used to update the clinical database at the practice. Completion of this questionnaire is now routine practice at FCM-TTH. All subjects in *Sample 1* and *Sample 2* will complete this questionnaire.

A stratified, random sample of subjects (*Sample 1*) will be constructed using the OHIP billing database at FCM-TTH. Subjects in *Sample 1* who have not completed the new version of the questionnaire during a visit to the practice in early 1998 will receive a questionnaire by mail and a cover letter (See attached cover letter). Repeat mailings and a telephone follow-up will be conducted to maximize response rates. The information collected from this questionnaire will be linked with two years of OHIP data (i.e. retrospective data for June 20, 1996 - July 1, 1998) to construct the dependent variables of annual charges, charges per visit and the frequency of annual visits.

Subjects in *Sample 2* will complete this same questionnaire during a visit to the practice during a one month period this summer (i.e. June or July 1998) and this information will be merged with data on the number of minutes these individuals spend with a physician.

Data extraction and analysis: Data will be collected from a questionnaire, Ontario Health Insurance Plan (OHIP) billing information at the practice[1] and Statistics Canada census profiles. ANOVA and post-hoc analyses will be used to identify significant differences in resource utilization for levels of each independent variable. Age and gender will be regressed on each dependent variable; other predictors will then be added one at a time to determine the power of adding any single variable. The step-wise, forward regression procedure will be used to identify the most powerful combination of variables. The 'goodness-of-fit' of the model will be assessed using the R^2 value, predictive ratio and a separate sub-sample (*from Sample 1 and 2*) for cross-validation. Stability will be assessed using two years of OHIP data. Residual analysis will be performed to determine the profile of outliers. The analysis will be repeated after extremely high users have been trimmed from the sample, as capitation contracts typically allow for exclusions.

Consent: Subjects in *Sample 1* will not be asked to sign a consent form as this project will require the compilation and analysis of clinical and administrative billing data routinely collected by FCM-TTH. The only non-routine nature of data collection is the telephone and mail solicitation of this information from individuals who have not visited the practice in early 1998. The data obtained through this telephone/mail process will be used to update the clinical database at the practice. Subjects in *Sample 2* will also complete the questionnaire, but these individuals will be asked to sign a consent form as the recording and analysis of the amount of time these individuals spend with their physician is not routine practice.

As described on the first page of the questionnaire, all patients are told that "we may analyze such information to help us better understand the populations we serve, and perhaps plan special programs." For the purposes of this project the information from the questionnaire will be used to better understand the population served by the practice.

Results: The findings of this research endeavor will be published as a doctoral dissertation at the University of Toronto by Diane Watson Landry. In addition, we expect to write and submit articles to refereed journals in health services research for publication. All patient information will be aggregated.

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[1] Only OHIP billing data from the practice will be used. The entire OHIP record for an individual will not be accessed from the Ministry of Health.

THE TORONTO HOSPITAL

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200 Elizabeth Street
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May 29, 1998

Ms. Diane Watson Landry
ww 2-814C

Dear Ms. Landry:

RE: 98-E065 Identifying Capitation Rate Adjusters for Primary Care

I am pleased to inform you that the above mentioned research protocol has been approved by the Executive of The Toronto Hospital Committee for Research on Human Subjects on 02/06/98.

Best wishes for the successful completion of your project.

Yours sincerely,

ME/bh

(Mrs.) M. Evis
Research Ethics Review Officer
The Toronto Hospital

University of Toronto

OFFICE OF RESEARCH SERVICES

PROTOCOL REFERENCE #3826

July 21, 1998

Dr. G. Pink
Department of Health Administration
McMurrich Building, 2nd Floor
12 Queen's Park Crescent West
University of Toronto

Dear Dr. Pink:

Re: Research protocol entitled "Identifying Capitation Rate Adjusters for Primary Care: A Case Study"

We are writing to advise you that Ms. Janet Beed a member of the Review Panel has granted approval to the above-named research study based on the Toronto Hospital approval.

The approved consent form is attached. Subjects should receive a copy of their consent form.

During the course of the research, any significant deviations from the approved protocol **(that is, any deviation which would lead to an increase in risk or a decrease in benefit to human subjects)** and/or any unanticipated developments within the research should be brought to the attention of the Office of Research Services.

Best wishes for the successful completion of your project.

Yours sincerely,

Susan Pilon
Executive Officer
Human Subjects Review Committee

SP/pp
Enclosure
cc: Prof. P. Leatt, Toronto Hospital, Ms. D. Watson

Appendix C

Simcoe Hall 27 King's College Circle Toronto Ontario M5S 1A1 Telephone 416/ 978-2163 Fax 416/ 971-2010

Department of Family & Community Medicine Letterhead

Family and Community Medicine Consent Form

I have been asked to participate in a study which is designed to assess which patient characteristics influence the amount of time people spend receiving medical care from a physician. I am aware that the study may not benefit me specifically, but that it should enhance the level of knowledge about the reasons why physicians spend more or less time with different patients.

Participation in this study will require that I complete the patient questionnaire (grey form) and that my physician record the approximate amount of time that I spend receiving medical attention during this current visit. I understand that completion of the questionnaire is part of the routine procedures at this practice and that the amount of time that I spend with my doctor will not be altered for the purpose of this study.

I have had the opportunity to discuss this study with my doctor. I have been informed that I can discuss the study with Diane Watson Landry, the researcher who is conducting this study at Family and Community Medicine at The Toronto Hospital. If I have further questions, I may call Dr. Phil Ellison, Family Physician-in-Chief at The Toronto Hospital at 608-5789 or Diane Watson Landry at 603-5800 extension 2407. I may also call Dr. Gordon Hardacre at 603-5681, who is not involved in this study, but who will answer general questions about participating in a research study.

Any information learned about me during this study will be confidential. Neither my name, nor any other personally identifying particulars will appear in any publications or be made available to anyone other than Diane Watson Landry, Dr. Phil Ellison and my health care team at this practice.

I consent to taking part in this study with the understanding that I may withdrawal at any time without prejudice to my treatment. I have been offered a copy of this form.

Dated at Family and Community Medicine at The Toronto Hospital this _______ day of ______________________ 19 ___.

______________________ ______________________

Patient's Name (please print) Patient's signature

____

Witness Signature

______________________ ______________________ ______________________

Name of Person Obtaining Consent Professional Relationship Signature

THE TORONTO HOSPITAL
A University of Toronto Teaching Hospital

Department of Family and Community Medicine
750 Dundas Street West
Toronto, Ontario M6J 3S3

Memorandum

To: Physicians and Residents

From: Phil Ellison
Diane Watson, Doctoral Student, UofT

Date: July 6, 1998

Re: Research Project – Commencement Date: July 13, 1998

On Monday, July 13, 1998 we will be requesting your assistance in data collection for a research project entitled "*Identifying Capitation Rate Adjusters for Primary Care: A Case Study*".

The purpose of this study is to assess the predictive validity of capitation rate adjusters that could be included in a formula to pay for primary care services for adults rostered to a family practice. This portion of the project will require an assessment of the patient characteristics that influence their use of physician resources. We will be linking data collected from patients on the registration form (re: socio-demographic and health status) with information on how much time patients spend receiving medical services.

Commencing July 13 all adult (≥16 years) patients, whose designated primary provider is listed below, will have a bright pink sticker attached to their 'Service Encounter Form' (see attached).

Berry	Ellison	Lyon	Stubbs
Bloom	Evans	Oandasan	Watson
Davis	Hardacre	Shafir	

Please record the total amount of time of medical services that provided to <u>each</u> individual, by checking the appropriate box on the encounter form. Medical services refers to the amount of time any physician or resident has spent directly with patients as well as indirect time (charting, etc.). Services can be provided by any resident or physician, as this information is also recorded directly on the encounter form.

If you have any questions regarding the study, please call Diane Watson at 340-4800 ext. 6977. We will also have a research assistant on site during the course of this project; Karen Atkin's temporary office is located in the library. Messages for Karen can be left with Sharon.

TGH FAMILY PRACTICE SERVICE ENCOUNTER FORM

DATE:

REMINDERS:
CHECK BLOOD PRESSURE

PHYSICIAN:	PATIENT:
DATE OF LAST VISIT:	TTH NUMBER:
DATE OF LAST COMPLETE:	HEALTH NUMBER:
PRIMARY PROVIDER:	TIME: LENGTH:
	REASON:

SERVICE CODE:

A001A	Minor Assessment	$16.25	K002A	Interv/Rel.	$47.30
A003A	Gen/Annual/AHE	$48.20	K004A	Psych Family	$51.40
A004A	Gen. Re-assessment	$28.10	K007A	Psych Therapy	$47.30
A007A	Interm Assess/WBV	$24.80	K013A	Counselling	$47.30
A008A	Mini Assess Only	$ 7.50	K015A	Couns/Relative	$47.30
A901A	Housecall Assess	$38.25	K017A	AHE/Child	$27.80
A903A	Pre-Op	$48.20	K990A	Premium Day	$16.70
G002A	Accucheck	$ 1.80	K991A	Each Additional	$ 9.50
G004A	Occult Blood	$ 1.40	K992A	Emergency Call	$33.40
G010A	Urinalysis.	$ 1.70	K993A	Each Additional	$14.30
G212A	Allergy Shot	$ 8.25	K994A	Nights/S/S/H	$33.40
G271A	Anticoag Supervision 1Mo	$ 9.75	K995A	Each Additional	$14.30
Z176A	5cm Laceration	$13.60	P003A	Prenatal Major	$48.20
G365A	Pap Smear	$ 4.10	P004A	Prenatal Care	$18.70
G370A	Aspr'n/Joint	$18.30	Z116A	Biopsy(s)	$13.50
G372A	IM/SC/Visit	$ 2.10	Z117A	Chem/Cryotherapy	$10.20
G373A	IM/SC/Only	$ 4.90	Z118A	Aspr'n Cytology	$26.00
G378A	Insertion of IUD	$19.70	Z122A	Ex/Single/Face	$29.60
G420A	Ear Syring	$ 5.20	Z139A	Aspr'n Cyst	$23.10
G462A	O/Polio Vac.	$ 1.50	Z141A	Needle Biopsy	$23.10
G480A	Veni/Infant [Heel Prick]	$ 8.50	Z153A	Debrid/Dressing	$12.90
G482A	Veni/Child	$ 5.80	Z156A	Exis/Sut/One	$13.60
G489A	Veni/Adult	$ 2.10	Z157A	Exis/Sut/Two	$20.40
G528A	Micro Tymp	$ 1.60	Z158A	Exis/Sut/Three	$34.00
G538A	Immuniz/Visit	$ 3.55	Z535A	Sigmoid	$33.90
G539A	Immunization	$ 8.00	Z543A	Anoscopy/Proctos	$ 5.40
H001A	Newborn Care	$47.80	Z719A	Endomet/Biopsy	$18.50
____	____________			No. Services ______	

DIAGNOSIS:

706	Acne/Sebaceous Cyst	477	All. Rhin./Hay Fever
250	Diabetes	300	Anxiety
493	Asthma	466	Bronchitis
727	Bursitis/Synovitis	460	Common Cold
599	UTI	311	Depression
691	Eczema	895	Family Planning
401	Hypertens.-Essential	412	CAD
781	MSK Symptoms NYD	278	Obesity
616	Vaginitis	496	COPD
078	Warts Non-venereal	916	Well Baby Care
917	Annual Health	715	Osteoarthritis
____	____________		

- ☐ Ineligible
- ☐ Declines
- ☐ Consents

VISIT MINUTES
- ☐ 10 or less
- ☐ 11-15
- ☐ 16-20
- ☐ 21-25
- ☐ 26-30
- ☐ 31 or more

____________	____________	____________
Clinical Clerk	Resident	Staff Physician

THE TORONTO HOSPITAL
A University of Toronto Teaching Hospital

Family and Community Medicine

TO OUR PATIENTS:

<u>This letter is to explain why we are requesting that you complete the remainder of our registration form</u>.

