PATTERNS OF AMBULATORY MEDICAL CARE IN RURAL MANITOBA: DETERMINANTS OF UTILIZATION AND THE EFFECT OF PHYSICIAN PRACTICE-MODALITY

BY

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A Thesis
Submitted to the Faculty of Graduate Studies
in Partial Fulfilment of the Requirements
for the Degree of

DOCTOR OF PHILOSOPHY

Department of Community Health Sciences
University of Manitoba
Winnipeg, Manitoba

December 1997

0-612-32032-4

THE UNIVERSITY OF MANITOBA

FACULTY OF GRADUATE STUDIES

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ABSTRACT

Systemic imbalances in the distribution of general practitioners concern rural residents, physicians, and policy-makers. This thesis investigates patterns of medical care utilization in rural Manitoba to discern the "reality" from the "myth" of imbalances in the distribution of physicians. To overcome methodological limitations of previous work, this research compiled the Manitoba Physician Resource Data Set. By tracking the movement of physicians over the 1990-91 to 1994-95 fiscal years, important workload and explanatory variables were estimated. These, and other data, were analysed to gain insights into the epidemiology of rural ambulatory medical care -- that is, the determinants of utilization and the role of practice-modality.

From population--physician-supply (macro-level) analysis, imbalances in physician-availability were compensated for by residents' out-of-area care-seeking and adjustments made by physicians in their workloads. Overall, physician-accessibility is comparable across rural Manitoba. Moreover, also through these mechanisms, physician-competition is comparable across rural areas. However, a population's rate of contact and utilization is not predicated on the need for ambulatory physician-visits or physician-availability. Although comparable access was found across small areas, low need populations had relatively higher rates of contact and visits.

From practice-profile--physician-practice (meso-level) analysis of the role of payment-modality, fee-for-service group practice provided superior performance: large patient-loads seen, patterns of visits in balance with expected need, and stable physician-practices. These findings, however, may be confounded by self-selection from Manitoba medical graduates concentrated in fee-for-service group practices in the larger rural communities. While stakeholders should be encouraged by the remarkable comparability in physician-accessibility and physician-competition across rural Manitoba, improvements could be made.

DEDICATION

This thesis is dedicated to my father, William Wall, and my supervisor, Dr. Noralou Roos.

My father, who died on November 23, 1996, gave me the freedom to pursue my goals and the support to accomplish them -- even when he did not fully understand why. May all children, particularly Morgan, my daughter, have parents with such wisdom!

In contrast, Noralou Roos, in a kind and considerate way, motivated me to finish. All this in spite of being the Director of the Manitoba Centre for Health Policy and Evaluation, engaged in the activities of an internationally respected researcher, and suffering back trauma. May all students have such supervisors!

ACKNOWLEDGEMENTS

This thesis is the product of collaboration on several levels. First, I am especially grateful for the support, encouragement, and guidance from my thesis committee chair, Dr. Noralou Roos and members, Drs. Black, Horne, Stoddart. As noted in the dedication, this thesis would not have been completed without Noralou Roos' motivation and encouragement. As both mentor and friend, Greg Stoddart strongly influenced my entering into, and continuing with, an academic career. Similarly, John Horne is a continuing source of advice and friendship. Finally, Charlyn Black's progress is an inspiration to all of us who are struggling to launch our own careers. Dr. Murray Brown, the external reviewer, made valuable contributions that enhanced the quality of this thesis.

Second, the creation of the Manitoba Physician Resource Data Set evolved over several years of collaboration with Bogdan Bogdanovic. Many thanks to the Manitoba Centre for Health Policy and Evaluation for providing access to needed data and providing the infrastructure for building the data set. The Centre is a remarkable place staffed by creative members. I enjoyed my four years of membership. Similarly, the Department of Community of Community Health Sciences provided a rich environment for learning.

Third, I am very grateful for the love and support of my family -- Marnie and children, Morgan, John, and Tara -- my mother, Muriel, and my mother-in-law, Helen. The opportunity cost of this thesis was the time not spent with them.

Finally, financial support from the National Health and Research Development Fund, the Manitoba Centre for Health Evaluation, and the Department of Community Health Sciences is gratefully acknowledged.

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1.0 INTRODUCTION

Following the seminal Lalonde Report (Lalonde 1974), Canadian policy-makers and researchers have widely recognized that environmental, socioeconomical, behavioural, and biological factors create health disparities which are manifested spatially as well as socially across populations (Birch and Eyles 1990; Clarke 1990; Coburn and Eakin 1993; Dickinson and Bolaria 1988; Evans and Stoddart 1990; Eyles 1993; Garber 1989; Joseph and Phillips 1984; Roos *et al.* 1994, 1996). The Canadian health-care system has the *potential* to improve health-related quality-of-life by reducing health-related disparities across populations. As the source of first-contact care and the gateway to health care resources, the primary-care sector is critical to achieving this goal (Angus *et al.* 1995b; Fry and Horder 1994; Starfield 1992).

Factors contributing to imbalances in population health and limiting the ability of policy-makers to deliver mandated services to rural Canadians include sparse patterns of settlement, declining numbers and aging demographic structure, economic and other social disparities, difficulties in recruiting/retaining health care providers, and other political/medical dominance of metropolitan regions (Gresler 1992; Joseph and Phillips 1984). As governments struggle to provide mandated services while improving health-care system performance, the lessons derived from Manitoba's experience may provide useful insights for policy-makers and planners elsewhere.

1.1 ISSUES IN RURAL PRIMARY MEDICAL CARE DELIVERY

Patterns of medical care utilization in rural settings are a concern to the populations served, the providers rendering care, and the policy-makers whose decisions directly (or indirectly) influence these care-seeking and care-giving behaviours. The balance between the "myth" and the "reality" of these concerns likely varies across rural settings. The following sections note issues of concern from the perspective of three key rural health-care system stakeholders: residents, physicians, and policy-makers. Although a variety of diverse concerns are expressed, some common themes can be identified: the distribution of health care resources; the stability of resources over time; patterns of ambulatory medical care utilization; quality-of-care, and satisfaction with the care process (see Table 1.1).

TABLE 1.1: RURAL MEDICAL CARE CONCERNS CLASSIFIED BY TYPE AND PERSPECTIVE

PERSPECTIVE	POPULATION	PHYSICIAN	POLICY-MAKER
RESOURCES	AVAILABILITY	COMPETITION	DISTRIBUTION
CARE UTILIZATION	ACCESSIBILITY	ACTIVITY/INCOME	EXPENDITURES
SUPPLY STABILITY	TURNOVER/GAPS	RELATIONSHIPS/COVERAGE	RECRUITMENT
QUALITY OF CARE	HEALTH STATUS	SKILLS, PREFERENCES	PATTERNS OF USAGE
SATISFACTION	ACCEPTABILITY	RURAL LIFESTYLE	RETENTION

The model of rural medical-care delivery employed here considers the general practitioner as the provider of first contact care and the entry point into post primary care rendered in hospital and specialist settings. This model is consistent with widely held beliefs regarding cost-effective health-care delivery (Fry and Horder 1994; Milio 1988; Starfield 1992), particularly in rural settings (Joseph and Phillips 1984; Ricketts and Cromartie 1992; Rosenblatt and Moscovice 1982). While this model is valid in most Canadian settings (Fry and Horder 1994, Starfield 1992), it is particularly relevant in rural Manitoba (Horne 1989; Michael Loyd & Associates 1993; Roos *et al.* 1996;

Tataryn *et al.* 1995).

1.1.1 POPULATION/PATIENT PERSPECTIVE

The local availability of medical care is perhaps the key concern of rural residents in Manitoba (Roos *et al.* 1996) and elsewhere (Barer and Stoddart 1992d; Joseph and Phillips 1984; Ricketts and Cromartie 1992). Besides the feeling of security and enhanced access to medical care, the continued local presence of physicians has economic implications for the community. First, physicians directly employ nursing and clerical staff. Second, physicians' use of hospitals argues for the continued funding of these resources. Clearly, for rural residents, the issue of physician-availability is part of larger concerns about perceived (and real) imbalances in the distribution of resources and access to services.

Spatial considerations characteristic of rural settlement suggest that, besides the traditional physician-to-population ratio comparing resources to potential users, the measure used to estimate physician-availability should consider residents' proximity to general practitioners (Joseph and Phillips 1984; Ricketts 1994). For example, local physician-availability is expanded when physicians in adjoining communities are included. Although differences in physician-availability occur, imbalances in physician-accessibility are typically much lower (Contandriopoulos and Fournier 1988; Horne 1987). However, even in the face of high physician-accessibility, residents in under serviced areas remain concerned when medical care is not available locally. Here, concerns about local physician-availability should be considered within the context of the overall issue of physician-accessibility.

The type of primary care provider is also of concern. While most rural primary care is rendered by general practitioners, nurses provide substantial amounts of primary care in the more isolated areas (Tataryn *et al.* 1995). Although this care is comparable (perhaps superior) to that rendered by physicians, rural residents may perceive such care as second best (O'Neil 1981). Among first nation residents, the sensitivity of physicians to native culture (especially the role of traditional healing) is a growing issue (Canadian Medical Association 1992; Young 1994). Similarly, despite rural women's preference to receive care from female physicians (Bartman and Weiss 1993), access is generally limited by the poor availability of these providers (Bowman and Allen 1985; Clarke 1990).

Attitudes toward physician-availability likely vary across rural residents. First, users and nonuser may hold different views. However, as approximately 80% of rural Manitobans make at least one ambulatory contact annually with physicians (Michael Loyd & Associates 1993; Tataryn 1995; Roos *et al.* 1996), and 95% do so within two years (Michael Loyd & Associates 1993), a more policy-relevant distinction considers the type of service used: emergency services; periodic ambulatory care used for acute, elective or preventive purposes by otherwise healthy residents; ambulatory visits used to monitor chronic conditions (e.g., diabetes, hypertension): and the care rendered to disadvantaged individuals with special needs (e.g., the frail elderly, the disabled). The key distinction among these situations is how much control that consumers exercise in contacting physicians.

Given the widespread distribution of trauma occurring from accidents and occupational injuries, the local availability of a hospital emergency room and qualified attending physicians is a concern to most rural residents (Rosenblatt and Moscovice 1982; Rutledge *et al.* 1992). Clearly, while few would advocate the placement of physicians in every rural community, the existing distribution of health care resources could be improved (WESTARC Group Inc. 1994). Moreover, both the training and skills of the existing physician stock and those likely to be recruited to rural practice may not be sufficiently broad to cope with the range of conditions. Furthermore, as clinical competence increases with patient volume, quality-of-care may vary with population density and other factors associated with the need for emergency services.

While differences in physician-availability may influence rates of contact for acute and preventive care, residents suffering with chronic conditions requiring ongoing visits are more affected. While availability is an important issue for these patients, physician-accessibility and the stability (continuity) of providers are, perhaps, more important concerns. First, for equal availability, access to local physicians varies with office hours, on-call schedules, emergency room coverage, calls to homes, and physicians' willingness to accept new patients. More generally, the willingness or ability of residents to seek care from more distant physicians will involve consideration of time and out-of-pocket expenses. Depending on the availability of transportation and child care, more mobile and motivated residents may prefer to use out-of-area physicians as their regular source of care while seeing local providers for more urgent or spontaneous purposes. Patient preferences are also important determinants of behaviour. For example, rather than seeing local male physicians, women may travel substantial distances to obtain care from one of the few rural female providers. Also, if the local practice suffers from high physician-turnover, rural residents concerned about the continuity of care may see physicians in distant, but more stable settings. Finally, for certain types of care, rural residents may be more concerned about access to qualified providers than local availability. For example, rural residents concerned about HIV infection may obtain diagnostic tests from anonymous hassle-free clinics in urban settings and, subsequently, obtain most of their medical care from the physicians staffing these sites.