We believe that it is important to understand your health in the context of the circumstances in which you live. For example, your health could be affected by social factors, such as employment and housing status. Your understanding of health and illness may be influenced by your cultural background. You may have difficulty with some of the health education materials we hand out, if you are not comfortable in using English.

The information that you provide becomes part of your medical record. It is confidential between you and your health care team, just as is any medical information in your record. We may analyze such information to help us better understand the populations we serve, and perhaps plan special programs. If so, any grouping of the information we do will not include your identification.

We therefore ask that you complete this form. We appreciate your cooperation.

If you have any further questions or comments that you wish to share, please contact me.

Yours very truly,

P. A. Ellison. M.D., C.C.F.P., DOHS
Family Physician-in-Chief

THE TORONTO HOSPITAL
A University of Toronto Teaching Hospital

Family and Community Medicine
750 Dundas St. W.,
Toronto, Ontario M6J 3S3

PATIENT REGISTRATION RENEWAL

Name

Title Last	First	Initial

Birth date **Sex**

Day	Month	Year	Male [] Female []

Address

Street	Apt No.
City	Province
Postal Code	

Telephone Numbers

Home ( )-	Bus. ( )-
Fax ( )-	Pharmacy ( )-

Out of Province Health Number (if appropriate)

Number	Province

Emergency Contact:

Name	Relationship- Relative [] Friend []
Home Phone ( )-	Bus. Phone ( )-

Ontario Health Card Number **Version Code**

Please bring your health card to <u>every</u> visit.

Marital Status

Single []	Married/Partnered []	Divorced/Separated []	Widowed []
Other (specify) -			

Are you a single parent with dependent children? Yes [] No []

What is your country of birth?
What is the country of your Mother's birth?

Language Spoken in Your Home-

How long have you lived at your present address?

0 - 3 months []	6 - 12 months []	3 - 4 years []
4 - 6 months []	1 - 2 years []	5 + years []

What type of housing are you currently living in?

Single house []	Rented room/hotel []	University residence []
Duplex/townhouse []	Seniors' residence []	No residence []
Apartment []	Group home/hostel []	
Other (specify)-		

Including yourself, how many adults (14 years and older) live at home? [ ]
How many children (13 years and younger) live in your home? [ ]

What level of schooling have you completed (approximately)?

None []	Secondary (10-12 yrs) []	University []
Primary (1-9 Yrs) []	Community College []	Postgraduate []

What was your main activity during the past year? (check one only)

Working full time []	Looking for work []	Keeping house []
Working part time []	Going to school []	Retired []
Unable to work []	Other (specify) -	

If you have a job, please name it, and describe briefly what you do.

Job title -
Description -

The following information helps us understand your general state of health at the time of joining our practice group:

In general, would you say your health is......

Excellent [ ] Very Good [ ] Good [ ] Fair [ ] Poor [ ]

Do you have any long-term disabilities or handicaps? By long term I mean a condition that has lasted or is expected to last more than 6 months?
Yes [ ] No [ ]

Are you limited in the kind or amount of activity you can do because of a long term physical condition, mental condition or health problem?
Yes [ ] No [ ]

In the next 12 months, do you expect to visit this clinic every time that you need to see a family doctor? Yes [ ] No [ ]

In the past 12 months, how many times have you visited a family doctor who does not work at this clinic?

0 Visits [ ] 1 Visit [ ] 2 Visits [ ] 3 or more Visits [ ]

Were you admitted to a hospital during the past 12 months?

Yes [ ] How many times? ________

No [ ]

If yes, in total how many nights did you spend in a hospital during the past 12 months? ________ nights

Thank you for completing this form. It remains confidential to your health record.

Department of Family & Community Medicine Letterhead

<Date>

<Name>
<Address>
<City, Ontario>
<Postal Code>

Dear <Name>

We are updating your medical record at your Family Doctor's office at the Department of Family and Community Medicine at The Toronto Hospital - Western Division. This letter is to explain why we are requesting that you update your record with this information.

We believe that it is important to understand your health in relation to your lifestyle, and the circumstances in which you live. For example, your health could be affected by social factors, such as employment and housing status. Your understanding of health and illness may be influenced by your cultural background. You may have difficulty with some of the health education materials we hand out, if you are not comfortable using English.

The information that you provide becomes part of your health record. It is confidential between you and your health care team, just as is any medical information in your record. We may analyze such information to help us better understand the populations we serve, and perhaps plan special programs. If so, any grouping of the information we do will not include your identification.

We therefore ask that you complete this form and return it to us in the enclosed envelope. If you have completed an earlier version of this form, please notice that there are new questions. Please complete and return this new form.

We appreciate your cooperation. If you have any further questions or comments that you wish to share, please contact me at 603-5789 or Diane Watson at 340-4800 extension 6977.

Yours very truly,

P. A. Ellison, M.D.,
Family Physician-in-Chief

Appendix I: Descriptive Profiles

Table I1

Social/Demographic/Health Profile of Participants

	Medical Minutes Study (n = 550)		Visit/Payment Study (n = 659)	
	People (#)	Proportion of Participants (%)	People (#)	Proportion of Participants (%)
Age				
16 - 30 years	74	13.5	98	14.9
31 - 45 years	153	27.8	189	28.7
46 - 65 years	194	35.3	228	34.6
66 - 75 years	74	13.5	102	15.5
> 76 years	55	10.0	42	6.4
Gender				
Male	199	36.2	277	42
Female	351	63.8	382	58
Marital Status				
Single	140	28.7	168	25.9
Married/Partner	225	52.3	384	59.2
Divorced/Separated	50	10.2	50	7.7
Widowed	41	8.4	46	7.1
Other	2	.4	1	.2
Family Structure				
Adults at Home				
Live alone	153	31.5	170	26.1
2	211	43.4	309	47.4
3	62	12.8	97	14.9
4	38	7.8	46	7.1
≥5	22	4.5	30	4.6
Education				
None	6	1.2	8	1.2
Primary (1-9 yrs)	43	8.7	50	7.6
Secondary (10-12 yrs)	125	25.4	134	20.4
Community College	85	17.2	123	18.7
University	142	28.8	192	29.2
Postgraduate	92	18.7	150	22.8

	Medical Minutes Study (*n* = 550)		Visit/Payment Study (*n* = 659)	
	People (#)	Proportion of Participants (%)	People (#)	Proportion of Participants (%)
Main Activity*				
Working Full-time	212	43.1	328	49.9
Working Part-time	59	12.0	55	8.4
Unable to work	35	7.1	25	3.8
Looking for work	10	2.0	8	1.2
Going to school	29	5.9	29	4.4
Keeping house	33	6.7	51	7.8
Retired	107	21.7	151	23
Other	7	1.4	10	1.5
Country of Birth				
Born in Canada	322	64.5	404	62.0
Born in other country	177	35.5	248	38.0
Language Spoken at Home				
English	443	89.7	591	90.5
Other	51	10.3	62	9.5
Health Status				
Poor	20	4.9	22	3.4
Fair	65	16	77	11.7
Good	134	33	202	30.8
Very good	123	30.3	220	33.5
Excellent	64	15.8	135	20.6
Disability Status				
Long term disability	141	35.2	206	31.5
No disability	260	64.8	449	68.5
Activity Limitations				
Limitations	133	32.7	167	25.5
No limitations	274	67.3	487	74.5
Hospital Admissions				
0	356	87.3	576	87.5
1	39	9.6	61	9.3
2	10	2.5	15	2.3
3 or more	3	.7	6	.9

	Medical Minutes Study ($n = 550$)		Visit/Payment Study ($n = 659$)	
	People (#)	Proportion of Participants (%)	People (#)	Proportion of Participants (%)
Time in Hospital				
1 - 3 days	16	36.4	27	42.9
4 - 6 days	11	25.0	15	23.8
7 - 9 days	4	9.1	6	9.5
10 or more days	13	29.5	15	23.8
External Use				
0 visits	263	65.6	536	81.3
1 visit	61	15.2	74	11.2
2 visits	38	9.5	49	7.4
3 or more visits	39	9.7	Excluded	Excluded

Table I2

Measures Derived from Census Data by Population

Measure	Medical minutes study Mean (Range)	Visit/Payment Study Mean (Range)	Toronto	Ontario
	Population			
Predisposing				
Proportion of census families with now-married and common-law partners (%)	82.75 (65-95)	83.24 (65-95)	68.22	85.6
Proportion of female lone-parent families (%)	14.78 (4-32)	14.34 (4-32)	13.21	12.11
Proportion of the population (15 years and over) whose highest level of education was Grade 13 or less (%)	40.24 (13-67)	39.07 (16-67)	44.36	47.65
Proportion of population that are immigrants (%)	43.76 (10-72)	42.57 (10-72)	43.12	26.29
Proportion of population that are recent immigrants (i.e., 1991-1996) (%)	10.2 (0-30)	9.82 (0-30)	10.42	5.29

Measure	Medical minutes study Mean (Range)	Visit/Payment Study Mean (Range)	Toronto	Ontario
<u>Enabling</u>				
Proportion of population with English as home language (%)	70.97 (37-98)	72.45 (37-98)	72.70	82.43
<u>Community-Level Enabling</u>				
Government transfer payments as proportion of total income (%)	12.18 (3.2-23.3)	11.62 (3.2-23.4)	10.4	12.5
Average value of dwelling ($) (range)	266,470 (132,466-584,789)	276,046 (129,097-584,789)	238,511	177,409
Average income ($) (15 years and older)	31,482 (18,504-77,241)	32,720 (17,153-77,241)	28,980	27,309
Median income ($) (15 years and older)	22,936 (12,508-281,189)	23,222 (12,508-40,072)	21,694	20,678
Average census family income ($)	69,994 (34,026-197,284)	73,460 (34,026-197,284)	64,044	59,830
Median census family income ($)	53,766 (26,473-114,854)	56,016 (26,473-114,845)	52,959	51,520
Average household income ($)	58,982 (30,889-136,539)	61,154 (30,889-136,539)	60,110	54,291

Measure	Medical minutes study Mean (Range)	Visit/Payment Study Mean (Range)	Toronto	Ontario
Median household income ($)	43,964 (21,444-85,577)	45,254 (21,444-85,577)	48,618	45,155
Incidence of low income of population in private households (%)	25.54 (4.8-53.4)	24.12 (5.9-53.4)	21.1	17.7
Unemployment rate (%) (total population)	9.62 (3.5-17.6)	9.18 (1.6-18.8)	9.1	9.1
Female labour force (15 years and older) participation rate (%)	61.05 (50.7-77.8)	61.31 (50.7-82.2)	61.3	60

Table I3

Resource Utilization by Population Characteristics

	Visit/Payment Study (n = 659)					Medical Minutes Study (n=550)	
	n	Visited at Least Once		Mean Visits per Annum (#)*	Mean Annual OHIP Payment ($)	n	Medical Services per Visit † (minutes)
		#	% of Cohort				
Predisposing Characteristics							
Age (years)							
16 - 30	98	88	90	3.64	125.69	74	22.39
31 - 45	189	150	79	4.10	140.71	153	20.68
46 - 65	228	204	89	4.17	118.29	194	19.57
66 - 75	102	97	95	5.29	141.97	74	17.32
> 76	42	40	95	6.40	160.41	55	17.91
Gender							
Male	277	238	86	4.24	113.08	199	18.80
Female	382	341	89	5.89	146.01	351	20.35
Marital Status							
Single	168	149	89	4.94	174.98	140	20.43
Married/partner	384	334	87	3.82	106.99	255	19.61
Divorced/separated	50	45	90	5.42	173.06	50	19.90
Widowed	46	42	91	6.48	153.46	41	19.46
Other	1	0	0	0	N/A	2	23.00
Single, divorced/separated, widowed or other	265	236	89	5.31	170.22	233	20.17
Married/partnered	384	334	87	3.82	106.99	255	19.61

Note. Sample sizes for each group may not equal the number of participants in each study due to missing data. * Frequency of annual visits among individuals who visited at least once. † The mean amount of time physicians spent providing medical services was calculated by assigning each patient participant a value equal to the mid-point of their assigned time interval, summing these values for all individuals in a group, and dividing the sum by the number of people in each group. N/A = Not applicable.