Physician-turnover and gaps in practice-coverage are also important concerns for the quality of care. The continuity of the patient--physician relationship is compromised by high physician-turnover. Moreover the ongoing cycling of physicians reinforces the perceptions that rural practice is less desirable to physicians and that policy-makers are not motivated (or empowered) to resolve this concern. To the extent that patient satisfaction, quality-of-care, and outcomes are compromised, physician-turnover is detrimental to individual and, collectively, population well-being. Also, as physicians trained outside Manitoba require greater time to establish referral relationships, the residents of areas experiencing high physician-turnover and staffed by International medical graduates may face greater barriers to obtaining specialist medical care.

Finally, the provision of care to the frail elderly, to the disabled, and to other special-needs rural residents is particularly problematic (Hall *et al.* 1992; Joseph 1992; Rosenberg and Moore 1992; Rosenblatt and Moscovice 1982). Although the needs of these individuals extend beyond the medical care system, when such community-based services are unavailable, this burden may shift to the physician. Clearly, quality-of-care and satisfaction with the care process suffer when medical services are substituted for other more appropriate care.

1.1.2 PHYSICIAN PERSPECTIVE

Recurring complaints voiced by rural practitioners include the workload (and the related issue of income), excessive on-call hours, long travel distance, and the mix of services rendered (Canadian Medical Association 1992). Difficulty in obtaining *locum tenens* or otherwise arranging practice coverage for necessary absences is especially burdensome in more isolated, solo practices. Rural lifestyles may be incompatible with social needs and preferences of the bulk of recent medical graduates (and their families) who are mostly drawn from urban (suburban) settings. Younger physicians seeking a more balanced lifestyle than their older counterparts may resent the long hours and interruptions inherent in rural practice. Other concerns -- such as educating children or the career of the spouse -- occurring at specific points over the physician life cycle may trigger dissatisfaction with rural practice.

As physicians function within a health-care delivery infrastructure, the lack of supporting resources may place an undue burden on rural practitioners. For example, distance from centres containing specialists may require local generalists to provide a broader range of services than their urban colleagues. Considering the cost of malpractice insurance (e.g., for deliveries), physicians face substantial financial disincentives against entry into rural practice if the income derived from certain services is insufficient to offset the associated overhead costs. Distance from a critical mass of colleagues and from medical schools limits the opportunities for continuing education.

Also, the absence of home care and other community-based services may increase the burden faced by physicians in caring for the frail elderly, the disabled, and other special needs patients. Moreover, training in tertiary care settings and academic settings is inconsistent with the more basic (dated) technology available in rural hospitals.

The local availability of physicians is of concern to rural practitioners for several reasons. Physician-availability is a measure of the competition among physicians over patients, and, among fee-for-service physicians for income. Protecting the supply of patients by discouraging (or at least not encouraging) the addition of physicians to the existing supply is a first-line defence. Where levels of physician-supply have not been stabilized, however, physicians may respond by altering the mix/volume of services rendered and/or sharing patients (e.g., in Winnipeg; see Evans *et al.* 1987, Roch *et* al. 1985). The high rate of movement of International medical graduates from entry rural settings to Winnipeg (Postl *et al.* 1994) may be motivated, at least in part, by financial considerations.

In assessing the desirability of rural practice, income potential -- the amount of the potential demand for care greater than the existing supply -- is critical to physician decision-making (Gordon *et al.* 1992). Analysis in Canada (Brown 1993) and the United States (Newhouse 1990) finds little migration of physicians from increasingly well supplied communities to under serviced areas even in the face of large increases in the overall stock of physicians (see Lomas and Barer 1986, Roch *et al.* 1995). In Manitoba, the large increases in physician-supply following the implementation of Medicare in 1971 was accommodated in Winnipeg, with little change elsewhere (Evans *et al.* 1987; Roch *et al.* 1985). Income potential appears to have different meanings depending upon the setting. Sparsely settled rural areas may afford only poor income potential. The larger rural communities may provide reasonable incomes, but only to a limited number of physicians. Through the mechanisms of patient sharing and supplier-induced demand, however, physicians may protect their incomes against the ever growing competition for patients in urban areas.

Some critical number of physicians is needed to support group practice and other (formal and informal) mechanisms for sharing practice-coverage. Areas affording sufficient potential demand to support solo practitioners may be viewed as undesirable practice locations because of time and other factors (see above). For fee-for-service physicians serving small communities, the balance between income and coverage considerations is critical.

Physician-supply stability is important to physicians. Turnover disrupts formal (and informal) relationships among physicians sharing on-call arrangements and collegiality for professional activities. Moreover, extensive gaps in practice-coverage occurring during periods of physician-turnover may increase the workloads of the remaining physicians and/or motivate residents to obtain medical care from stable out-of-area practices permanently.

An important concern of rural physicians is the range of services that they are required to provide. In rural practices distant from urban areas, general practitioners are called upon to provide services that would otherwise be rendered by specialists. Although telemedicine and other initiatives reduce isolation, not all physicians are sufficiently qualified (or comfortable) to render the wide range of services typically managed in rural (especially more isolated) settings. To some extent, patient quality-of-care is comprised when physicians provide excess discretionary services, or if the volumes of specific interventions performed are not sufficient to maintain their clinical skills (see Michael Loyd & Associates 1993, Roos and Roos 1994).

1.1.3 SYSTEM (POLICY-MAKER) PERSPECTIVE

Canadian social welfare policy-making has generally taken a strong egalitarian stance regarding disparities and the extent of inequalities (Armitage 1988). Public policy -- "a course of action or inaction chosen by public authorities to address a given problem or interrelated set of problems" (Pal 1989, p 4) -- is expressed through financial and functional objectives (Evans 1984). In response to political will and limited resources, health care policy-making has shifted from passively responding to the demands of patients and physicians, to actively striving for cost-containment. Whereas in the first instance more is always equated with higher quality care, the second approach is a blunt instrument affecting both appropriate and inappropriate patterns of medical care utilization. More recently health care policy-making has shifted toward outcomes management (Relman 1988). This approach has the potential to improve the cost-effectiveness of the health care provided to individuals and, collectively, to populations.

Current arrangements for delivering primary care services reflect historic decisions about health-care system structure, financing, and organization. These decisions concern policies regarding the distribution of health insurance; the supply, mix, distribution of providers; the financing of, and organization for, the delivery of services;

and mechanisms for governance and accountability. Through their influence on care-seeking and care-providing behaviours, these arrangements create conditions in which imbalances occur in medical care use and health outcomes.

Policy-making is expressed through financial and functional objectives (Evans 1984). Financial objectives refer to patterns of claims, of goods and services, and of debits and credits across the members of society; patterns that arise from the incidence of illness and the response of the health-care system to those who would pay and benefit (Evans 1984). The 1984 Canada Health Act states that the primary objectives of Canadian health care policy "is to protect, promote and restore the physical and mental well-being of residents of Canada and to facilitate reasonable access to health services without financial or other barriers" [c. 6. 2. 3.]. Although there is widespread agreement that Medicare removed economic barriers to accessing medical and other services, equity has clearly not been achieved in the availability, use, quality, and outcomes of health care (Badgley and Wolfe 1992; Grant 1988; Manga 1981, 1987; Roos *et al.* 1994). While cost-containment policies have locked-in imbalances, more recent pronouncements by federal and provincial governments and interest in decentralizing the delivery of services has focused attention on inequities in access, utilization, and health (Birch and Eyles 1990; Carrothers *et al.* 1991; Law 1986; Manitoba Health Advisory Network 1991; Pederson *et al.* 1994; WESTARC Group Inc. 1994).

Functional objectives relate to the distribution of resources and the actual patterns of health care utilization: what goods and services are produced, in what quantities, and for whom (Evans 1984)? Because the implementation of Medicare froze in place traditional organizational and financial arrangements (Evans 1984), primary care is dominated by autonomous fee-for-service physicians in solo practice: families obtain medical care from local physicians; families are free to choose their doctor; and physicians locate where they please. Ideally, families have regular caregivers and communities have sufficient numbers of physicians to meet their needs. Given the focus on the patient--physician relationship, substantial Canadian policy-making has focused on physician resource planning (Barer and Stoddart 1992a, 1992e; Lomas and Barer 1986; Soderstrom 1994).

In Manitoba, since 1979, the Standing Committee on Medical Manpower (SCOMM) implemented several programmes designed to improving physician recruitment to, and retention in, rural practice. To date, these programmes include: placement service; under serviced area grants; summer placement of medical students; forgivable loans for medical students; the family medicine clerkship programme; the family medicine residency programme for rural general practitioners; the rural general practitioners' anaesthesia programme, family medicine rural residency programmes; and the rural continuing medical education programme (Postl *et al.* 1994). International medical graduates were extensively recruited and a limited-time Ministerial Waiver could be granted to enable those who have not yet qualified with the Manitoba College of Physicians and Surgeons to enter practice in designated under serviced areas. Also, salaried payment is available in certain communities that have implemented community health centres. This option was thought to appeal to physicians wishing to avoid the negative aspects of fee-for-service practice or those found in PSAs that do not afford sufficient income. Moreover, as these salaried sites were usually staffed by at least three physicians, issues arising from excessive after-hours coverage were avoided (Wall *et al.* 1994).

More recently, following the seminal Barer-Stoddart Report (1992e), several initiatives potentially affecting rural physician-availability were carried out (see Roos *et al.* 1996). First, while enrollment in the University of Manitoba Faculty of Medicine was recently decreased by 10%, this initiative will not reduce the stock of physicians, nor affect its distribution in Manitoba for several years. Of more immediate effect, however, the provision of billing numbers and the use of financial incentives encouraging new entrants to locate in under serviced areas may have been offset by licensing changes by the Manitoba College of Physicians and Surgeons. Since January 1994, limitations on the entry of international medical graduates and a one-time delay of Manitoba medical graduates have limited opportunities for physician recruitment. Given the historic dependence on foreign trained physicians in Manitoba (see Postl *et al.* 1994) and beyond (see Barer and Stoddart 1992b), some rural communities will experience problems in maintaining local physician-availability. The entry of graduates of the rural family medicine residency programme into rural practice, however, is an encouraging trend that may stabilize the physician-supply of rural Manitoba.

Roch and colleagues (1985) argue that self-regulation, an expanded pool of insured patients, and increased funding for medical services enabled physicians in Manitoba to increase medical care usage (incomes) while preserving their autonomous practice-styles. While the growth of medical care expenditures over time (Nycz and

Schmelzer 1992; Taylor 1987; Tholl 1994) have long been a concern of governments, variation in population health and patterns of health care usage have recently become issues for policy-makers (Coyte 1994; Evans 1990; Shapiro 1991). Unexplained variation can arise from differences in the comparative need for services, access to providers, and complex demand and supply interrelationships. In the face of poor local availability of medical care, residents travel in search of physicians and physicians travel in search of patients (see Contandriopoulos and Fournier 1988, Horne 1987, Michael Loyd & Associates 1993, Roos *et al.* 1996, Tataryn *et al.* 1995). These phenomena shift the debate from physician-availability to transportation and other policies enhancing physician-accessibility (Brown 1993, Newhouse 1990). In the face of competition, physicians may induce demand (utilization) to achieve some target income (see Evans 1984). This behaviour raises issues of incentives and organization to ensure agreement between system and physician objectives. However, as a substantial portion of small area variation typically remains unexplained, it is unclear what proportion is inappropriate and, so, the behaviours that policy-makers should address. However, because well-defined standards of care relating patterns of usage to outcomes are not in place, the interpretation of unexplained small area variation is problematic.

A recent study in Manitoba estimated population expected-need for ambulatory medical care as the provincial average rate of utilization adjusted for physician service area demographic structure, socioeconomic risk, and health status (see Roos *et al.* 1996). Comparing actual usage against this "standard" identifies areas with comparatively high and low patterns of usage. Although the task faced by policy-makers in redressing these imbalances is complex, this information, at least, narrows the breadth of debate.

1.2 THESIS GOAL AND OBJECTIVES

The overarching goal of this thesis is to advance our understanding of the epidemiology of ambulatory medical care utilization in rural Manitoba. While the above concerns are important, they also show the tension between perspectives on how primary medical care in rural settings *ought to be* delivered. While physician-availability is a concern of residents, and the historic focus of policy-making, perhaps rural stakeholders should contemplate imbalances in physician-accessibility and physician-workload. In shifting the focus to utilization, however, analysts should define inappropriate patterns of usage and consider the determinants underpinning these observations. Physician practice-modality (payment-modality and practice-organization) is a key mechanism available to policy makers to influence the provision of medical care in rural settings.

1.2.1 DETERMINANTS OF AMBULATORY MEDICAL CARE UTILIZATION

The theoretical and empirical literature bearing upon the determinants of physician behaviour is appraised to identify important measures of physician-workload (utilization) and its explanatory variables. Relationships among these variables are hypothesized. As most of this literature pertains to urban settings, however, caution must be exercised in generalizing these findings to rural practice. Whereas payment-modality is currently a key focus of physician resource management (Barer and Stoddart 1992c), practice-organization and physician-supply characteristics are likely also important in determining patterns of utilization (expenditures) (see Aday 1993).

Important measures of physician-workload include patient-contacts with physicians occurring in ambulatory and inpatient settings and the resulting utilization of medical care over the illness episode (i.e., patient-visits). Moreover, as some physicians provide "speciality" services and all general practitioners are entry points into post primary care, variations in rates of consultations rendered and referrals made to "specialists" will be noted.

Explanatory variables are characterized as those belonging to the physician service area, physician, and patient-profile (all discrete patients contacting a physician). Physician service area variables include the physician-supply and the availability of staffed hospital beds. Because within-area variation may be less than that between-areas levels, mean rates of ambulatory and hospital care may provide important insights into differences across small areas and between alternative practice-modalities. Important variables characterizing alternative practice-modalities include payment-modality (fee-for-service, salary), organization (solo, group, community health centre) and practice-duration (e.g., sessional, *locum*, clinic, and permanent practice). Physician behaviour varies with age, sex, and place of graduation. Finally, patient-profiles are characterized by differences in the comparative need for ambulatory medical care and the accessibility of physicians.

1.2.2 THE MANITOBA PHYSICIAN RESOURCE DATA SET

The ability of analysts to tease out important relationships explaining patterns of rural primary medical care utilization is influenced by the quality of the data used for both descriptive and analytical purposes. Although Manitoba Health administrative data has been extensively used for more than twenty years, comprehensive data sets that can be routinely analysed to inform on patterns and determinants of health care utilization have only recently been initiated. The highly regarded population health information system (POPULIS) is an early initiative (Roos *et al.* 1995). Given the increasing emphasis being place on decision-making informed by high-quality analysis, the Manitoba Physician Resource Data Set (MPRDS) provides valuable information required for this thesis research, but it can support the data needs of future projects.

Using data from the medical claims file, the population registry and the physician registry, we may comprehensively define the utilization of medical care by combining data on the provider, the patient, the setting, and the services used. Currently, data from the 1991-92 through 1994-95 fiscal years have been processed by the Manitoba Centre for Health Policy and Evaluation. Besides linking physicians to settings (small areas), patient movement and physician practice initiation/termination and movement within Manitoba can be accurately tracked. Changes in practice (location, practice-modality and/or specialization) are noted as separate observations within the data set -- that is, some physicians will have several entries because of changes in one or more of these factors. Practice-profile expected need for ambulatory medical care, and other explanatory variables are estimated for each complete physician-quarter. Through a comprehensive set of variables estimated using high quality data, this data set offers significant advances.

1.2.3 PATTERNS OF AMBULATORY CARE UTILIZATION ACROSS RURAL MANITOBA PHYSICIAN SERVICE AREAS

An important contribution of the proposed research is describing and analysing the provision of medical care in rural Manitoba. What are the roles of population expected need for ambulatory physician visits, physician-availability, physician-accessibility, and physician-competition in determining patterns of medical care utilization?

First, patterns of utilization will be investigated from the population perspective. Variations across physician service areas in the utilization of physician visits in relation to the comparative population need for primary medical care (i.e., demographic, social status and health status factors), physician-availability (i.e., the local physician-supply adjusted care rendered to out-of-area patients), and physician-accessibility (i.e., physician-availability adjusted for care obtained from out-of-area physicians) is examined. This research finds that while rural populations exhibit comparable levels of realized physician-accessibility, whatever the local supply and availability of physicians, patterns of utilization bear little relationship to the expected need for ambulatory medical care. The cities of Winnipeg and, to a lesser extent, Brandon play important roles in providing medical care to rural residents.

Second, substantial variation is observed across physician service areas in physician patient-load and in the visit-intensity rendered, even in the face of comparable physician-competition (i.e., the local physician-supply adjusted for the effects of out-of-area care-giving and into-area care-seeking). Whereas variation in visit-intensity bears some relationship to population need for physician visits, insufficient numbers of visits are rendered in high need physician service areas while the opposite is noted in low need areas. While the achievement of a comparable level of physician-completion, despite differences in need and supply, is remarkable, this finding is disturbing. Clearly, other factors enable fee-for-service physicians found in low-need--high-competition areas to attain incomes comparable to those in less needy and competitive settings.

Finally, for physicians entering rural practice, place of graduation (Manitoba and other Canadian Universities, International Universities) differ across small areas and between payment-modalities with Manitobans generally preferring group practice in well-supplied areas. The availability and stability of the physician-supply are major concerns in rural Manitoba. Physician-turnover is generally lower and physician-retention is higher for fee-for-service group practice; however, the lowest gaps in practice-coverage were detected for salaried settings.

1.2.4 THE ROLE OF PRACTICE-MODALITY IN DETERMINING THE PROVISION OF AMBULATORY MEDICAL CARE IN RURAL MANITOBA

The role of practice-modality (payment-modality and practice-organization) in determining the provision of ambulatory medical care in rural Manitoba was investigated using physician-specific data obtained from the Manitoba Physician Resource Data Set.

The much larger visit-workload estimated for the fee-for-service payment-modality compared with salaried physicians is explained by the greater number of patient-contacts seen and the marginally higher visit-intensity rendered. Within the fee-for-service practice-modality, physicians in group practice manage larger discrete patient-loads, but see patients less often than their solo colleagues. Overall, however, fee-for-service physicians see comparable numbers of patient-contacts, whatever their practice-organization. While the effect of group practice-organization is observed for both salaried and fee-for-service payment, these groupings differ substantially as to the size of the discrete patient-load managed. For example, salaried physicians see 43% fewer discrete patients per quarter.

Relationships between outcomes, utilization, and explanatory variables are increasingly being examined using multivariate analysis. Although recent trends include the use of structural equations, our limited understanding of causal pathways may not warrant the application of such sophisticated analysis. As a starting point for a research agenda, this research employs descriptive analysis to identify important relationships. Future research will use multivariate models of increasing complexity to attempt to isolate the effect of payment-modality on the utilization of ambulatory medical care.

1.2.5 POLICY IMPLICATIONS

The key overall policy implication of this research is that rural Manitoba's patterns of primary medical care utilization occur within a complex *system*. Therefore, the widespread focus on physician-supply as a measure of appropriate physician distribution is clearly misplaced. Policy-makers concerned with physician-availability also benefit from knowledge of the extent of residents' out-of-area care-seeking. In truth, oversupplied settings may have "reasonable" levels of physician-supplies because of into-area patient care-seeking increasing the effective size of the population managed. Similarly, undersupplied settings may have "reasonable" levels of physician-supplies because of out-of-area patient care-seeking reducing the effective size of the population served.

Although rural communities are concerned about the local availability of health care resources, physician distribution is not congruent with population expected need for ambulatory medical care (Roos *et al.* 1996). Also, extensive out-of-area-care-seeking in some areas undermines arguments justifying the continuous restaffing of one-physician settings. However, will efforts to redistribute physicians to under serviced areas redress imbalances in prevailing patterns of care-seeking and care-giving? Only in areas where low levels of contact could be appropriately increased would the addition of new physicians (or physician substitutes, such as nurse practitioners) are unambiguously beneficial -- that is, physician-accessibility is the bottleneck constraining the consumption of needed ambulatory medical care.

1.3 THESIS RESEARCH CONTRIBUTIONS AND LIMITATIONS

1.3.1 METHODOLOGICAL CONTRIBUTIONS

The methodological contributions of this research include the specification of a basic conceptual model of the utilization process and the development of a data set supporting research investigating physician behaviour.

Building from theory, empirical findings, and conceptual frameworks, this thesis develops a conceptual model of the process of medical utilization in rural settings. Analysis is performed using macro-level and meso-level relationships between utilization and its determinants. Macro-level analysis is concerned with large number of individuals in social environments (Collins 1988) -- for this research, populations and physician-supplies interacting within the context of rural physician service areas. From a macro-level perspective, the relationships between primary medical care utilization and population expected need for physician visits, physician-supply, physician-availability, physician-accessibility, physician-competition, and physician-workload are explored. Meso-level analysis is concerned with the way in which individuals behave within organizations (Collins 1988) -- for this research, the interaction between physicians in specific practices (physician-practices) and the patients managed (patient-profiles), and patterns of utilization are investigated.

In building the Manitoba Physician Resource Data Set, administrative data were converted into physician-specific outcome and explanatory population, practice-profile, physician, practice and physician service area variables. While the full potential of the data set is not tapped, I did undertake important analyses that advanced our understanding of physician performance (workload and practice-stability) in rural settings.

1.3.2 EMPIRICAL CONTRIBUTIONS

An important advance made by this analysis is the finding that patterns of utilization across all rural Manitoba settings generally are not determined by population expected need for ambulatory physician visits. The utilization of ambulatory medical care in rural Manitoba suggests that equal access to physicians for all residents regardless of location has been achieved. While population contact-rate is uniformly high, however, the variation of patient visit-intensity across settings is not predicted by population need for ambulatory physician-visits. Whereas this accomplishment is significant (and perhaps rare), policy-makers should contemplate how the more equitable goal of "equal visits for equal need" can be achieved.

Four findings from this study have important policy implications regarding patterns of ambulatory medical care utilization in rural Manitoba. First, differences in physician-availability are compensated for through visits made to out-of-area physicians. Overall, rural Manitobans face comparable levels of physician-accessibility no matter place of residence and/or expected need for medical care. Overall, the high annual rate of physician contact (around 80%) found in all areas and the very weak positive relationship between utilization and expected need for medical care suggest that the determinants of utilization are complex. Neither the need for care nor its availability is sufficient to explain these findings. Second, unexpected findings of comparable levels of physician-competition across rural Manitoba were explained by interactions between physician-supply, average physician visit-workload, and the effective population seen by in-area physicians. Third, physician-supply stability does not vary with need, competition, or workload. Finally, physician practice-modality matters, with fee-for-service group practitioners exhibiting higher performance in terms of managing larger patient-loads, agreement between needed and rendered visits, and greater practice-stability.

1.3.3 RESEARCH LIMITATIONS AND CONSTRAINTS

The analyses proposed here benefit from several significant advantages. Physicians, patients, settings, and services can be linked and described using high quality data that has been repeatedly validated. All physicians and residents are included. No evidence was found of salaried practitioners under reporting patient contacts and utilization.