	Visit/Payment Study (n = 659)					Medical Minutes Study (n=550)	
	n	Visited at Least Once		Mean Visits per Annum (#)*	Mean Annual OHIP Payment ($)	n	Medical Services per Visit † (minutes)
		#	% of Cohort				
Adults at home							
Lives alone	170	157	92	5.18	180.50	153	19.99
2 adults	309	261	84	4.23	116.16	211	19.47
3 adults	97	85	88	3.86	102.39	62	20.74
4 adults	46	41	89	4.20	130.06	38	20.50
≥5 adults	30	28	93	3.93	118.37	22	21.18
Lives alone	170	157	92	5.18	180.50	153	19.99
Not live alone	482	415	86	4.13	115.05	333	19.94
Education							
None	8	8	100	6.75	223.15	6	14.67
Primary (1-9 years)	50	47	94	6.09	172.86	43	17.53
Secondary (10-12 years)	134	114	85	5.99	178.34	125	19.44
Community College	123	107	87	4.50	139.29	85	20.29
University	192	171	89	3.53	103.54	142	20.39
Postgraduate	150	128	85	3.33	104.60	92	21.10
Secondary or less	192	172	90	6.05	178.78	174	28.80
Post-secondary	465	406	87	3.72	133.34	319	20.57
Main Activity							
Working Full-time	328	277	84	3.29	95.04	212	20.57
Working Part-time	55	49	89	3.53	115.80	59	22.75
Unable to work	25	23	92	11.13	446.64	35	19.29
Looking for work	8	8	100	4.63	177.24	10	19.00
Going to school	29	26	90	3.54	109.01	29	23.52
Keeping house	51	43	84	5.51	169.31	33	18.00
Retired	151	143	95	5.54	145.19	107	17.39
Other	10	8	80	6.00	305.17	7	15.86
Working	383	326	85	3.33	98.02	271	21.04
Unable/Looking	33	31	94	9.45	381.33	45	19.22
Other	241	220	91	5.31	152.58	176	18.45
Born in Canada							
Yes	404	350	87	4.21	125.15	322	20.28
No	248	223	90	4.81	146.36	177	18.82

	Visit/Payment Study (n = 659)					Medical Minutes Study (n=550)	
	n	Visited at Least Once		Mean Visits per Annum (#)*	Mean Annual OHIP Payment ($)	n	Medical Services per Visit † (minutes)
		#	% of Cohort				
Enabling Resources							
English as home language							
Yes	591	518	88	4.25	130.31	443	20.10
No	62	56	90	5.95	155.54	51	18.00
Need Characteristics							
Health Status							
Poor	22	21	95	10.48	287.17	20	19.25
Fair	77	70	91	7.63	228.62	65	19.77
Good	202	185	92	4.77	141.44	134	19.08
Very good	220	194	88	3.27	106.93	123	21.29
Excellent	135	108	80	2.62	81.33	64	22.22
Disability Status							
Long-term disability	206	188	91	6.43	196.22	141	19.24
No long-term disability	449	387	86	3.42	102.57	260	20.96
Activity Limitations							
Limitations	167	153	92	6.96	208.97	133	19.62
No limitations	487	421	86	3.47	105.53	274	20.76
Hospital Admissions							
No admit in past 12 months	576	500	87	4.00	113.33	356	20.56
Admitted in past 12 months	82	78	95	6.22	203.91	52	19.63
No admissions	576	500	87	4.00	113.33	356	20.56
1 admission	61	59	97	5.37	174.83	39	18.13
2 admissions	15	14	93	8.36	316.92	10	24.50
3 or more admissions	6	5	83	10.20	216.96	3	23.00
No admission	576	500	87	4.00	113.33	356	20.56
1 admission	61	59	97	5.37	174.83	39	18.13
2 or more admissions	21	19	90	8.84	288.36	13	24.15

	Visit/Payment Study (n = 659)					Medical Minutes Study (n=550)	
	n	Visited at Least Once		Mean Visits per Annum (#)*	Mean Annual OHIP Payment ($)	n	Medical Services per Visit † (minutes)
		#	% of Cohort				
Time in Hospital							
No nights	577	501	87	4.13	121.98	506	19.77
1 - 3 nights	46	44	96	4.30	143.03	16	19.25
4 - 6 nights	15	15	100	7.93	299.42	11	19.82
7 - 9 nights	6	6	100	7.50	200.27	4	16.75
10 or more nights	15	14	93	10.0	296.52	13	22.23
No nights	577	501	87	4.13	121.98	506	19.77
1 - 9 nights	67	64	96	5.39	183.17	31	19.13
10 or more nights	15	14	93	10.0	296.52	13	22.23
Prior Year Primary Care Use							
0 - 5 visits	506	430	85	2.90	82.54	N/A	N/A
≥ 6 visits	153	149	97	8.77	296.29	N/A	N/A
0 - 2 visits	334	276	83	2.49	71.82	N/A	N/A
3 - 5 visits	172	154	90	3.66	103.37	N/A	N/A
6 - 8 visits	63	62	98	5.50	178.23	N/A	N/A
≥9 visits	90	87	97	11.09	5101.20	N/A	N/A

Note. Sample sizes for each group may not equal the number of participants in each study due to missing data. * Frequency of annual visits among individuals who visited at least once. † The mean amount of time physicians spent providing medical services was calculated by assigning each patient participant a value equal to the mid-point of their assigned time interval, summing these values for all individuals in a group, and dividing the sum by the number of people in each group. N/A = Not applicable.

	Visit/Payment Study (*n* = 659)					Medical Minutes Study (*n*=550)	
	n	Visited at Least Once		Mean Visits per Annum (#)*	Mean Annual OHIP Payment ($)	*n*	Medical Services per Visit † (minutes)
		#	% of Cohort				
Individual Provider-Related Characteristics							
Primary Provider							
1	47	41	87	6.44	169.83	N/A	N/A
2	22	20	91	4.05	100.97	N/A	N/A
3	41	40	98	5.83	186.41	N/A	N/A
4	63	58	92	4.47	129.81	N/A	N/A
5	70	57	81	4.51	99.58	N/A	N/A
6	140	126	90	3.17	93.34	N/A	N/A
7	67	56	84	3.61	128.56	N/A	N/A
8	47	41	87	4.90	120.86	N/A	N/A
9	19	16	84	6.19	204.56	N/A	N/A
10	86	71	83	3.70	102.43	N/A	N/A
11	57	53	93	5.58	247.55	N/A	N/A
Physician Seen							
1	N/A	N/A	N/A	N/A	N/A	22	17.09
2	N/A	N/A	N/A	N/A	N/A	24	22.17
3	N/A	N/A	N/A	N/A	N/A	35	19.29
4	N/A	N/A	N/A	N/A	N/A	63	16.89
5	N/A	N/A	N/A	N/A	N/A	72	20.71
6	N/A	N/A	N/A	N/A	N/A	69	20.54
7	N/A	N/A	N/A	N/A	N/A	64	20.27
8	N/A	N/A	N/A	N/A	N/A	44	16.41
9	N/A	N/A	N/A	N/A	N/A	30	20.66
10	N/A	N/A	N/A	N/A	N/A	59	17.92
11	N/A	N/A	N/A	N/A	N/A	33	27.85
Resident 1	N/A	N/A	N/A	N/A	N/A	2	10.50
Resident 2	N/A	N/A	N/A	N/A	N/A	7	23.00
Resident 3	N/A	N/A	N/A	N/A	N/A	1	18.00
Resident 4	N/A	N/A	N/A	N/A	N/A	2	25.50
Resident 5	N/A	N/A	N/A	N/A	N/A	1	13.00
Resident 6	N/A	N/A	N/A	N/A	N/A	1	33.00
Resident 7	N/A	N/A	N/A	N/A	N/A	3	16.33
Resident 8	N/A	N/A	N/A	N/A	N/A	4	14.25
Resident 9	N/A	N/A	N/A	N/A	N/A	2	33.00
Resident 10	N/A	N/A	N/A	N/A	N/A	2	33.00
Resident 11	N/A	N/A	N/A	N/A	N/A	4	21.75
Resident 12	N/A	N/A	N/A	N/A	N/A	1	33.00
Resident 13	N/A	N/A	N/A	N/A	N/A	1	23.00
Resident 14	N/A	N/A	N/A	N/A	N/A	4	18.00

	Visit/Payment Study (*n* = 659)					Medical Minutes Study (*n*=550)	
	n	Visited at Least Once		Mean Visits per Annum (#)*	Mean Annual OHIP Payment ($)	*n*	Medical Services per Visit † (minutes)
		#	% of Cohort				
Other							
External Use							
0 visits	536	476	89	4.57	139.53	N/A	N/A
1 visit	74	66	89	3.53	101.37	N/A	N/A
2 visits	49	37	76	3.92	98.19	N/A	N/A

Figure I4

Frequency Distribution of Prior Visits (n = 659)

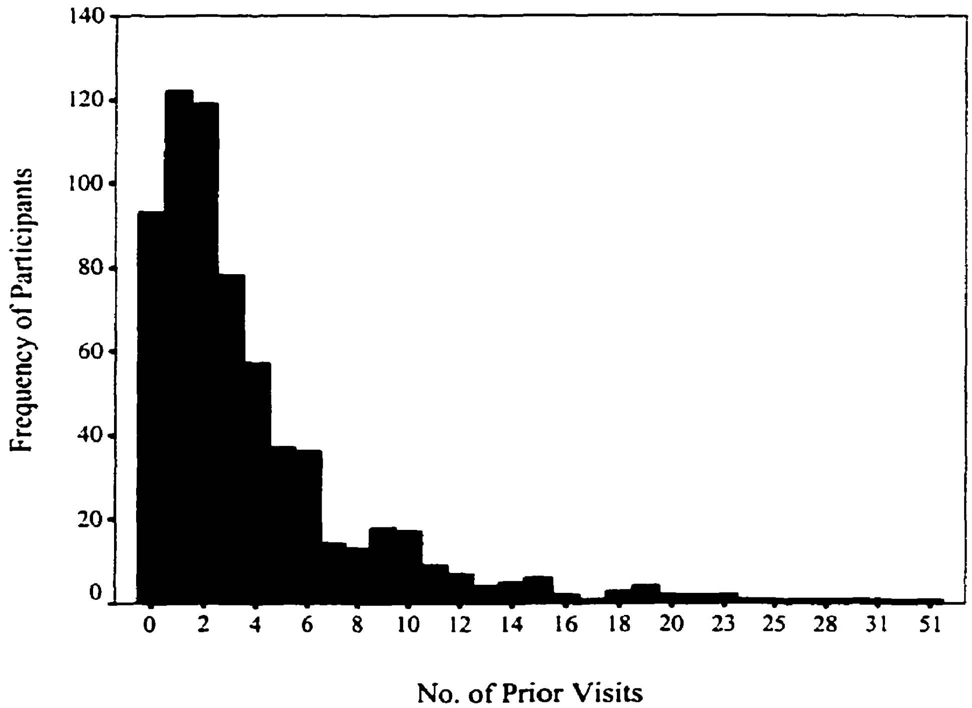


Table I5

Cumulative Frequency Table of Prior Visits (n = 659)

No. Visits (Year 1)	Frequency	Percent	Valid Percent	Cumulative Percent
0	93	14.1	14.1	14.1
1	122	18.5	18.5	32.6
2	119	18.1	18.1	50.7
3	78	11.8	11.8	62.5
4	57	8.6	8.6	71.2
5	37	5.6	5.6	76.8
6	36	5.5	5.5	82.2
7	14	2.1	2.1	84.4
8	13	2.0	2.0	86.3
9	18	2.7	2.7	89.1
10	17	2.6	2.6	91.7
11	9	1.4	1.4	93.0
12	7	1.1	1.1	94.1
13	4	.6	.6	94.7
14	5	.8	.8	95.4
15	6	.9	.9	96.4
16	2	.3	.3	96.7
17	1	.2	.2	96.8
18	3	.5	.5	97.3
19	4	.6	.6	97.9
20	2	.3	.3	98.2
22	2	.3	.3	98.5
23	2	.3	.3	98.8
24	1	.2	.2	98.9
25	1	.2	.2	99.1
26	1	.2	.2	99.2
28	1	.2	.2	99.4
29	1	.2	.2	99.5
31	1	.2	.2	99.7
38	1	.2	.2	99.8
51	1	.2	.2	100.0
Total	659	100.0	100.0	

Appendix J: Multicollinearity Assessment

Table J1

Cross-Tabulation between Marital Status and Number of Adults in the Home

		Number of adults in the home		Total
		Lives alone	Not live alone	
Marital status	Single, divorced, separated, widowed or other	149	110	259
	Married/partnered	17	366	383
Total		166	476	642

Note. Phi and Cramer's V = .595 p <.001.

Table J2

Cross-Tabulation of Education status and Work Status

		Work Status			Total
		Working	Unable to work or looking for work	Other	
Educational status	Secondary school or less	71	13	108	192
	Post-secondary education	312	19	132	463
Total		383	32	240	655

Note. Phi and Cramer's V = .282 p <.001.

Figure J3

Pearson Correlations Between Measures of Health and Disability Status: Visit/Payment Study

	Health Status	Disability Status	Activity Limitations	Prior Visits†
Health Status	-	.451**	.504**	-0.334
Disability Status	.451**	-	.684**	-0.274
Activity Limitations	.504**	.684**	-	-0.267
Prior Visits†	-0.334	-0.274	-0.267	-

Note. ** Correlation is significant at the .001 level (2-tailed). † = measured using four categories.

Figure J4

Pearson Correlations Between Measures of Health and Disability Status: Cross-Sectional Study

	Health Status	Disability Status	Activity Limitations
Health Status	-	.504**	.513**
Disability Status	.504**	-	.687**
Activity Limitations	.513**	.687**	-

Note. ** Correlation is significant at the .001 level (2-tailed).

Figure J5

Pearson Correlations Between Measures of Hospital Utilization: Random Sample Study

	Hospital admissions (Yes/No)	Hospital admissions	Time in hospital
Hospital admissions (Yes/No)	-	.937**	.944**
Hospital admissions	.937**	-	.936**
Time in hospital	.944**	.936**	-

Note. ** Correlation is significant at the .001 level (2-tailed).

Figure J6

Pearson Correlations Between Measures of Hospital Utilization: Cross-Sectional Study

	Hospital Admission (Yes/No)	Hospital admissions	Time in hospital
Hospital Admission (Yes/No)	-	.938**	.835**
Hospital admissions	.938**	-	.835**
Time in hospital	.835**	.835**	-

Note. ** Correlation is significant at the .001 level (2-tailed).

Figure J7

Pearson Correlations* Between Measures of Economic Climate and Relative Wealth: Visit/Payment Study (n = 656)

		(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)
Government transfer payments %	(A)	-	-0.82	-0.87	-0.79	-0.84	0.77	-0.81	-0.77	-0.64	-0.77	0.888
Average income $	(B)	-0.82	-	0.93	0.99	0.96	-0.70	0.94	0.71	0.88	0.471	-0.79
Median income $	(C)	-0.87	0.93	-	0.89	0.94	-0.80	0.89	0.81	0.70	0.588	-0.89
Average census family income $	(D)	-0.79	0.99	0.89	-	0.96	-0.70	0.95	0.70	0.91	0.432	-0.76
Median census family income $	(E)	-0.84	0.96	0.94	0.96	-	-0.90	0.97	0.84	0.81	0.482	-0.85
Incidence of low income of population in private households (%)	(F)	0.77	-0.72	-0.83	-0.72	-0.85	-	-0.83	-0.92	-0.51	-0.47	0.886
Average income of all private households ($)	(G)	-0.81	0.94	0.89	0.95	0.97	-0.80	-	0.87	0.83	0.41	-0.8
Median income of all private households ($)	(H)	-0.77	0.71	0.81	0.70	0.84	-0.90	0.87	-	0.49	0.432	-0.8
Average value of dwelling ($)	(I)	-0.64	0.88	0.70	0.91	0.81	-0.50	0.83	0.49	-	0.279	-0.58
Female labor force participation rate	(J)	-0.77	0.47	0.59	0.43	0.48	-0.50	0.41	0.43	0.28	-	-0.63
Unemployment rate	(K)	0.89	-0.79	-0.89	-0.76	-0.85	0.89	-0.80	-0.80	-0.58	-0.63	-

Note. * All correlations are significant at the .001 level (2-tailed).

Appendix K: Interaction Terms

Figure K1

Non-Significant Interaction between Age and Gender as a Predictor of Medical Minutes Per Encounter (p = .064)[1]

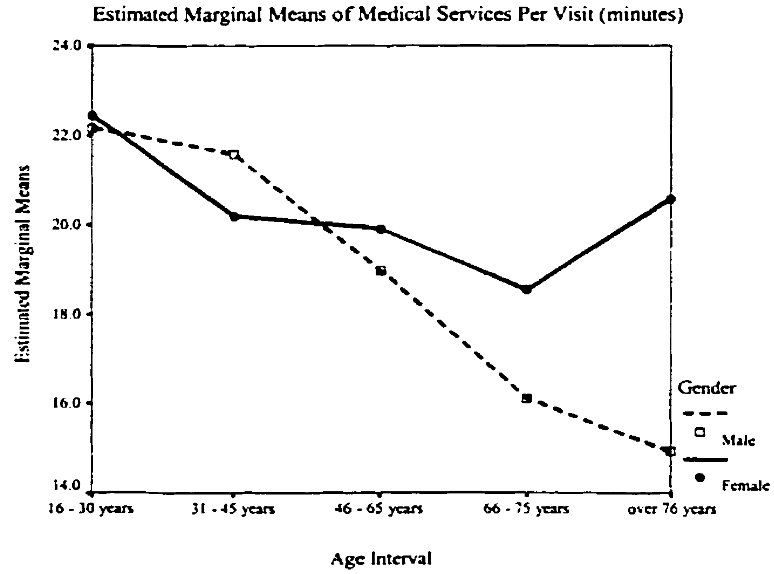
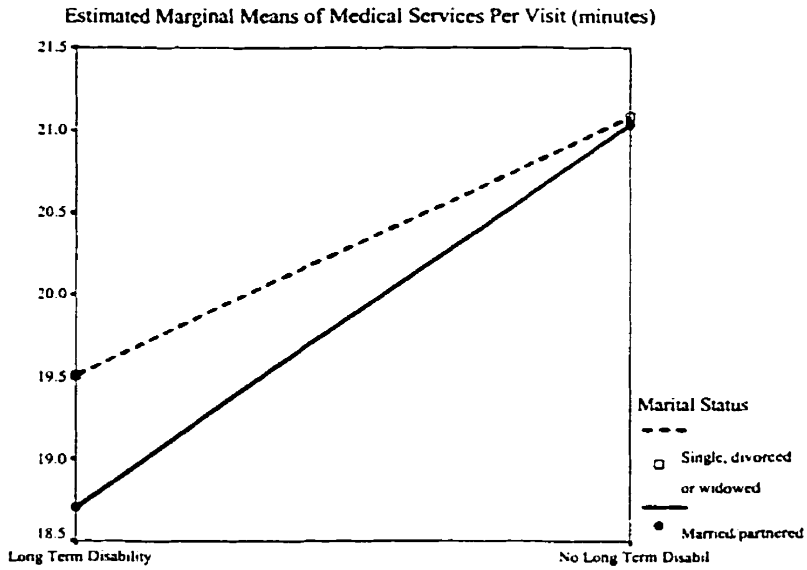


Figure K2

Non-Significant Interaction between Marital Status and Disability Status as a Predictor of Medical Minutes Per Encounter (p = .656)



[1] When age was coded as a continuous variable, which was the strategy used in multivariate analyses, this interaction remained non-significant (F[60, 550] = 1.05, p = .381).

Figure K3

Non-Significant Interaction between Marital Status and Health Status as a Predictor of Medical Minutes Per Encounter (p = .956)

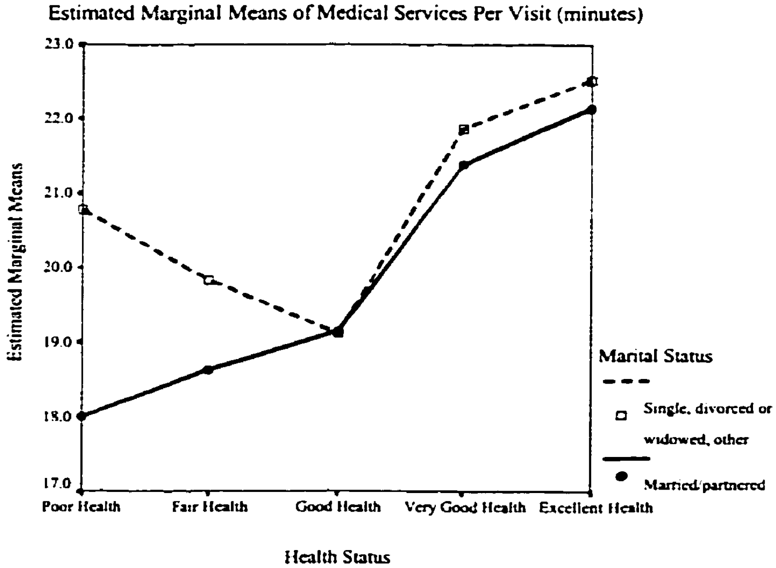


Figure K4

Non-Significant Interaction between the Number of Adults and Disability Status as a Predictor of Medical Minutes Per Encounter (p = .252)