Moreover, the prevailing physician-supply is accurately estimated since bias arising from physician misclassification was eliminated. Most important, this research builds upon previous methodological and data initiatives made by members of the Manitoba Centre for Health Policy and Evaluation.

The nature of quasi-experimental designs and secondary data, however, limits our ability to interpret research findings. First, although these sources of administrative data produced a high-quality data set, the lessons that can be drawn from this research are limited by missing data (e.g., patient outcomes; the time devoted by physicians to direct patient care). For example, whereas areas suffering from high physician-turnover are identified, the explanation of these events cannot be fully learned from secondary data alone. Similarly, besides the lack of fee-for-service financial incentives, the much smaller patient-loads managed by salaried physicians may also reflect physician staffing and/or time constraints imposed by administrative duties.

Finally, self-selection bias limits our understanding of between-modality differences in utilization if physicians entering salaried practice systematically differ from those electing fee-for-service payment. Although selected between-modality comparisons (e.g., recent graduates from the same country entering practice in the same year; physicians switching payment-modality) can reduce potential bias, self-selection cannot be eliminated as an explanation of the between-modality differences found here.

2.0 MEDICAL CARE UTILIZATION: EMPIRICAL ASSOCIATIONS AND CONCEPTUAL (CAUSAL) MODELS

> *Only individuals act. Everything else -- society, culture, social structure, power, groups, organizations -- is ultimately dependent on the acts of individuals. Yet individuals can act only because they acquire the capacity to do so as members of a society, which is the source of their knowledge, language, skills, orientations, and motives. Individuals are born into and shaped by a society that already exists and that will persist long after they are dead; yet that same society owes its existence and continuity to the conduct of its members* (Hewitt 1991, p 5).

This observation is key to understanding complex patterns of medical care utilization typically expressed in primary and secondary data (i.e., the epidemiology of medical care). Patterns of utilization are determined by interactions among care-seeking and care-giving behaviours, which, in part are determined by complex *interactions* among the broad determinants of health (e.g., genetic, psychological, social, economic, and cultural). Moreover, since care-seeking/care-giving behaviours are social activities, the family, the broader social fabric, and the health-care system also influence utilization. Finally, since current patterns of utilization arise from attitudes and relationships derived from life experiences and past policies, the effects of time should be considered. The purpose of social analysis is to "project meaning into webs of relationships among persons" (Heilbroner 1986, p 181). While we observe medical and other health care utilization and perceive underlying structures motivating and otherwise influencing individuals' behaviours, social analysis is complicated by the competing meanings assigned to these institutional arrangements. How behaviours are conceptualized cannot be separated from the underlying social matrix (Heilbroner 1985; Stiglitz 1992).

This chapter assesses the potential of routinely collected administrative data to inform on the performance of the primary medical-care system in rural Manitoba. First, performance and its dimensions are defined. The potential of administrative data to provide useful information to residents, patients, physicians, and third-party payers is discussed. However, because social analysis requires a conceptual framework of performance, key determinants of care-seeking/care-providing behaviours generating measured utilization data are discussed. Rather than comprehensively reviewing the substantial social sciences' literature (anthropology, economics, epidemiology, geography, psychology, sociology, and their cross-disciplines) only selected empirical findings and conceptual models are considered.

2.1 PATTERNS OF UTILIZATION: INTERPRETATION AND MEASUREMENT

Performance -- the process of functioning -- is a normative concept expressing the goals, beliefs, and values of decision-makers (i.e., consumers, providers, and payers) in holding those delegated responsibility for providing medical care accountable for their activities. While some overarching factor -- such as the profit motive in perfectly competitive markets motivating providers to respond efficiently to consumers' preferences or physicians' selfless behaviour as the patient's agent in rendering only needed care -- would ideally guarantee optimal performance, in practice, the incomplete vertical integration of the Canadian health-care system provides no such assurance (Evans 1984, 1981). Hence, health services research -- inquiry to produce knowledge about the structure, processes or effects of personal health services (Institute of Medicine 1979) --

is key to informing policy-makers/managers on health-care *system* performance (Aday 1993; Aday *et al.* 1993; Andersen 1995; Evans and Stoddart 1990; Ginzberg 1991; Mechanic 1992).

Utilization -- the mix and volume of medical services provided by physicians and consumed by patients -- derives from the interaction of patient care-seeking and physician care-providing behaviours. For poorly understood reasons, differences in behaviours generate important cross-sectional as well as temporal variations in patterns of utilization. Utilization analysis -- an important methodology for evaluating the mix and volume of medical care provided in a given geographic area during a defined period -- provides information to decision-makers concerned with improving health-care system performance (Anderson and Lomas 1988; Barer 1988; Lomas 1988). Although "it is extraordinarily difficult to relate the patterns of primary care to outcomes and to estimate the cost-effectiveness of different patterns of care (Williams 1992, p 157)," other dimensions of medical care performance can be usefully investigated (see Roos and Roos 1994). Indeed, because explicit performance objectives are rarely specified, unexplained variation becomes the focus of assessment (Battista *et al.* 1986; Contandriopoulos *et al.* 1987; Evans 1990, 1984; Labelle *et al.* 1990; McGuire 1990; Roos *et al.* 1996).

Given the wide range of medical care provided (consumed) by rural physicians (residents), an appropriate set of weights is needed to aggregate these diverse medical services into a single index summarizing utilization. Lacking weights derived from time-and-motion studies, two approaches are widely used. First, by assuming that all services consume equal time, output can be estimated as the unweighed (i.e., arithmetic) service-count. Alternatively, in assuming that the fee-schedule tariffs appropriately value the time used to provide services, output can be estimated as total-cost -- that is, the sum, over all fee-schedule items, of the multiplicative product of counted services, by each item, times the corresponding tariff. However, as the time consumed in rending care varies widely across medical services and the relationship between fees and time is distorted by the politics of fee-schedule negotiation, the alternative approach used here focuses on patterns of patient contacts (see Roos *et al.* 1996, Tataryn *et al.* 1995). Specifically, ambulatory visits, hospital inpatient visits, and referrals to specialists are estimated. As inpatient and/or specialist care can, to some extent, substitute for ambulatory care, the sum of ambulatory, inpatient plus referral, visits are also calculated to measure the total visit-workload seen by rural physicians. By examining the distribution of this workload, insight will be gained into how physicians manage their patients.

TABLE 2.1: AMBULATORY MEDICAL CARE UTILIZATION AND ITS DETERMINANTS

UTILIZATION	PHYSICIAN WORKLOAD ($/physician)					PHYSICIAN-
EXPENDITURE	CONTACT-RATE	PRACTICE-LOAD	EPISODE-RATE	VISIT-INTENSITY	FEE-INTENSITY	SUPPLY
$/'000 =	***patients/resident***	***residents/physician***	***episodes/patient***	***visits/episode***	***fees/visit***	***physicians/'000***
BEHAVIOUR	expressed need care accessibility	competition commonality competition	expressed need evaluated need	expressed need evaluated need competition	evaluated need competition	physician income public policy

For ambulatory medical visits, the effects of patient, physician, and interactive patient--physician behaviours can be investigated by examining the components of utilization: contact-rate, patient-load, episode-rate, visit-intensity, fee-intensity, and physician-supply (see Table 2.1). For small-areas, the average utilization per thousand residents, estimated as the ratio of expenditures to the population-count in thousands

($/000), is the multiplicative product of the average physician visit-workload, estimated as the ratio of expenditures to the count of physicians ($/MD), times the physician-supply caring for these residents, calculated as the ratio of the physician-count to the population-count in thousands (MD/'000). Thus, the relationship between average physician visit-workload and small-area (population) aggregate utilization is expressed through physician-supply. The workload of individual physicians is further expressed as the multiplicative product of a set of ratios that, collectively, form a conceptual framework of accounting relationships (identities) for investigating variation in utilization. Across individual physicians, utilization ($/physician) is the multiplicative product of the average patient-load -- that is, the contact-rate (patients/residents) times the average practice-profile managed (residents/physician) -- times the average episode-rate (episodes/patient) times the average visit-intensity (visits/episode) times the average billing-intensity (fees/visit). Important determinants bearing upon these components are noted in Table 2.1 and discussed in the following sections.

2.2 TOWARDS A MODEL OF UTILIZATION

Observed patterns of medical care utilization are the result of an underlying process not obvious from administrative or other secondary data. Researchers concerned with explaining *collective* social phenomena overcome this limitation by positing theoretical macro-level relationships while assuming *predictable* micro-level behaviour among the underlying constituents (see Hunter 1986, Kay 1992, Stiglitz 1992). Although some economists stress consumers' demand for medical care while other analysts emphasize the role of unmet needs or uncertainty in clinical decision-making, utilization is more accurately understood as two interrelated sub-processes: consumers' demand for episodes of medical care and physicians' supply of medical services during these episodes (Stoddart and Barer 1981). Each of these sub-processes consists of an expressed behaviour and its determinants. While most analysts distinguish between the respective roles of consumers and providers in determining utilization, there is disagreement over the extent that demand and supply behaviours are independent, which determinants of observed (posited) behaviours should be included in the model, and how these (inter)relationships should be specified.

The foundation of the medical care utilization process is the patient--physician interaction. Within the context of this (inter)relationship, physicians arbitrate between economic forces driving them to behave as any producer of services, their legal responsibility as agents answerable for patients' wellbeing and external consideration affecting the group or social concerns (Contandriopoulos *et al.* 1987; Eisenberg 1986; Starfield 1992) while patients balance the anticipated benefits of medical care against the costs of care-seeking and of complying with prescribed therapy (Cockerham 1995; Evans 1984; Frankel *et al.* 1996). Patterns of utilization vary both temporally and cross-sectionally with changes in the underlying determinants of health and health behaviour, shifts in the distribution of power within patient--physician relationship, and constraints imposed by the external environment. Moreover, as much primary care decision-making occurs under conditions of uncertainty, marked differences in consumers' and providers' behaviours across settings (and encounters) generate substantial variation in the mix and volume of care used.

Whereas social science theory diverges widely in the conceptual models used to explain the process of medical care utilization, "[t]here is little disagreement regarding the dramatic changes occurring in the primary care sector and the important role being played by medical technology" (Young *et al.* 1989, p 10). The understanding of utilization is advanced by recognizing how medical technology -- that is, the ways of doing something (Boulding 1956) -- has penetrated into the social construction of the reality of health and of health care (see Conrad and Schneider 1992, Evans 1984, Feeny 1994, Frankel *et al.* 1996; Frankel 1990). Technology is a powerful force changing relationships within the embodying social systems while motivating us, collectively, to reconsider our notions of power and accountability (Frankel 1990). As medical technologies are widely perceived to treat ailments successfully, the medicalization of many human problems has led consumers to expect physicians to resolve (or at least manage) their illnesses. Moreover, as most residents annually contact the health-care system, physicians have opportunities to supply medical technology.

Three forces act to increase the usage of medical technology in primary care settings (Horder and Medcalfe 1989):

- improvements in diagnostic capabilities increase the range of primary care utilization through the earlier detection of disease;
- following diagnosis some form of medical intervention invariably follows; and,
- the diffusion of therapeutic/rehabilitative technologies from inpatient into ambulatory settings enables generalists to provide greater amounts of care.

The dissemination of medical technology provides opportunities (indeed, imperatives) for both providers and consumers to act.

Beyond the availability of physicians, equipment, and other health care resources, however, the utilization of medical technology critically depends upon the decision-maker's (patient, physician, and/or patient--physician interaction) *knowledge of*, and *attitudes toward* its applications. Who, ultimately, is (are) the decision-maker(s)? How is knowledge of health, risks and technology communicated to these decision-makers? What forces shape decision-makers' attitudes toward applying this knowledge? Differences between consumers and/or physicians in one or more of these considerations could explain (at least) some observed variation in medical care utilization.