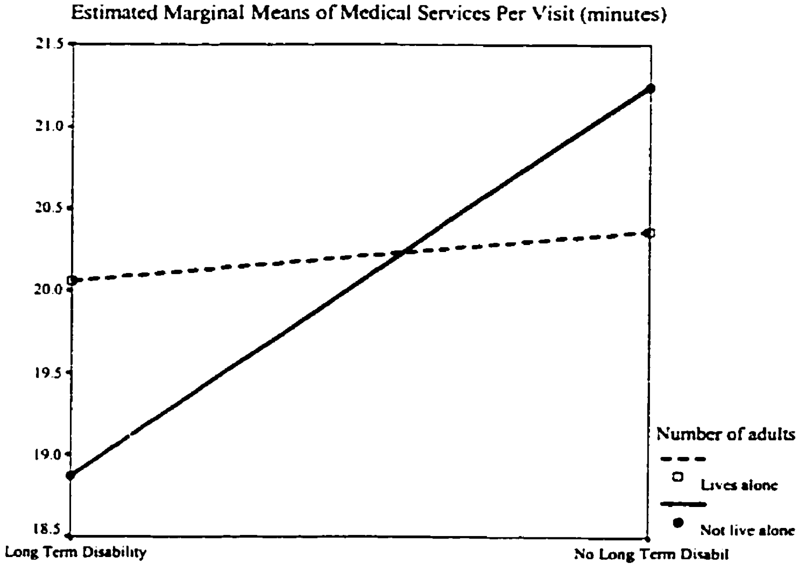


Figure K5

Non-Significant Interaction between the Number of Adults and Health Status as a Predictor of Medical Minutes Per Encounter (p = .556)

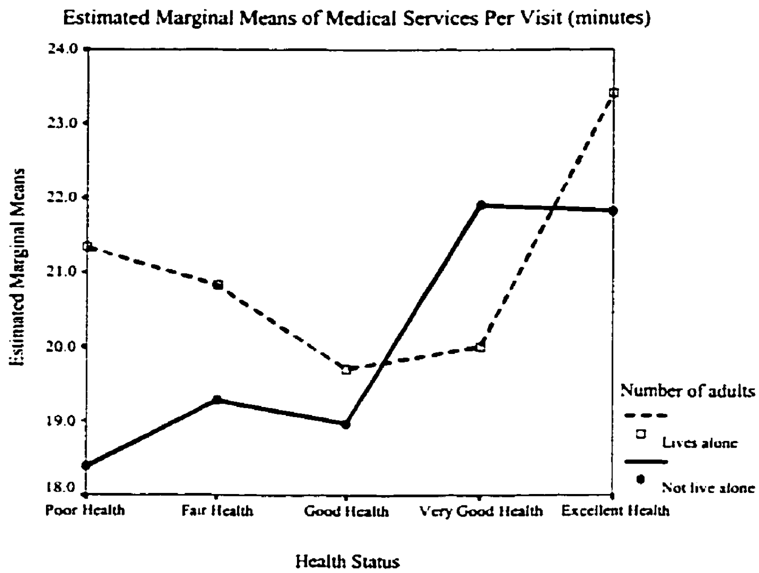


Figure K6

Non-Significant Interaction between Educational Status and Health Status as a Predictor of Medical Minutes Per Encounter (p = .854)

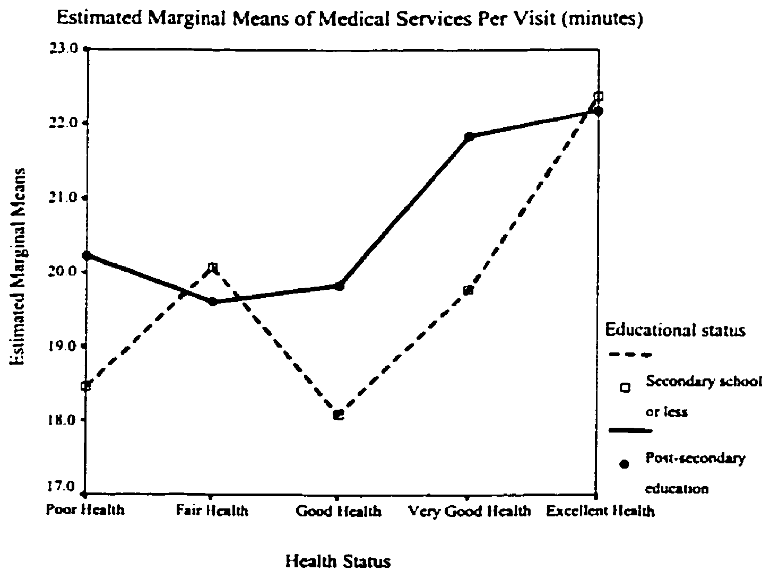


Figure K7

Non-Significant Interaction between Work Status and Gender as a Predictor of Medical Minutes Per Encounter ($p = .135$)

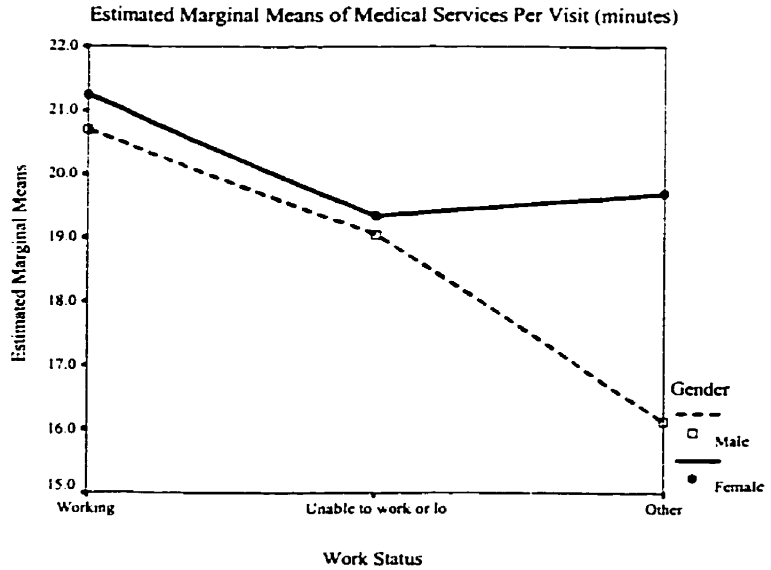
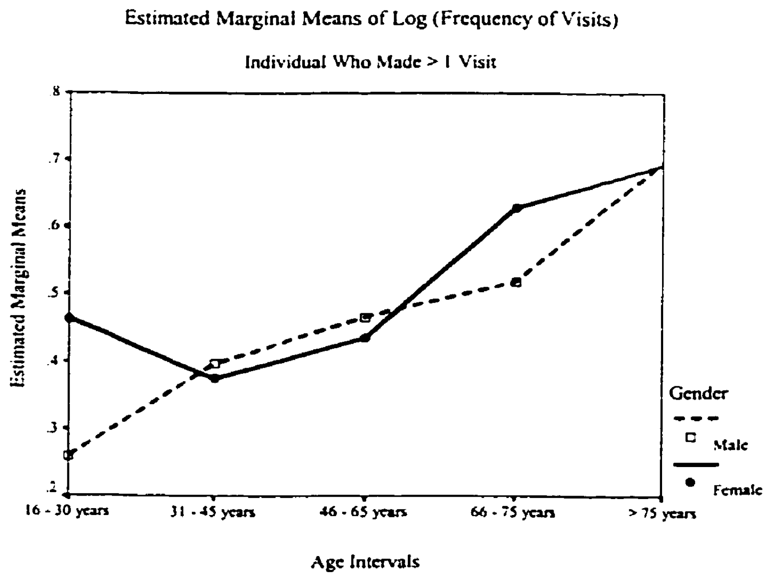


Figure K8

Non-Significant Interaction between Age and Gender as a Predictor of Log (Visits Per Annum Among Adults Who Visit at Least Once ($p = .131$)[2]



[2] When age was coded as a continuous variable, which was the strategy used in multivariate analyses, this interaction remained non-significant (F[70, 578] = .878, $p = .726$).

Figure K9

Non-Significant Interaction between Marital Status and Disability Status as a Predictor of Log (Visits Per Annum Among Adults Who Visit at Least Once (p = .064)

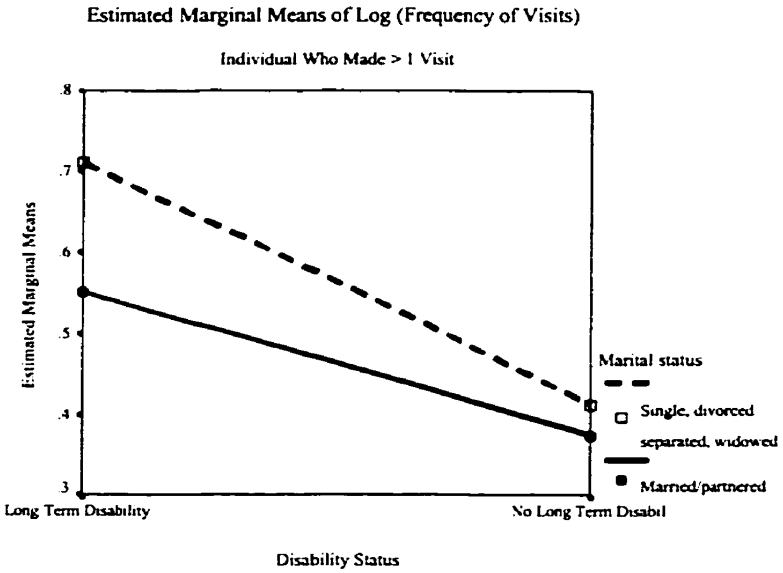


Figure K10

Significant Interaction between Marital Status and Health Status as a Predictor of Log (Visits Per Annum Among Adults Who Visit at Least Once (p = .045)

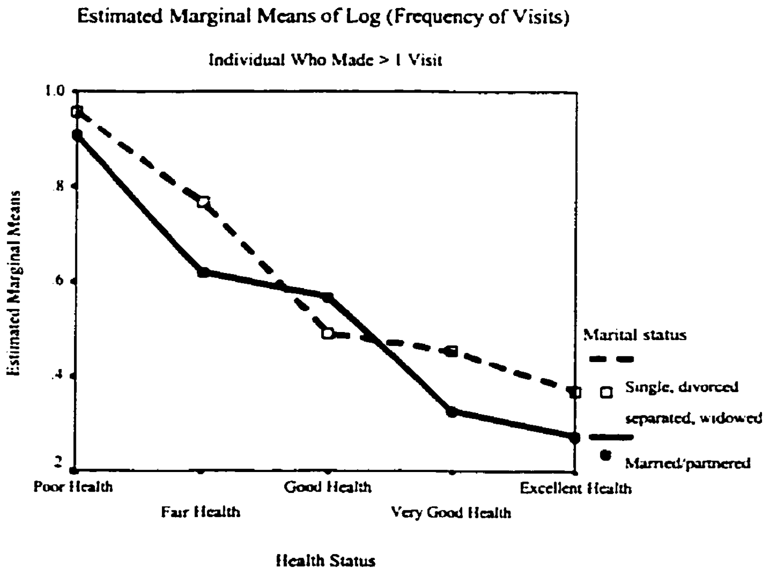


Figure K11

Non-Significant Interaction between the Number of Adults and Disability Status as a Predictor of Log (Visits Per Annum Among Adults Who Visit at Least Once (p = .055)