Need -- a condition characterized by lack of an ingredient that would otherwise improve, maintain or restore the "desired" level of health -- is critical to interpreting patterns of health care utilization. While patterns of utilization typically follow the availability of physicians and their ancillary technology, additional variation also occurs because of collective differences in consumers' felt needs (i.e., health care wants), their expressed needs (i.e., the demand for medical care) and physicians' evaluation of patients' needs (i.e., the supply of medical services) and the outcomes of the patient--physician interaction. For policy-making, however, comparative need -- expected behaviour in light of group characteristics (Bradshaw 1972) -- becomes the focus of analysis. As Canadian social welfare policy-making has generally taken a strong egalitarian stance regarding disparities and the extent of inequalities (Armitage 1988) comparison remains a key approach for evaluating health-care system performance (see Aday *et al.* 1993, Birch and Eyles 1990, Ellencweig 1992, Institute of Medicine 1993).

Therefore, variations in the relationship between comparative need, technology, and resource availability and utilization occurring across small areas and practice-profiles can be investigated for their equity and cost implications.

2.2.1 COMPARATIVE NEED

Comparative need has been estimated for populations using self-reported global status available from health surveys and data obtained from administrative sources:

- mortality data (Eyles *et al.* 1991);
- morbidity/mortality data (Cohen and MacWilliam 1995);
- socioeconomic data (Frohlich and Mustard 1994);
- socioeconomic/demographic data (Mustard *et al.* 1995); and,
- socioeconomic/demographic/mortality data (Birch *et al.* 1996; Roos *et al.* 1996, 1997).

Although it is not clear how these top-down approaches relate to the actual health status of the underlying constituents (however aggregated) in the absolute sense -- that is, what is actually measured -- these methods do provide a basis for comparing populations (see Roos *et al.* 1996). In general, health status varies across populations distinguished by socioeconomic, demographic, cultural, and other considerations, but also temporally and spatially. Inverse relationships between both mortality and morbidity with population socioeconomic status have consistently been found in Canada (see Birch *et al.* 1990, Frankel *et al.* 1996, Grant 1988, Manga 1987, Mustard *et al.* 1995, Ujimoto 1988) and beyond (see Aday 1993, Argyle 1994, Dutton 1986, Hertzman *et al.* 1994, Marmot and Mustard 1994, Marmot *et al.* 1995, Mishler 1981, Patrick and Erickson 1993, Patrick and Wickizer 1995). These findings suggest that socioeconomic status is a key component of the construct, "actual population health status". For Manitoba Health Planning Regions, the Frohlich and Mustard (1994) socioeconomic risk index was highly correlated with population health status estimated using the proxy measure, premature mortality (standardized mortality rate). Explanatory power is increased by incorporating demographic, socioeconomic, and health factors that also predict patterns of ambulatory care utilization (see Birch et al. 1996, Roos *et al.* 1996).

Wilkins and colleagues (1991) identified strong income-related differences in mortality for both Canadian adults and children. Wolfson and colleagues (1993) found elevated risk of death for male Canada Pension Plan recipients reporting lower labour force earnings for twenty years before retirement. Morbidity measures were consistently correlated with male adult income (Hays 1988). For a sample of Ontario residents, inverse relationships for adults were detected between cumulative mortality risk and income (Hirdes and Forbes 1992) as well as between global health status and education attainment (Roberge *et al.* 1994; Torrance *et al.* 1992). For the Manitoba population, Mustard and colleagues (1995) estimated mortality and morbidity gradients by life-stage and socioeconomic status. Mortality is inversely related to household income as well as educational attainment among adults. Although an imperfect measure, health status estimated as the prevalence of clinically diagnosed disease was correlated with socioeconomic status (education attainment, family income), both for the diagnosis of specific disorders and disease-severity estimated as the presence of three or more conditions. While consistent inverse associations between socioeconomic status and treatment prevalence were estimated, greater variation was observed for income compared with education.

While population health status is generally highly correlated with socioeconomic status, it is not obvious what mechanism explains these observations (see Corrin 1995, Marmot *et al.* 1995). For coronary heart disease, Marmot and Mustard (1994) argue that preliminary research suggests that the interaction of multiple lifestyle behaviours (i.e., nutrition and smoking behaviours), as mitigated by the socioeconomic environment, have the potential to explain perverse research findings not otherwise explained by the biomedical or other simple models. Moreover, as lifestyle behaviour, itself, is powerfully influenced by education, occupation, and income, socioeconomic status is both a modifier and also a determinant of health. In general, the growing integration of biological and social sciences research findings suggests that the pathways linking host defense response to stress are also powerfully influenced by the socioeconomic environment (see Evans *et al.* 1994).

Population health status also varies spatially. Wilkins and Adams (1983, 1988) found that the health status of Canadians, estimated as life expectancy weighted for disability-days, varied by community size in all provinces with rural areas consistently faring worse. In Manitoba, both the prevalence of clinically important risks for cardiovascular disease (i.e., hypertension, smoking, serum lipids, all three) and less significant factors (i.e., physical inactivity, obesity, drinking, poor diet, family history) were consistently higher for small rural communities (< 2,000 residents). The regional centres (including the larger towns) and Winnipeg Region had respectively lower rates than rural areas (Young *et al.* 1991). Recent cross-sectional analyses found differences in population health status (measured as treatment prevalence from administrative data using 102 standardized indicators) between Winnipeg and non-Winnipeg as well as across eight Manitoba Health planning regions (Cohen and MacWilliam 1994). Compared with Winnipeg, many non-Winnipeg areas exhibited comparable, or better, health. Whereas morbidity and mortality rates for the regions clustered around the provincial mean, the residents of the remote Thompson and Norman Regions displayed the poorest health while those residing in the rural Central and largely rural Westman Regions (also containing the City of Brandon) generally exhibited superior health (see Cohen and MacWilliam 1994). Population socioeconomic status, estimated for each region using the socioeconomic risk index, was highly correlated with population health (Frohlich and Mustard 1994).

Temporal and spatial variations in aggregate health status reflect changes in population demographic, socioeconomic, and ethnic composition. Research consistently finds health status to be poorer among the elderly (Meade 1992; Ujimoto 1988), native Canadians (see Young 1994), the unemployed (D'Arcy and Siddique 1985), than those experiencing frequent interruptions in employment and/or working in occupations characterized by few job demands (see Birch *et al.* 1988). As rural communities generally have higher proportions of one or more of these groups (Gesler *et al.* 1992; Grant 1988; Rosenblatt and Moscovice 1982), these populations are in greater need of health care (Birch and Eyles 1990; Patrick and Erickson 1993). Moreover, because population composition varies for complex reasons related to community functioning (Everitt and Gill 1993), substantial differences in health occur. Also, sparse patterns of settlement and difficulties in recruiting/retaining health care providers impair the ability of governments to deliver mandated services in rural Canada (Gesler *et al.* 1992).

Over time, self-selection occurs as individuals move for economic, service, and other reasons. For example, the ongoing loss of educated youth to cities and the migration of elderly residents to select rural settings, or to Winnipeg/Brandon, is not a random process. Therefore, population demographic, socioeconomic, and other characteristics will differ with rurality and community specialization -- retirement sites differ from, for example, satellite communities beside cities, regional centres providing market services and recreation areas characterized by substantial seasonal changes in population size and composition. Similarly, residents self-select themselves into physician-practices based on their continuing satisfaction with the patient--physician relationship (e.g., the correspondence between age, gender, expectations). Moreover, while patterns of disease change over time, the socioeconomic gradient in health remains (Marmot and Mustard 1994).

Although evidence exhibiting strength, primacy, and dose-response suggest that utilization is causally related to need (however measured; see Aday 1993, Akin *et al.* 1985, Hulka and Wheat 1985, Miners 1981) other researchers have found little evidence of a relationship (see Roos 1992, Roos and Shapiro 1981, Roos *et al.* 1996, Wennberg 1985). Disagreement reflects differences

- in the unit-of-analysis employed (i.e., the individual, the household, the population; see Akin *et al.* 1985, Andersen 1995, Hulka and Wheat 1985, Miners 1981, Stoddart and Barer 1981, Roos *et al.* 1996),

- in how populations are defined for aggregate analysis (i.e., regions/other arbitrary administrative groupings versus well-defined markets; see Hewitt 1992, Morrisey 1991, Wennberg 1985),
- in distinguishing medical care demand from utilization (i.e., demand for care episodes versus utilization of medical care during these episodes; see Black 1990, Stoddart and Barer 1981), and
- in controlling for combined effects of perceived need and predisposing/enabling factors also influencing demand/utilization (e.g., while high need United States residents are also more likely to be under insured or to have no health insurance, survey, and secondary data poorly measures this status; see Mechanic 1992).

Whatever the true relationship, however, Canadians and their policy-makers generally agree that "actual (comparative) need" should be a key consideration in policy-making on the delivery of health care (Badgley and Wolfe 1992; Birch *et al.* 1992; Eyles and Woods 1983; Taylor 1987). Hence, indirect adjustment for need using variables measuring the characteristics of at least one of population demographical structure, social status, and/or health status is widely used in health services research investigating patterns of medical care utilization (see reviews by Aday *et al.* 1993, Hulka and Wheat 1985).

2.2.2 FELT/EXPRESSED NEED (CONSUMER DEMAND BEHAVIOUR)

The determinants of demand behaviour are diverse and often conflicting. Individuals' behaviours in responding to their health are complex and heterogenous -- since both health and health behaviour are products of culture and social structure, consumer demand arises from prevailing belief systems as well as patterned activities reinforced by the way of life within a particular culture (Mechanic 1992). Therefore, both individual and aggregate demand can deviate substantially from the "actual" need for medical care.

Individuals are characterized by differing social-psychological attitudes forming their behaviour in response to:

- self-assessed (perceived) health, cognizance of symptoms, and awareness of health-risks;
- information from physicians and other external sources informing on health risks; and
- diagnostic, prognostic, and therapeutic information concerning specific medical encounters (Green and Kreuter 1991; Rajecki 1990).

These attitudes, developed initially through parental and peer modelling, evolve (slowly) over time through ongoing exposure to information, and from life experiences (Bruhn 1988). Personal characteristics thought to influence health beliefs include personality (e.g., anxiety, dependency, and extraversion), demographic (e.g., age and gender), culture (e.g., Status Indian), and socioeconomic status (e.g., income, education and occupation) as well as subjective (e.g., number of self-reported medical conditions) and perceived (e.g., self-rating of health) measures of need (see Cockerham 1995, Frankel *et al.* 1996, Freund and McGuire 1995, Mishler 1981, Waldron 1988).

The weak correlation typically estimated between attitude and observed behaviour reflects incomplete understanding of complex interactions and also limitations in operationalizing these constructs (see Green and Kreuter 1991, Rajecki 1990). First, attitudes are typically created, maintained, or modified through interpersonal processes.

Hence, social networks rather than isolated individuals may be the appropriate unit-of-analysis (Erickson 1988). Cues and messages derived from the family (Sallis and Nader 1988), the social support network (Ritter 1988), the wider community (Geertsen 1988) as well as through interactions with the physician (Mechanic 1992; Roter 1988), the practice-setting (Greenley and Davidson 1988, and the wider health-care system (Aday 1993, Andersen 1995, Mishler 1981) all influence individuals' perceptions of (felt) need as well as their predisposition to demand physician contacts and to utilize prescribed medical care. Estimation is further distorted by predicting demand (a single-act behaviour) using global measures of attitude and/or health status (see Mechanic 1992, Rajecki 1990).

Health services researchers typically distinguish between three types of consumer behaviour: health, illness, and sick-role (see Frankel *et al.* 1996). Health behaviour includes all activities undertaken by individuals to prevent and/or detect illness in its pre-symptomatic phase. Illness behaviour refers to actions, taken in the presence of symptoms, leading to the diagnosis and/or treatment of disease. Finally, following the formal diagnosis of disease, sick-role behaviour includes activities undertaken to restore health, prevent further disability, or provide palliation. In each phase, behaviour can (but does not necessarily) include demand for medical care -- that is, contacting a primary care physician and consuming medical services. Variation in medical care utilization is greater during the health and sick roles because patient behaviour is influenced (directed) by the physician's evaluation of disease and recommendation of care. This behaviour is discussed below under patient--physician interaction.

Variation in individuals' care-seeking behaviours reflects differences in their perceptions of (felt) need, the availability of family/community resources enabling response and/or factors (demographic, socioeconomic, and ethnic characteristics) predisposing them to seek medical care (see Aday 1993, Akin *et al.* 1985, Hulka and Wheat 1985, Segall 1988). Therefore, in responding to comparable mix/intensity of symptoms, variation in utilization reflects differences in the demand for medical care -- that is, how individuals translate perceptions into expressed needs for medical care. Differences in the acceptability of medical care (i.e., predisposing factors influenced by culture, education, experience) and/or physician-accessibility (enabling factors determined by community and family resources) are thought to explain at least some variation (see Aday 1993, Andersen 1995, Evans 1984, Eyles and Donovan 1990, Frankel *et al.* 1996, Joseph and Phillips 1984; Phillips 1981).

Individuals' health, illness, and sick role behaviours determine the initiation of medical care episodes and influence the subsequent utilization of medical services. This demand for medical care -- the decisions made by residents on whether, when, and where to contact physicians -- depends on three interrelated variables: the underlying health status (actual need), perceived need for medical care, and the opportunity cost of care-seeking. Therefore, important sources of variation in the demand for primary medical care arise from differences in underlying actual health status (need), how needs are perceived (wants), the effect of financial and other barriers on the translation of wants into physician contact (costs) and, finally, the resulting consumption of medical services (demand). Throughout this process, micro-, meso- and macro-level relationships influence patterns of medical care demand (and, so, utilization; see Table 2.2). Selected variables of interest to stakeholders -- population and practice-profile-need, physician-supply, physician-availability, physician-accessibility; physician-workload, competition (see Table 2.2) -- arise from complex (inter)relationships occurring at the micro-, meso-, and macro-levels of interactions between consumers and providers.

TABLE 2.2: THE EFFECT OF MICRO-, MESO- AND MACRO-LEVEL INTERACTIONS BETWEEN CONSUMERS AND PROVIDERS ON MEDICAL CARE UTILIZATION

MICRO-, MESO- MICRO-LEVEL INTERACTIONS	PATIENT	FAMILY	PRACTICE-PROFILE	POPULATION (SOCIETY)	PHYSICIAN	PRACTICE	SUPPLY
PATIENT	latent attitude	health behaviour sick role	access	norms	access supply	access	access
FAMILY	burden	resources	access	norms		access	access
PRACTICE-PROFILE	evaluated need						competition
POPULATION				need			availability
PHYSICIAN	expressed need a sick role	compliance	compliance	norms	attitudes	norms	workload
PRACTICE							
SUPPLY					workload	workload	

While healthy lifestyles -- voluntary health behaviour based on the set of choices available to individuals according to their life situations (Cockerham *et al.* 1993) -- includes contact with physicians for preventive care, many of these activities occur outside of the health-care system. Health behaviour affects current patterns of medical care usage (e.g., contacts for periodic health examinations, immunizations) and, through lowering health risks and avoiding acute illness, may reduce future demand for health care. Although healthy lifestyle was originally the concern of higher socioeconomic groups, health promotion activities by governments, agencies, and physicians have increased general awareness of this idea while the attitudes of opinion leaders in the community and family affect its adoption. Hence, except nations with more rigid class boundaries, healthy lifestyles have become widely disseminated (see Cockerham 1995). The demand for preventive medical services increases with socioeconomic status (Sheridan and Radmacher 1992).

Illness behaviour is also socially and culturally learned (Mechanic 1978). Illness is a subjective state, concerning an individual's psychological awareness of having a disease, and usually causing that person to modify his/her behaviour (Cockerham 1995). In recognizing the symptoms of illness, individuals take into account frequency, persistence, and disruption of functioning in social roles. Tolerance of symptoms varies with the perceived danger of inaction balanced against the perceived costs of action (Frankel *et al.* 1996). How individuals monitor their bodies, define, and interpret bodily indications, decide about needed treatment, and how they use informal as well as formal sources of care, however, is conditioned by education as well as many other factors, including the out-of-pocket and time costs of care-seeking (Mechanic 1986). For example, while highly educated individuals see physicians more frequently and initiate contact at earlier stages of symptoms (Mechanic 1992), Segall and Goldstein (1989) found that Canadian women, younger persons, and the well educated were more likely to treat their own symptoms.

Variation in care-seeking (demand/utilization) behaviour reflects important differences in the interpretation of illness by the groups distinguished by these crude socioeconomic and demographic proxies (see Cockerham 1995). For research using secondary data to investigate patterns of utilization at the level of the population--

physician-supply and the practice-profile--physician-practice level of interaction, accounting for these determinants of demand and compliance is essential.

PHYSICIAN-ACCESSIBILITY:

Consumers' access to physicians and related medical technology is an important constraint affecting the translation of felt into expressed need. Access is enhanced by the local availability of acceptable care and/or transportation and other resources enabling consumers to reach further afield.

Current arrangements delivering primary care services reflect historic decisions regarding structure, financing, and organization -- that is, policies regarding the distribution of health insurance, the supply/mix/distribution of providers, practice-modality, the financing of, and organization for, the delivery of services, and mechanisms for governance and accountability. Policy-making was historically concerned with expanding access to medical care by reducing financial barriers to demand and increasing the global supply of resources. Distributional imbalances were not specifically considered nor redressed (Lomas and Barer 1986). More recent cost-containment policies further locked-in-place existing geographic imbalances. However, pronouncements by federal and provincial governments showing a strong interest in decentralizing the delivery of health and other publicly-funded services have focused attention on inequities in access (Birch and Eyles 1990; Carrothers *et al.* 1991; Law 1986; Manitoba Health Advisory Network 1993; Pederson *et al.* 1994; WESTARC Group Inc. 1994).

The implementation of Medicare tended to "freeze in place" existing organizational and financial arrangements as well as traditional modes of delivery (Evans 1984, Frankel *et al.* 1996). Primary care is mostly provided by family physicians/general practitioners (collectively called primary care physicians; Bass and Elford 1987). Some 90% of Canadians report having a personal primary care physician, with slightly greater percentages reported by rural residents and by females (Bass and Elford 1987). Most primary care physicians are reimbursed through fee-for-service mechanisms and practice in solo or, increasingly, group arrangements; however, alternative practice-modalities are making inroads (Williams 1992). The development of alternative sources of primary care is, however, challenging the conventional patient--physician relationship (Woodward and Stoddart 1990).

Within these arrangements, while families mostly obtain medical care from local physicians, they are free to choose their doctor while providers locate where they please. Ideally, each family has a regular caregiver and each community has sufficient physicians to meet its needs (Grant 1988). In reality, however, professional self-regulation, an expanded pool of insured patients, and historic growth in health care resources/funding enabled new graduates to practice in already well supplied urban (and certain rural) settings in spite of an ever shrinking pool of patients in these areas in Manitoba (Evans *et al.* 1987; Roch *et al.* 1985), Ontario (Chan and Anderson 1996), Alberta (Brown 1993) and elsewhere in Canada (see Roos *et al.* 1996).

Roch and colleagues (1985) estimated that over the ten years following the implementation of Medicare in Manitoba (1971-72 to 1981-82), a 27% increase in the aggregate supply of primary care physicians in Manitoba was mostly absorbed through

56% growth in Winnipeg (change from 0.41 to 0.63 physicians per thousand capita), a 2% increase in rural/remote areas (0.57 to 0.58), and a 6% decline in Brandon (0.63 to 0.61). Some ten years later, little difference is noted between Winnipeg and non-Winnipeg in *per capita* physician-supply, but some variation (ranging from 0.50 to 0.80 physicians per thousand capita) was detected across eight Manitoba Health Planning Regions (Tataryn *et al.* 1995) and a ten-fold difference was detected across small rural areas (Wall *et al.* 1994). Whereas these approaches are typical of the methods used to estimate physician-availability, the assumption of impermeable boundaries is likely violated with decreasing levels of spatial aggregation -- both from inaccurate placement of all small area boundaries around clusters of physicians and from residents obtaining care from larger centres.

Rural and remote areas with small populations (low income potential) and great distances from the resources and amenities of urban centres, have found it difficult to recruit and retain physicians (Canadian Medical Association 1992). Although incentives directed at Manitoba graduates and efforts to recruit foreign graduates (and other Canadians) provides a short-term solution for staffing these under supplied communities, high physician-turnover suggests that this approach is not an adequate foundation for building a stable rural physician-supply.

Local physician-availability, however, is only one factor determining accessibility to medical care providers. Revealed physician-accessibility -- the actual use of medical services in the face of out-of-pocket, distance, time, and financial barriers -- provides a comprehensive measure of rural residents' access to general practitioners. A recent analysis comparing Manitoba Health Planning Regions for ambulatory visits to general practitioners found comparable rates of utilization measured as the rate of physician-contact (78 to 85%) and visits (4.14 to 5.29 visits *per capita* in spite of the lower physician-supplies in rural/remote Regions (Tataryn *et al.* 1995; Note: the higher values are Winnipeg's). A more recent analysis examining patterns of utilization across physician service areas (see Wall *et al.* 1994) also found comparable rates of general practitioner contact, but greater variation in visit intensity and expenditures (Roos *et al.* 1996). Consistent with other findings for Manitoba (Horne 1987; Michael Loyd & Associates 1993) and Quebec (Contandriopoulos *et al.* 1988), the residents of under serviced areas adjust for poor local physician-availability through seeking services from adjacent and/or more distant communities (e.g. Winnipeg). Formal transportation programmes can enable isolated residents (especially northern status Indians and the elderly) to overcome distance barriers (see Kihl 1993, Michael Loyd & Associates 1993). However, for rural residents using their own resources to compensate for poor physician-availability, is distance a barrier to equal or equitable access and should these costs be borne by users? The finding by Michael Loyd and Associates that the most isolated southern rural residents consume the lowest number of primary health services suggests that distance may be a barrier; however, socioeconomic and other factors may be more important (e.g. farmers and their families not being able to take time off to obtain discretionary care).

Research in Manitoba and beyond finds that population access to medical care is not well predicted by physician-supply. Given the importance of this concept to understanding patterns of utilization, developing some construct of accessibility that can be estimated from administrative data is critical. Moreover, these conceptualizations should consider complementary dimensions of physician-accessibility: the proportion of the population making contact, the number of visits *per capita*, and the effective physician-supply seen (i.e., the equivalent number of physicians contacted by residents, both in-area and beyond).