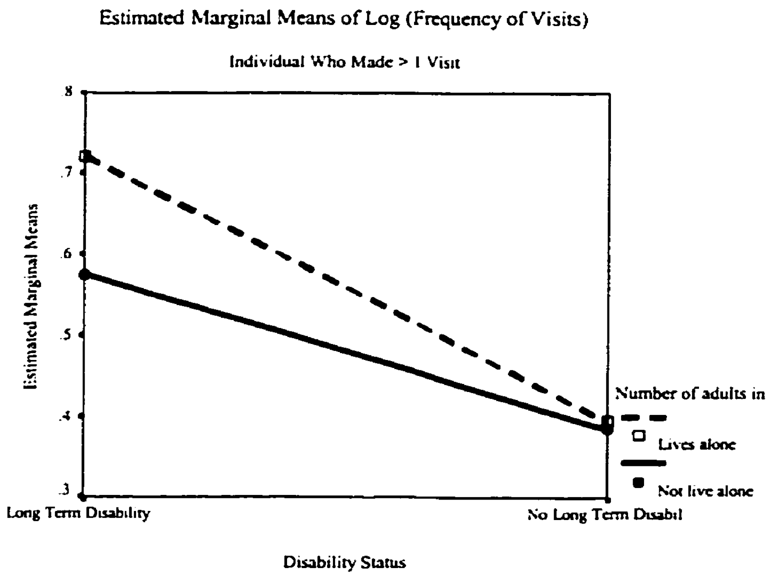


Figure K12

Non-Significant Interaction between the Number of Adults and Health Status as a Predictor of Log (Visits Per Annum Among Adults Who Visit at Least Once (p = .765)

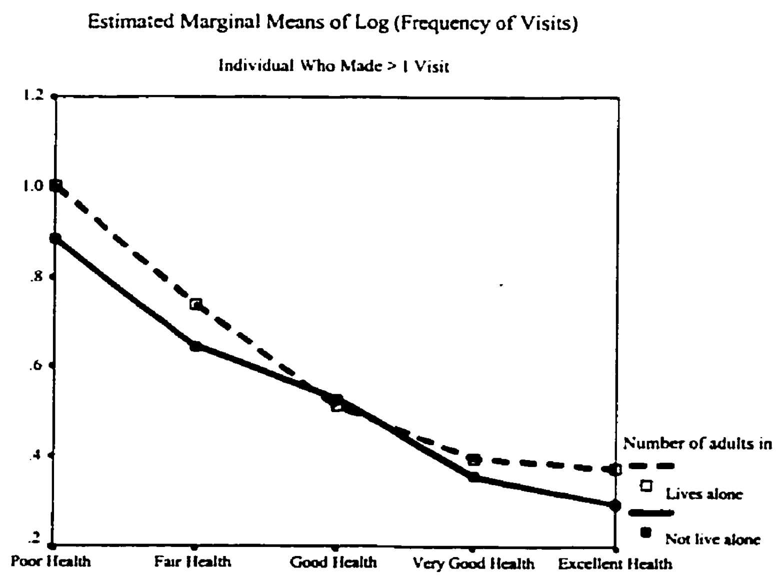


Figure K13

Non-Significant Interact.:n between Educational Status and Health Status as a Predictor of Log (Visits Per Annum Among Adults Who Visit at Least Once (p = .146)

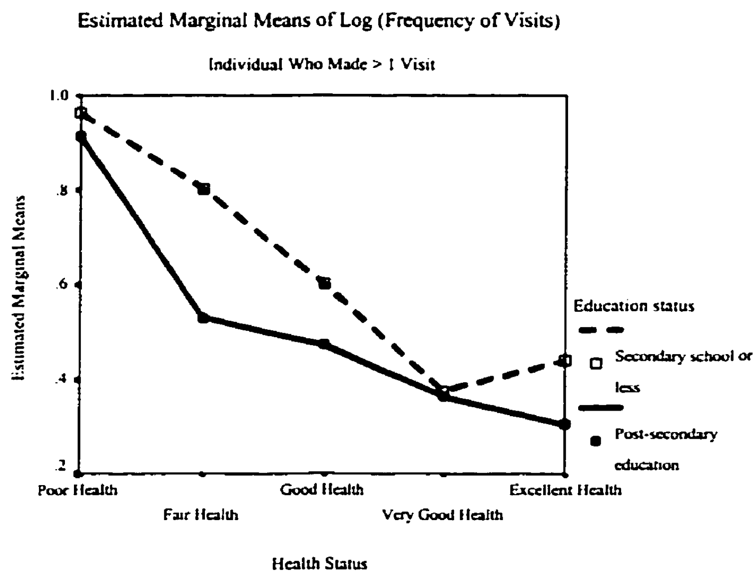


Figure K14

Non-Significant Interaction between Work Status and Gender as a Predictor of Log (Visits Per Annum Among Adults Who Visit at Least Once (p = .098)

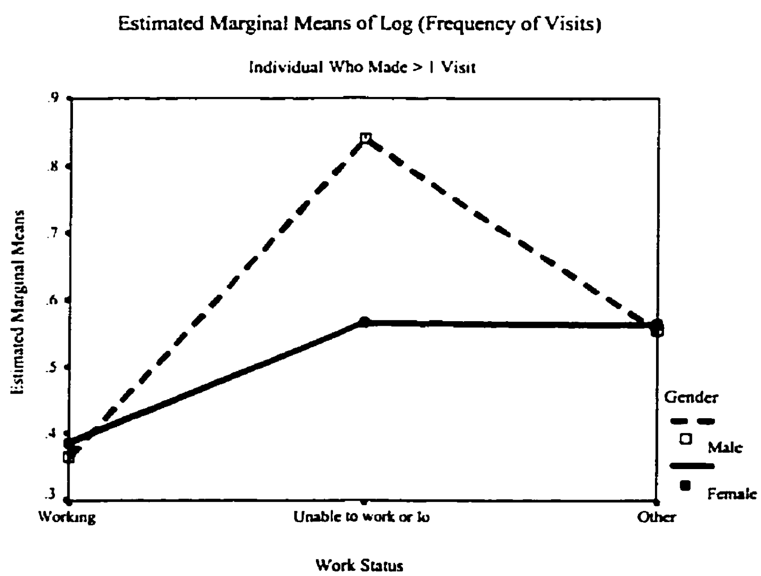


Figure K15

Non-Significant Interaction between Age and Gender as a Predictor of Log (Total, Annual OHIP Payments + 10) (p = .182)[3]

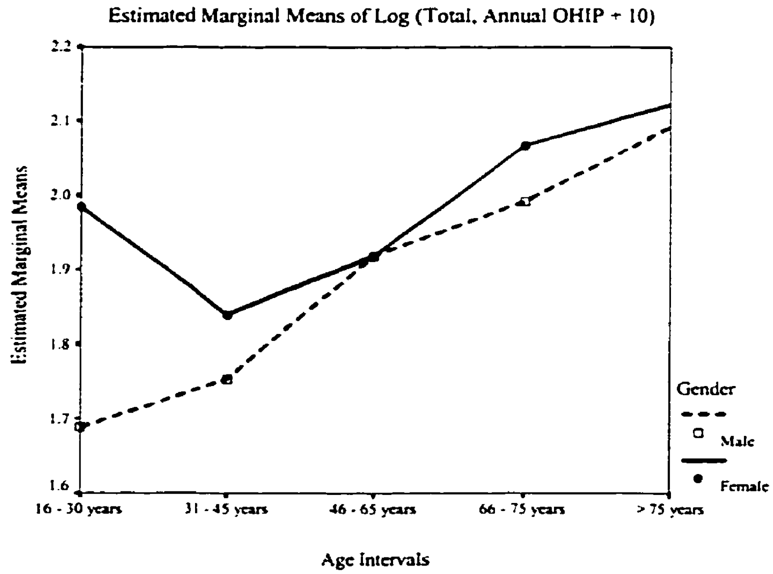
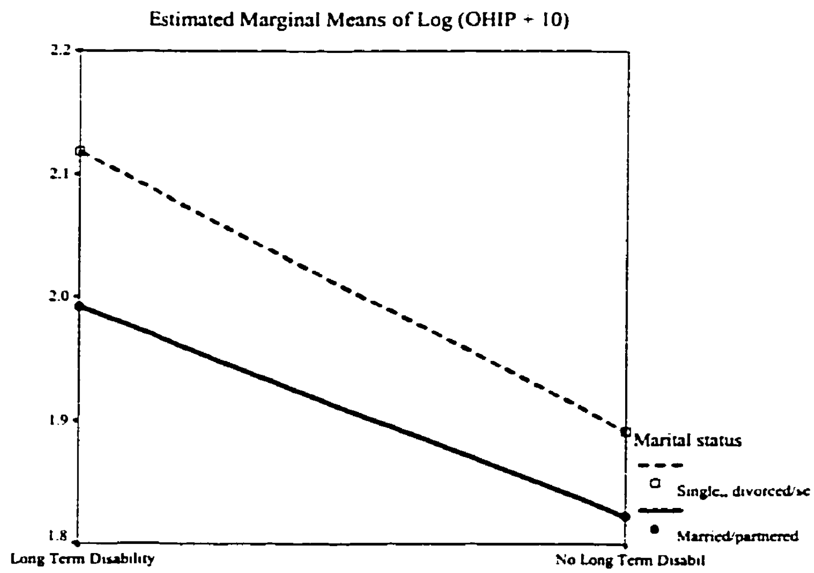


Figure K16

Non-Significant Interaction between Marital Status and Disability Status as a Predictor of Log (Total, Annual OHIP Payments + 10) (p = .469)



[3] When age was coded as a continuous variable, which was the strategy used in multivariate analyses, this interaction remained non-significant (F[62, 658] = 1.07, p = .342).

Figure K17

Non-Significant Interaction between the Marital Status and Health Status as a Predictor of Log (Total, Annual OHIP Payments + 10) (p = .563)

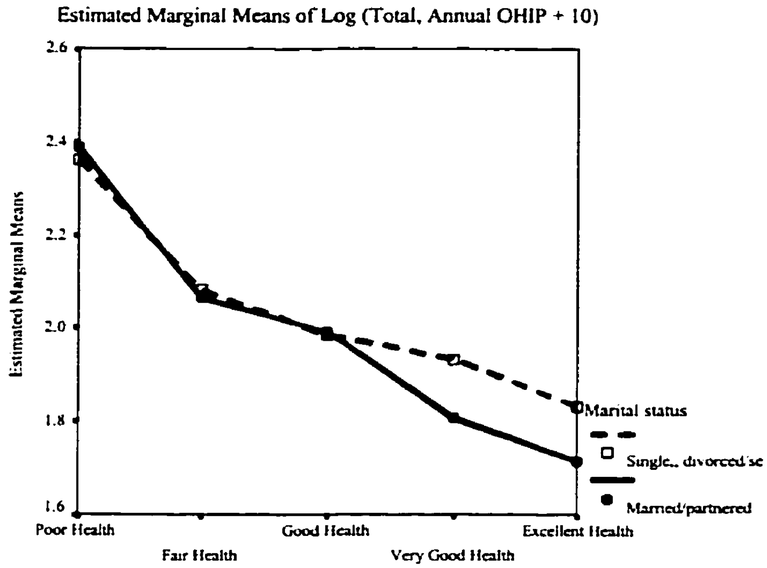


Figure K18

Non-Significant Interaction between the Number of Adults and Disability Status as a Predictor of Log (Total, Annual OHIP Payments + 10) (p = .123)