INCENTIVE/CONSTRAINTS FROM THE WIDER ENVIRONMENT:

The limited set of public policies empowering and motivating consumers to take responsibility for their health behaviours (e.g., community health centres, health promotion campaigns), while conceptually appealing, has not been widely supported by patients or the medical profession (Battista *et al.* 1986; Evans 1990; Pederson *et al.* 1994). Financial incentives could be used to motivate consumers to adopt healthier lifestyles (Birch and Stoddart 1991). In removing financial barriers to care-seeking, however, policy-makers failed to provide incentives motivating patients to select physicians with low cost, high-quality practice-styles (Evans 1984; Stoddart and Sheldon 1984; Stoddart 1991). Indeed, to the extent that the mix/volume of service utilized is equated with high quality care, patients face perverse incentives to demand (or, at least, to expect) costly care (Woodward and Stoddart 1990; Young *et al.* 1989). Although consumer groups are challenging the medicalization of birth, chronic diseases, and life transitions (e.g., menopause, death), it is not clear to what extent most consumers want to, are empowered to, or, indeed, *should* influence the utilization of medical services. In theory, a restructured health-care system could motivate and empower informed consumers to demand cost-effective care (Muldoon and Stoddart 1989).

PATIENTS' UNWARRANTED USE OF MEDICAL CARE:

An emerging theme explaining the growth of primary medical expenditures is patients' unwarranted use of medical services (Woodward *et al.* 1983). Anecdotal reports by physicians suggest that many patient contacts are for trivial reasons. As noted by Mechanic (1992), however, physicians trained to respond to well-defined symptoms may not appreciate the vague complaints of patients burdened by stress. Also, whereas a recent study in Quebec (Demers 1995) found that residents contact several physicians over a year, not accounting for physician-turnover limits the validity of the conclusion that doctor-shopping by consumers for second opinions accounts for these findings. Similarly, in urban settings, while the use of walk-in clinics is thought to be an add-on (i.e., patients also contact their family physicians), research investigating such behaviours and their costs/outcomes implications is lacking.

Although unwarranted use by patients not facing out-of-pocket costs to purchase health care services may occur (Gafni *et al.* 1982), Woodward and Stoddart (1990) conclude that eliminating patient-initiated overuse would have little effect on utilization among the Ontario physicians surveyed. These findings raise methodological and empirical implications for research investigating patterns of primary medical care utilization. First, it is important to consider both patient and physician movements to distinguish between the effects of demand and turnover on the number of physicians seen. Second, whereas "inappropriate" patterns of medical care usage arise from the patient--physician (inter)relationship, the provider likely exerts greater influence on demand behaviour (see Labelle *et al.* 1994a).

2.2.3 EVALUATED PATIENT NEED (PHYSICIAN-SUPPLY BEHAVIOUR)

The process of clinical management consists of four interrelated decision-making phases: disease assessment, goal setting, developing the management plan, and tactical implementation (Essex 1985; Taylor and Gordon 1985). Following patient contact, the physician considers patient care in terms of the diagnostic, prognostic, and resources (formal and informal) available for patient management. In planning patient management, the physician chooses specific therapeutic and monitoring interventions that optimize patient care. Whereas provider-consumer-disease interactions occurring within the context of environmental constraints/incentives collectively influence patient management, the physician typically remains the dominant decision-maker. Therefore, the determinants of physician practice-style are key to understanding variation in the utilization of health care technology.

In establishing diagnosis, the physician may supplement patient presented symptoms with information derived from diagnostic tests and through consultations with specialists. In turn, diagnosis suggests a set of treatment strategies, from which, subject to the constraints imposed by the availability of (formal and informal) resources and provider knowledge, the physician makes a recommendation. Although conceptually straightforward, physician decision-making is obscured by clinical uncertainty throughout all linkages connecting information, diagnosis, treatment, and outcomes (Baumann and Deber 1991; Eisenberg 1986; Starfield 1992). While the amount of clinical uncertainty varies with the dissemination of proven, generally accepted diagnostic/therapeutic technologies (Sox *et al.* 1988), since much primary care is characterized by contacts where the presenting symptoms are vague and remain poorly defined even after professional assessment, substantial variation is expected in the use of technology. As professional autonomy affords physicians wide latitude in responding to clinical uncertainty (Luft 1986), however, much variation reflects physicians' discretionary decision-making. For example, Chassin and colleagues (1986) found that physicians ordering greater numbers of diagnostic tests *also* rendered more therapeutic services. Indeed, some physicians focus more on procedures and tools than on the job of primary care (Horder and Medcalfe 1989).

Physicians' attitudes towards the use of medical technologies influence their practice-styles (which is, itself, a technology) through three related beliefs:

- variation in physicians' responses to clinical uncertainty may underlie differences in performance; physicians with an aggressive practice-style have greater propensities to intervene (often using unproven technology) when faced with the uncertainty intrinsic to most medical practice;
- spatial and other clusters of "like" physicians reduces within-area variation while emphasizing between-area differences; and,
- high rates indicate discretionary decisions and overuse of resources.

However, as a "not-only-for-profit firm" (Evans 1984), physician decision-making encompasses both clinical and economic considerations. Recent research argues that physician practice-patterns reflect the interaction of financial incentives and clinical uncertainty (Flierman 1991; Hickson *et al.* 1987).

For this research, important determinants of physicians' use of visits and the choice of settings for treatment in the face of clinical uncertainty include:

- personal characteristics (age, gender), medical education (certifications, places/dates of training, continuing) and cumulative experience (in total and in rural settings);
- current practice-modality (payment and formal/informal organizational arrangements); and,
- the availability of health care resources (within the practice, community, and beyond).

PHYSICIAN CHARACTERISTICS:

The Contandriopoulos and colleagues (1987) conceptual model of the process of physician socialization explains the development of care-giving behaviour as a (an almost) shared set of attitudes beginning with the self-selection of students sharing common values into medical schools followed by strong professionalization through medical education (see also Blishen 1991, Frankel *et al.* 1996). After graduation, physicians distribute themselves into practice arrangements and across locations most consistent with their preferences -- that is, aggressive physicians join like-minded colleagues in urban (high volume) fee-for-service settings while more conservative providers are content with alternative delivery-modalities. As most students come from higher socioeconomic status families living in urban settings and their training is not consistent with the reality of rural practice, it is not surprising that graduates prefer to remain in urban areas. Over time, more recent career experiences and the incentives/constraints faced in the current practice setting dominate care-giving behaviour. Moreover, the opinions of local physician-leaders, macro- (e.g., licensing and professional bodies, government), meso-level (e.g., hospital, practice) policies constraining behaviour and, possibly, continuing education are also important influences (Blishen 1991). From this model, while physicians belonging to cohorts defined by age, gender, date/place of graduation share similar attitudes at the time of graduation, over time, additional within-cohort differences can arise from differences in career and/or life experiences.

In introducing physicians to technology, medical school training affects clinical decision-making. Throughout their transition into professionals, their teachers (and training settings) influence students' evolving practice-styles. The combination of undergraduate and residency training has important effects on practice-style. Recent research done in Ontario finds that the medical school and the site of residency affect the range of care provided and attitudes towards care-giving (Woodward *et al.* 1994). For example, international medical graduates may be better trained/experienced to respond to (cope with) a broader range of care. Whereas the effect of obtaining family practice certification on physician practice-style has not been determined (Williams 1992), other research finds that certified specialists providing generalist care exhibit more costly practice-styles than non certified generalists (Eisenberg 1986). The emphasis on diagnosis and speciality medicine fosters a dependency on "high" technology that may be reinforced by subsequent career and practice choices. Shifting medical training from tertiary to secondary and, particularly, ambulatory settings will emphasize the development of basic clinical skills and familiarity with community needs (Horder and Metcalfe 1989). However, as curriculums evolve over time, the interaction of sites of undergraduate and residency training with the dates of graduation may have greater explanatory power.

Demographic characteristics are important predictors of physician practice-style. Age is related to the use of diagnostic tests; however, why younger physicians over use auxiliary services -- for example, because of limited clinical experience or the effects of medical training -- is not known (Eisenberg 1986). Whereas female physicians provide more time per patient-visit and order more (and more expensive) services per patient, their male colleagues generate higher incomes through working longer hours and seeing more patients (Bowman and Allen 1985; Williams 1992; Woodward *et al.* 1994). In general, while female physicians appear to be less motivated by the monetary aspects of practice, stress, children, and personality factors also appear to affect productivity (see Bowman and Allen 1985). Williams (1992) concludes that physician gender is more important than place of graduation in predicting practice-style.

PRACTICE-MODALITY:

Practice-modality is a meso-level influence thought to influence physician behaviour (see Ableson 1994, Birch *et al.* 1994, Goodman and Swartwout 1984, Groenewegen *et al.* 1991. Practice-modality consists of the intersection of a payment mechanism (i.e., fee-for-service, capitation, salary) and practice organization (i.e., solo, group, community health centre). Over their career, physicians may change practice-modalities. For example, International medical graduates entering Manitoba through salaried practices may shift to rural or urban fee-for-service settings following the completion of their contracts.

Cantandriopoulos and colleagues (1987) note that payment mechanisms are designed to reimburse physicians for the time consumed (salary), the services rendered (fee-for-service) or for the responsibility of providing care to a defined population (capitation). Whereas traditional fee-for-service payment remains most common (Bass and Elford 1987), alternative modalities are increasingly being used (Williams 1992). Both theoretical and empirical findings suggest that payment-modality affects the time devoted to practice, organization for practice, productivity, the practice-profile, linkages to second-line provision of care, and, ultimately, physician performance (process and outcome measures) and the distribution of care and health across populations.

Whereas salary is the simplest approach to physician payment, compensation, and staffing policies have important implications for performance. On one hand, inadequate compensation may result in poor moral and excessive turnover -- both detrimental to physician performance; on the other hand, excessive salaries are costly and will, at best, only marginally improve performance (Charns and Schaefer 1983). Similarly, inadequate staffing leads to heavy workloads -- possibly reducing patient quality-of-care while impairing physician moral; excess staffing is costly and may damage physician morale because of too little activity. Subject to these caveats, the motivation of salaried physicians stems from their preferences, as influenced by forces arising from within the organization.

If the rate paid per resident adequately reflects the population's actual medical care needs, capitated physicians are motivated to manage an "optimal" workload. Through coupling income and supply, capitation continuously provides incentives to resolve staffing problems. On one hand, too many physicians decreases the average income; on the other hand, too few physicians increases the average workload. Also, by separating income and utilization, physicians are motivated to consider the costs of their practice-styles. In addition to patients' preferences, variation in visit- and service-intensity would reflect differences in physicians' practice-styles in the absence of financial incentives. Although not facing fee-for-service financial incentives which may bring on supplier-induced demand behaviour, there is some danger of physicians providing inappropriately low levels of services.

Finally, fee-for-service provides physicians with several levers for adjusting work-load to maintain/increase income. Notwithstanding that increased supply combined with constant or declining real fees should reduce income, fully coupling practice-style and income enables physicians to alter the mix/volume of services rendered in order to offset cost-containment policies by government (Barer *et al.* 1988) and the increasing concentration of primary care practitioners in urban regions (Evans *et al.* 1987; Roch *et al.* 1985) and in certain rural areas (Wall *et al.* 1994).

Birch and colleagues (1990) reviewed the literature on the effects of payment-modality on physician performance. They concluded that payment-modalities alternative to traditional fee-for-service reimbursement:

- reduce rates of hospitalization (medium evidence);
- do not affect primary medical care utilization (weak evidence);
- increase physician patient-load (medium evidence);
- increase the employment of non physician health personnel (medium evidence);

- enhance the provision of preventive services (weak evidence);
- eliminate financial disincentives against the provision of preventive services (weak evidence);
- increase the quality of care (weak evidence); and
- reduce patient satisfaction with the medical care process (weak evidence).

Whereas "payment mechanisms can affect the cost and quality of health care, differences within modalities are as great, or greater, than those between modalities" (Birch *et al.* 1990, p. iv). This conclusion is supported by the findings of Wolinsky and Marder (1985) and Williams and colleagues (1990). While payment-modality clearly is important, how physician practice is organized also affects physician performance. Too little attention has been paid to the typology of practice-organization in research on physician behaviour (Williams *et al.* 1990; Wolinsky and Marder 1985).