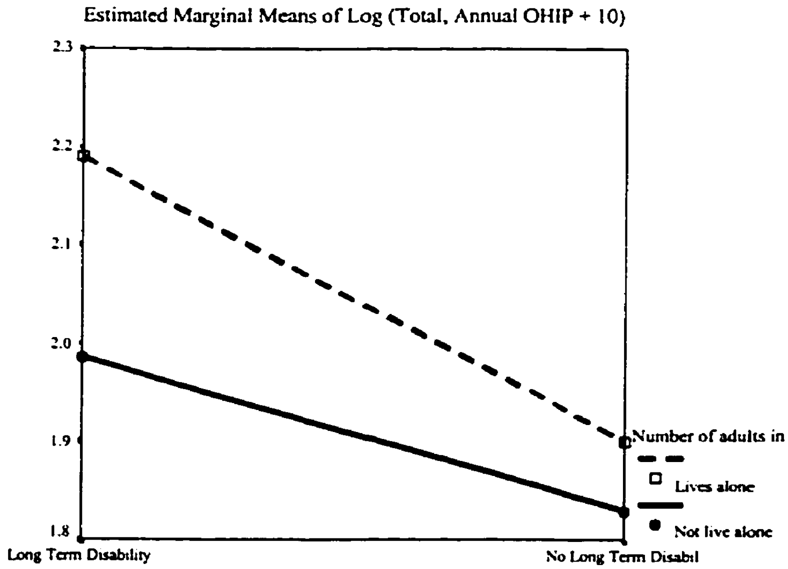


Figure K19

Non-Significant Interaction between the Number of Adults and Health Status as a Predictor of Log (Total, Annual OHIP Payments + 10) (p = .860)

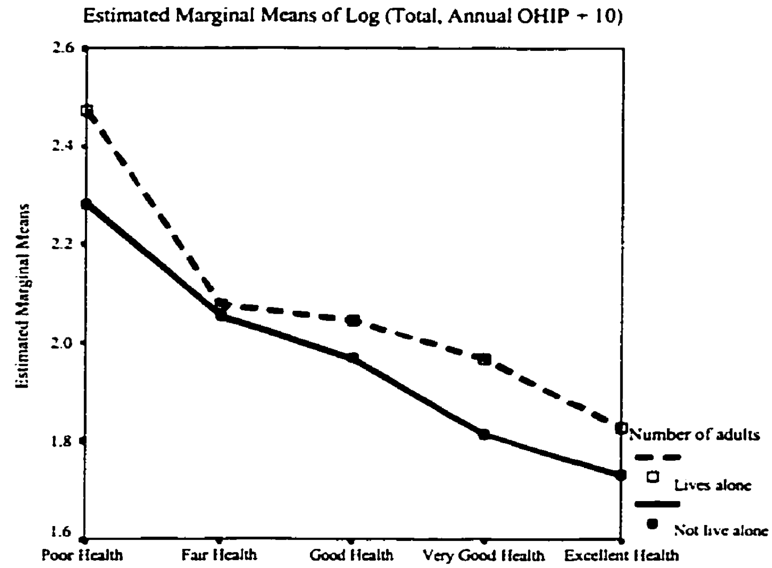


Figure K20

Non-Significant Interaction between Educational Status and Health Status as a Predictor of Log (Total, Annual OHIP Payments + 10) (p = .074)

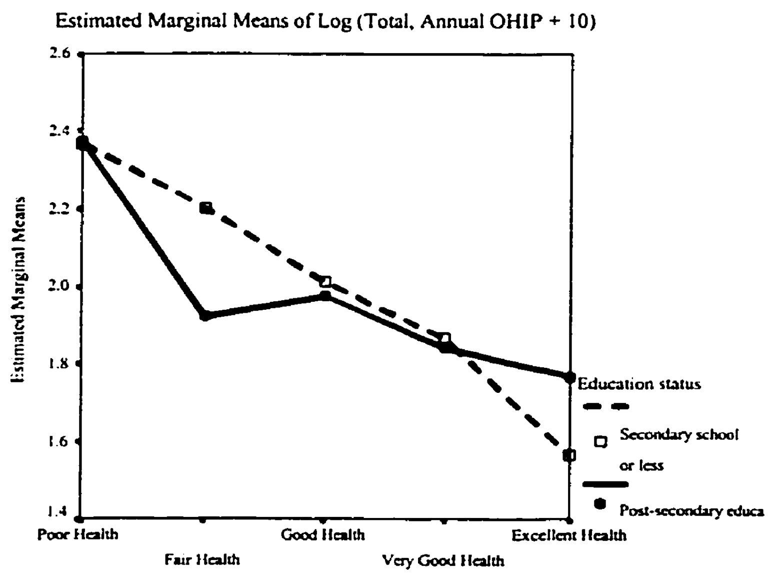
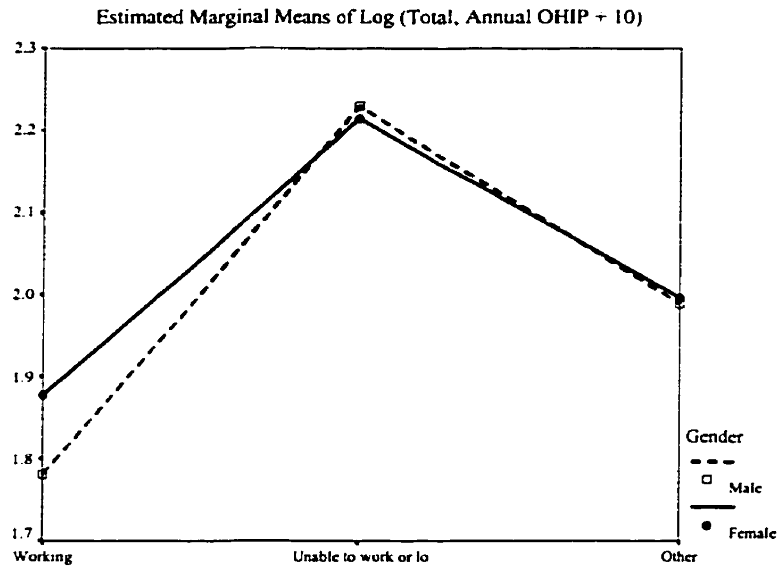


Figure K21

Non-Significant Interaction between the Work Status and Gender as a Predictor of Log (Total, Annual OHIP Payments + 10) (p = .455)



Appendix L: Multivariable Models

Table L1: Odds Ratios (Confidence Intervals) for Population Characteristics Associated with At Least One Physician Visit

Variables		Hypothesis 1	Hypothesis 2		Hypothesis 3	
		Model 1A (*n* = 659)	Model 1B (*n* = 651)	Model 1C (*n* = 647)	Model 1D (*n* = 647)	Model 1E (*n* =647)
Constant (B)		2.17***	2.45***	2.09*	1.74**	2.51***
Age (years)	16 - 30	1.00***	1.00*	1.00**	1.00**	1.00***
	31 - 45	.43* (.21-.92)	.42* (.19-.94)	.47 (.22-1.02)	.45* (.22-.97)	.43* (.21-.93)
	46 - 65	.97 (.44-2.10)	.99 (.45-2.19)	1.08 (.48-2.42)	1.11 (.50-2.47)	1.10 (.49-2.43)
	66 - 75	2.20 (.72-6.68)	2.44 (.76-7.81)	2.09 (.67-6.50)	2.07 (.67-6.39)	2.16 (.70-6.63)
	≥76	2.27 (.47-10.82)	2.60 (.51-13.23)	1.94 (.39-9.74)	1.98 (.41-9.75)	2.25 (.46-10.93)
Gender	Male		1	1	1	1
	Female		1.45* (.29-2.39)	1.39 (.86-2.29)	1.36 (.83-2.23)	1.44 (.88-2.35)
No. of Adults	Lives alone		1			1
	Not live alone		.52 (.27-1.02)			.49* (.25-.94)

Variables		Hypothesis 1	Hypothesis 2		Hypothesis 3	
		Model 1A (n = 659)	Model 1B (n = 651)	Model 1C (n = 647)	Model 1D (n = 647)	Model 1E (n =647)
No. of Children	No children		1			
	1 or 2		1.14 (.59-2.20)			
	3 or more		53 (.17-1.69)			
Work Status	Working		1			
	Unable to work		2.27 (.51-9.97)			
	Looking for Work		.83 (.44-1.59)			
Health Status	Poor			1		
	Fair			.46 (.05-4.19)		
	Good			.85 (.11-7.10)		
	Very Good			.77 (.09-6.31)		
	Excellent			.43 (.05-3.54)		

Variables		Hypothesis 1	Hypothesis 2		Hypothesis 3	
		Model 1A (n = 659)	Model 1B (n = 651)	Model 1C (n = 647)	Model 1D (n = 647)	Model 1E (n =647)
Hospitalized in the past year	No admission			1		
	Admitted			2.56 (.89-7.40)		
Prior visits	0 - 5			1	1	
	≥ 6			5.27*** (1.84-15.05)	5.62** (2.00-15.76)	
Prior visits	0 - 2					
	3 - 5					
	6 - 8					
	≥ 9					
-2 log likelihood ratio		466.45	454.82	428.26	436.16	448.04
Model χ^2		20.81***	30.35***	50.12***	40.07***	28.19***
Classification ‡ (%)		87.86	87.71	88.09	87.94	87.94
Hosmer-Lemeshow (χ^2)		0.00^{NS}	8.70^{NS}	2.98^{NS}	2.12^{NS}	2.05^{NS}
Negelkere's R^2		0.059	0.087	0.142	0.115	0.082

Note. Values in the table represent the adjusted odds ratios (confidence intervals) from the regression equation. χ^2= chi-square value. ‡ Percent correctly classified. ^{NS} = not significant. * p<.05, ** p<.01, *** p<.001.

Table L2

The Determinants of the Amount of Time Physicians Spend Providing Medical Services to Individuals During One Visit

Variables	Hypothesis 1	Hypothesis 2				
	Model 2A (n = 549)	Model 2B (n = 479)	Model 2C (n = 387)	Model 2D (n = 377)	Model 2E (n = 482)	Model 2F (n = 391)
			Predisposing characteristics			
Age	-.15*	-0.05	-.11*	-0.04	-.11*	-.17**
Gender	0.04	0.02	-0.03	-0.02	0.05	-0.01
Work status		-0.08		-.11*	-0.09	
Single parent		0.04		0.04	0.07	
Educational status		0.07		0.05	0.04	
Country of birth		-0.05		-0.05	-0.06	
			Need characteristics			
Health status			0.09	0.07		0.08
Disability status			0.03	0.03		0.03
Hospital admissions (# past year)			0.009	0.02		0.05
			Control variables			
Doctor seen	0.08	.13**	.12***	.13*	0.08	0.08
Type of visit		.30***	.29*	.28***		
R^2						
(Training sample)	.026	.114	.127	.149	.051	.044
(Test sample)	.070	.193	.200	.247	.108	.119
R^2 (Full sample)	0.039	0.143	0.131	0.141	0.065	0.055

Note. Values in the table represent the standardized β coefficients from the regression equation with the full sample. # = number. † = training sample size is equal to 350. ‡ = test sample size is equal to 200. * $p<.05$, ** $p<.01$, *** $p<.001$.

Table L3

Determinants of Visits Per Annum Among Individuals Who Came to the Practice At Least Once

Variables	Hypothesis 2				
	Model 3A (n = 557)	Model 3B (n = 573)	Model 3C (n = 568)	Model 3D (n = 568)	Model 3E (n = 575)
	Predisposing characteristics				
Age	.17***	.20***	.10**	.09**	.23***
Gender	0.03	0.04	0.02	0.01	0.07
Marital status	-.13**				
No. of children	-0.02				
Education status	-.18***				
Country of birth	0.05				
	Enabling resources				
Language at home		-.12**			
	Need characteristics				
Health status			-.18***	-.15***	
Disability status			-0.02	0	
Activity limits			-0.05	-0.06	
Admitted (yes/no)			.14***	.13***	
Prior year visits (0-5 versus ≥6)			.43***		
Prior year visits (0-2, 3-5, 6-8, ≥ 9)				.49***	
	Community-enabling resources				
Government transfer payments					0.04
Average census family income					-0.01
Incidence of low income					.21**

Variables	Hypothesis 2				
	Model 3A (n = 557)	Model 3B (n = 573)	Model 3C (n = 568)	Model 3D (n = 568)	Model 3E (n = 575)
Female labour force participation					0.03
Control variable					
Primary provider	-0.04	-0.06	-0.02	-0.01	-0.04
R^2					
(Training sample)	.117	.105	.394	.434	.125
(Test sample)	.106	.105	.331	.380	.095
R^2 (Full sample)	0.107	0.062	0.361	0.406	0.106

Note. Values in the table represent the standardized β coefficients from the regression equation. † = training sample size is equal to 350. ‡ = test sample size is equal to 229. * $p<.05$, ** $p<.01$, *** $p<.001$.

Table L4

Determinants of Visits Per Annum Among Individuals Who Came to the Practice At Least Once

Variables	Hypothesis 3				
	Model 3F (n = 578)	Model 3G (n = 578)	Model 3H (n = 542)	Model 3J (n = 577)	Model 3K (n = 574)
Predisposing characteristics					
Age	.16***	.14***	.12**	.21***	0.24
Gender	0.001	-0.01	0.08	0.06	.08*
Need characteristics					
Health status			-.24***		
Activity limitations			-.11*		
Hospital admissions (yes/no)			.16***	.19***	.18***
Prior year visits (0-5 versus ≥6)	.51***				
Prior year visits (0-2, 3-5, 6-8, ≥ 9 visits)		.57***			
Community-enabling resources					
Incidence of low income			.17***		.24***
Control variable					
Primary provider	-0.04	-0.03	-0.008	-.08*	-0.05
R^2					
(Training sample)	.320	.377	.215	.082	.146
(Test sample)	.276	.336	.251	.091	.149
R^2 (Full sample)	0.302	0.366	0.22	0.091	0.146

Note. Values in the table represent the standardized β coefficients from the regression equation. † = training sample size is equal to 350. ‡ = test sample size is equal to 229. * p<.05, ** p<.01, *** p<.001.

Table L5: Determinants of Total, Annual OHIP Payments

Variables	Hypothesis 2					Hypothesis 3		Hypothes is 4
	Model 4A (n = 635)	Model 4B (n = 653)	Model 4C (n = 647)	Model 4D (n = 647)	Model 4E (n = 656)	Model 4F (n = 617)	Model 4G (n = 655)	Model 4H (n = 656)
Predisposing characteristics								
Age	.09*	.17***	.09*	.08*	.18***	.12**	.19***	.19***
Gender	.08*	.10*	0.06	0.06	.10**	.09*	.11**	.11**
No. of adults	-.09*							
No. of children	-0.06							
Work status	0.08							
Country of birth	0.06							
Enabling resources								
Language at home		0.06						
Need characteristics								
Health status			-.12**	-.09*		- .20***		
Disability status			0.01	0.02				
Activity limits			0	0				
Admitted (yes/no)			.14***	.13***		.16***	.17***	
Prior year visits (0-5 versus ≥6)			.38***					
Prior year visits (0-2, 3-5, 6-8, ≥ 9)				.42***				
Community-enabling resources								
Median income private households					-.15*	-.11**	-.18***	
Government transfer payments					0			

Variables	Hypothesis 2					Hypothesis 3		Hypothes is 4
	Model 4A (n = 635)	Model 4B (n = 653)	Model 4C (n = 647)	Model 4D (n = 647)	Model 4E (n = 656)	Model 4F (n = 617)	Model 4G (n = 655)	Model 4H (n = 656)
Average census family income					0			
Unemployment rate								.15***
Control variable								
Primary provider	0	-0.1	0	0	0	0	-0.03	-0.03
R^2								
(Training sample)	.087	.320	.298	.335	.049	.172	.124	.054
(Test sample)	.066	.054	.237	.250	.072	.119	.086	.069
R^2 (Full sample)	0.06	0.04	0.253	0.276	0.06	0.127	0.095	0.061

Note. Values in the table represent the standardized β coefficients from the regression equation. † = training sample size is equal to 400. ‡ = test sample size is equal to 259. *$p<.05$, ** $p<.01$, *** $p<.001$.

Appendix M: Outliers

Outlier Analyses

Only seven participants were identified as outlier cases in all of the multivariable models summarized in tabular format in this chapter. These individuals ranged in age from 32 to 79 years old - four women and three men. They represented the extremes of use and their average utilization was high. For example, during year two (i.e., time period of the dependent variables) these adults visited a physician between 0 and 69 times and the average number of visits was 18.86. Participants in the sample (including these outlier cases) visited between 0 and 69 times, but the average number of visits was 3.88. Payments for outlier cases ranged from \$0.00 to \$5101.20, and average OHIP payment was \$1171.65. Payments for participants ranged from \$0.00 to \$5101.20, but the average OHIP payment was \$132.17.

Three of the seven outlier cases were high-users in terms of prior visits (seven, 10 and 11 visits, respectively), but did not visit the practice in the subsequent year. One of these people reported that they visited a doctor at another clinic twice, but the other two reported no outside use of family physician services. One additional person of the seven outlier cases was a high-user in terms of prior visits, but only visited the practice once in the subsequent year.

The three remaining outlier cases were high-users in terms of prior visits (29, 38 and 51 visits, respectively), and in terms of subsequent year use (25, 69 and 37 visits, respectively). Consequently, payments for all three of these participants were very high in both time periods. OHIP claims data indicated that psychiatric diagnoses were associated with the majority of visits for two of the three cases. The majority of the visits for the final case were for allergy shots.

The outlier cases reported a high degree of disability, but varied in their self-ratings of general health. Five of the seven outlier cases indicated that they had a long term disability, and four of these individuals indicated that they had activity limitations. Two cases reported fair health, two cases reported good health, and two reported very good health. No outlier cases indicated they were in poor health, but one person indicated that they were in excellent health. Participants rated their health toward the end of year two. The person that rated their health as excellent had no visits during year two, but the two individuals who rated their health as very good had 25 and 37 visits in year two. One of these people was seen for psychiatric conditions, while the other received services for allergies. Table 16 summaries these findings.

Table M1

Characteristics of Outlier Cases

Case Number	Outlier in Multivariable Models*			Age♯	Gender	Year 1		Year 2		External Visits†
	Visit (Yes/No)	Visit Frequency	Annual Payment			Payment ($)	Visits (No.)	Payment ($)	Visits (No.)	
6710	√		√	80	Female	243	10	0	0	2
8978			√	60	Male	156.5	7	0	0	0
103245		√		50	Male	494.75	9	72.1	1	1
158480			√		Female	2573.7	29	2346.6	25	0
162065		√	√	40	Female	2810.8	38	5101.2	69	0
177803			√	30	Male	325.6	11	0	0	0
522838		√		30	Female	495.15	51	681.65	37	1

Note. * These cases were identified in one or more of the multivariable models listed. ♯ = ages of these participants were rounded to the nearest 10 to protect the privacy of these individuals. † = the number of visits in the preceding 12 months that were made to a physician who does not work at the practice. No. = number. Refer to Tables 11 to 14 in this chapter to identify which cases were outliers in which models.

Table M1 (continued)

Characteristics of Outlier Cases (continued)

Case Number	Hospital Admit	Health Status	Disability Status	Activity Limitation
6710	No	Fair	Long term disability	Yes
8978	No	Good	Long term disability	Yes
103245	Yes, one admission for 1 - 3 days	Good	Long term disability	Yes
158480	No	Very Good	Long term disability	No
162065	Missing data	Fair	Long term disability	Yes
177803	No	Excellent	No long term disability	No
522838	No	Very Good	No long term disability	No

Appendix N: Payment Schedules

Table N1

Capitation Rates in Dollars: Age-Gender Formula

Age Interval	Male			Female		
	Mean	Median	*n*	Mean	Median	*n*
16 - 30 years	105.51	105.73	28	138.87	138.29	70
31 - 45 years	109.66	109.29	78	144.67	145.63	111
46 - 65 years	114.08	113.88	101	147.71	146.98	127
66 - 75 years	117.64	117.90	46	151.69	151.19	56
> 75 years	120.10	120.21	24	152.36	152.38	18

Note: *n* = cell count or the number of people in this cohort. Table values reflect the average payment for each cohort and were calculated by regressing the annual OHIP payments on age, gender and primary provider predictors.

Table N2

Capitation Rates in Dollars: Age-Gender-Prior Visit Formula

Age Intervals	Male			Female		
	Mean	Median	*n*	Mean	Median	*n*
16 - 30 years	87.12	60.71	28	157.72	138.80	70
31 - 45 years	113.88	60.84	78	140.66	83.96	111
46 - 65 years	111.56	59.82	101	131.19	78.49	127
66 - 75 years	120.66	116.09	46	165.50	140.58	56
> 75 years	132.64	120.53	24	177.39	216.61	18

Note: *n* = cell count or the number of people in this cohort. Table values reflect the average payment for each cohort and were calculated by regressing annual OHIP payments on age, gender, prior visit (four-part categorical variable) and primary provider predictors.

Table N3

Capitation Rates: Age-Gender-Health Status Formula

Age Intervals	Male			Female		
	Mean	Median	*n*	Mean	Median	n
16 - 30 years	121.16	110.31	28	149.72	152.09	70
31 - 45 years	104.74	99.16	78	138.94	142.52	111
46 - 65 years	115.91	113.1	101	144.82	145.33	127
66 - 75 years	105.67	106.52	46	153.63	159.79	56
> 75 years	137.92	131.44	24	170.61	184.67	18

Note: *n* = cell count or the number of people in this cohort. Table values reflect the average payment for each cohort and were calculated by regressing annual OHIP payments on age, gender, health status and primary provider predictors.

Table N4

Capitation Rates: Age-Gender-Hospital Admission Formula

Age Interval	Male			Female		
	Mean	Median	*n*	Mean	Median	*n*
16 - 30 years	93.28	84.91	28	126.21	111.81	70
31 - 45 years	98.39	91.10	78	122.27	115.94	111
46 - 65 years	114.63	101.59	101	138.69	128.78	127
66 - 75 years	132.91	113.22	46	144.03	138.06	56
> 75 years	139.44	118.25	24	150.63	143.94	18

Note: *n* = cell count or the number of people in this cohort. Table values reflect the average payment for each cohort and were calculated by regressing annual OHIP payments on age, gender, hospital admission and primary provider predictors.

Table N5

Capitation Rates: Age-Gender-Incidence of Low Income

Age Interval	Male			Female		
	Mean	Median	*n*	Mean	Median	*n*
16 - 30 years	107.52	104.78	28	143.93	141.49	70
31 - 45 years	108.05	106.23	78	142.71	142.25	111
46 - 65 years	113.23	116.04	101	145.60	144.47	127
66 - 75 years	118.87	120.77	46	156.66	157.06	56
> 75 years	124.22	109.44	24	153.50	157.75	18

Note: *n* = cell count or the number of people in this cohort. Table values reflect the average payment for each cohort and were calculated by regressing annual OHIP payments on age, gender, the incidence of low income and primary provider predictors.