A study comparing fee-for-service and salaried physicians practicing in rural Manitoba found that whereas salaried payment was associated with the management of smaller patient-loads and a lower intensity of patient-servicing (no difference was found for the mix of services), fee-for-service physicians exhibited much greater variation in both dimensions (Wall *et al.* 1994). Of particular interest, variability in fee-for-service physicians' service-intensity (where discretionary physician decision-making should be most evident) increased substantially with decreasing patient-load. Although preliminary, these results suggest that some physicians respond to the financial incentives available through fee-for-service payment. Lacey (1987) also found little difference in patient-load and utilization in a case-control study comparing a rural Manitoba salaried setting to its surrounding fee-for-service communities.

A recent Ontario study unexpectedly found little differences in the rates of hospitalization and lengths-of-stay for general practitioners switching from fee-for-service reimbursement to capitation payment compared with a matched group remaining in fee-for-service practice (Hutchison *et al.* 1994). Besides the methodological concerns about earlier Canadian studies (see Birch *et al.* 1990), physicians choosing capitation payment may no longer differ significantly from those entering (or remaining in) fee-for-service practice. Also, global cost-containment efforts, by eliminating hospital beds and limiting general practitioners' access to hospital resources, may obscure any practice-modality effects.

Although the validity of these empirical findings is impaired by methodological concerns, poor quality data, and limited explanation of large within-modality variation, they suggest that how physicians are reimbursed *can* affect the utilization of medical services in the primary care sector and beyond. Deviations from theory may reflect organizational effects or bias. Generalizing findings from other settings (particularly the United States where provider and insurer functions are combined) may provide very misleading guidance to Canadian policy-makers (e.g. health service organizations in Ontario). As noted by Birch and colleagues (1990), how meso-level relationships within health maintenance organizations influence physician practice-style is poorly understood. Also, because of the large market share held by health maintenance organizations in the United States, physicians choose between traditional fee-for-service group/solo practice and capitation. If physicians possessing conservative practice-styles mostly select capitation practice, then between-modality differences in utilization (both the central tendency and the variation of responses) may, in part, reflect self-selection bias (Luft 1986).

A related issue is where physician response to financial incentives is expressed. A recent before-after study examining the effects of introducing selected fee-for-service tariffs into the fully capitated Copenhagen City payment system found that physicians provided more consultations and diagnostic/therapeutic services, but reduced their referrals to specialists (Krasnik *et al.* 1990). A more powerful pooled longitudinal and cross-sectional analysis comparing these practitioners with a control group formed by the surrounding rural physicians who had been exposed to the mixed payment system for some time found significant changes only in the use of diagnostic/therapeutic services and specialist referrals (Flierman 1991). These findings suggest that, in the face of decision-making over discretionary medical care, physicians selectively increase utilization by expanding their domains of clinical expertise -- that is, they treated wider ranges of health conditions using interventions whose efficacy had not been established and they treated patients who would previously have been referred to specialists.

A randomized-controlled study comparing pediatric residents for compliance with guidelines for follow-up care found that the salaried and fee-for-service groups missed scheduling recommended visits respectively 9% and 4% of the time, but that excess well-care visits were scheduled respectively 4% and 22% of the time (Hickson *et al.* 1987). These highly statistically significant differences suggest that salaried payment causes physicians to miss ordering some beneficial follow-up visits (5% too few), whereas fee-for-service payment motivates physicians to render unnecessary well-care visits (18% too many).

Practice-organization (fee-for-service solo and group practices; salaried community health centres; capitated health service organizations) is thought to affect physician performance. For fee-for-service physicians, group practice provides opportunities for sharing on-call coverage, operating costs (e.g. auxiliary staff and office expenses) and, in some provinces (e.g. Nova Scotia) certain malpractice and tax advantages; however, in pooling revenues, fee-for-service incentives are diluted while sharing common resources may compromise technical efficiency (Feldstein 1993).

Community health centres "employing" salaried physicians may specify workloads, practice guidelines, on-call schedules, non care activities, and other consideration affecting performance; however, to the extent that these organizations "manage" their "employees", their influence over physician performance will vary. The limited accountability for resources and outcomes under current global funding arrangements, however, provides few incentives to Canadian community health centres to improve their performance. Also, as the organization of and payment for capitated practice in Ontario differs significantly from that of the well-documented health maintenance organizations in the United States (Centre for Health Economics and Policy Analysis 1986; Evans 1981; Hasting and Vayda 1986; Nash 1994), it is not clear that evidence from these settings is relevant to Canadian policy-making. Although severing the payment-service linkage, these Ontario organizations currently have few incentives to manage physicians' practice-styles (Hutchison 1994). Payment systems directing performance towards social goals while satisfying providers' aspirations must be developed (Birch 1994).

As proven cost-effective providers of primary care, nurse practitioners could be employed to improve physician productivity through undertaking routine care-giving tasks (see Evans 1984). Because of fee-schedules limitations and resistance to "encroachments" by substitute providers, fee-for-service physicians are not motivated to use substitute providers; however, salaried and capitated physicians face no financial penalties provided nurse-practitioners are funded by others, but may still resist the multidisciplinary team approach to patient management (Ableson and Lomas 1990). Although debate has re-emerged in Ontario over the use of nurse-practitioners (see Birehbaum 1994, Moore 1994, Morgan and Cohen 1992, Way and Jones 1994), evidence from Quebec finds that in the face of growing over supply of physicians it is unlikely that substitute providers will be accepted as autonomous primary care providers, even in alternative delivery-modalities (Contandriopoulos *et al.* 1986). However, serious attempts to reorganize the delivery of ambulatory services (e.g., the New Brunswick Home Health Plan) can realize cost-effective substitutions between physicians and alternative health professionals (see Brown 1995).

In separating the direct and immediate feedback loop between output, reward, and income, however, managers of alternative delivery-modalities face motivational problems shared by most employers of professionals. In that (income and non-financial) rewards are derived from the organization as well as external peers and regulatory agencies, incentives for high performance (low cost, quality care) must be desired by these employees while remaining consistent with their obligations as professionals (which is largely beyond the control of the firm); also, the distribution of rewards must be seen as fair. In that most professionals are motivated through the formal recognition of their achievements, few mechanisms are available (other than career promotions). (See Medcof and Wall 1990 for the case of hospital nurses and a general discussion of the literature bearing upon the management of professionals.) Theoretical and empirical knowledge of the attributes of firms for motivating primary care physicians to achieve organizational goals is largely incomplete and until recently, except Quebec, mostly irrelevant (see Ableson 1994, Contandriopoulos *et al.* 1986, Frenk 1994, Glasser 1986, Hutchison 1994).

Payment-modality may affect the time used to provide patient care through influencing both total hours worked and its partitioning between caregiving and other professional activities. Subject to the value placed on family, leisure, and non care professional activities, fee-for-service physicians face strong financial incentives to expand the time used for patient care. Furthermore, they are also financially motivated to "cycle" patients -- that is, to expend as little time as possible on each case.

For income considerations, capitated practitioners may increase the time worked in order to manage larger caseloads and may also "cycle" patients to free up time to see additional cases. Alternatively, these physicians may "cycle" patients to achieve in income goals while increasing time for non care activities.

As employees, salaried physicians face no financial incentives to work longer hours than contractually required. Moreover, they may also be responsible to other professional activities that further reduce the time available for direct patient care. Unpublished data from the 1991 Canadian Medical Association survey reports that salaried physicians in Manitoba (rural, urban, and all) work fewer hours than their fee-for-service colleagues and that they have significantly less time for direct patient care. Besides payment-modality, however, these findings may also reflect the effects of group practice-organization as well as the higher proportions of female physicians and International medical graduates found in salaried practice (see Wall *et al.* 1994).

In the face of the ever-shrinking pool of patients available in preferred urban locations, theory suggests that recent graduates should distribute themselves across under serviced areas in response to the income potential afforded by the "unmet" needs of these populations. Analysis finding for Manitoba that the large increases in physician-supply have been accommodated largely within Winnipeg (Evans *et al.* 1987; Roch *et al.* 1985) is consistent with other empirical findings that physicians adjust their practice-time (Sloan 1974) and service-intensity (more visits/services per illness episode) (Labelle *et al.* 1994a) in order to achieve a target income given the available patient-load. Furthermore, hospital privileges in urban communities are increasingly being restricted to specialists while primary care physicians have access to largely under used facilities in most rural settings.

For capitated practitioners and salaried physicians (but not those in health service organizations in Ontario), decisions about practice location are largely determined by the availability of positions. To the extent that planners (or employers) correctly ascertain staffing needs, some balance will be struck between the number of physicians and their workloads (not an easy task). Wall and colleagues (1994) suggest that the consistent finding of lower salaried physician patient-loads in rural Manitoba may stem from planners attempting to balance the number of physicians required for an acceptable on-call schedule (necessary for recruitment) against the medical care needs of the small populations living in sparsely settled areas.

Fee-for-service payment is thought to increase medical care costs through its incentives to inflate patient-loads through sharing patients with colleagues (Evans *et al.* 1987; Roch *et al.* 1995) while using more visits and employing a more expensive mix and/or wider range of diagnostic/therapeutic services to treat episodes of illness (Evans 1984). This situation is further complicated when physicians also specify their fees charged for services (Beck and Horne 1980; Brown and Hicks 1984; Wolfson and Tuohy 1980). On one hand, in the face of a patient shortage, fee-for-service physicians can achieve target incomes though adjusting the service mix and volume rendered (Evans 1987; Roch *et al.* 1985); on the other hand, in respond to high physician-competition, fee-for-service physicians can increase their level of servicing to (somewhat) offset the scarcity of patients.

Fee-for-service payment motivates physicians to undertake larger workloads either through managing more patients and/or by rendering larger amounts of services to these patients. In contrast, however, expanding their patient-loads is the only avenue available for capitated physicians to increase their incomes; moreover, capitation provides strong financial disincentives against excessive utilization of medical services. Salaried arrangements provide no financial incentives for physicians to increase their workloads either through managing larger patient-loads or providing higher intensity of services to these patients.

Although salary and capitation payment-modalities may place patients at risk of not being offered all proven services, existing fee-for-service payment schedules in Canada do not encourage physicians to provide preventive care, education, counselling, telephone consultations, and other non billable activities (see Contandriopoulos *et al.* 1987, Edwards 1991). Although fee-for-service payment has been criticized for motivating physicians to render inappropriate patterns of care, it should be understood that it is the perverse incentives build into the system, not the payment system itself, that is the problem. In theory, an effective system of incentives could be set up within the context of fee-for-service payment.

From their role of providing first contact care, general practitioners and other generalists are gatekeepers (explicitly or implicity) directing patient access to the second-line provision of care (hospitals and specialists). Compared with fee-for-service physicians, salaried and capitated physicians face no financial incentives to delay patient referrals to specialists; however, it is not clear if payment-modality effects the costs and quality of patient care. To the extent that beneficial consultations are delayed, patient outcomes may be adversely affected; however, to the extent that earlier referral increases costs without markedly improving patient outcomes, excess servicing may arise. Fee-for-service physicians also face incentives to provide hospital-based services (surgery and obstetrical care). New fee-for-service physicians locating in urban areas may not be granted privileges while practitioners in some rural areas essentially have unobstructed access to hospital beds. Overall, it is not clear if the costs and outcomes derived from total episodes of care (primary and beyond) are affected by payment-modality.

Fee-for-service payment is thought to increase physician productivity -- the ratio of outputs produced to inputs used -- through its effects on the time made available for patient care and the services rendered (see Contandripoulos *et al.* 1987). Although salaried and capitated physicians are more likely to use productivity enhancing nurse providers, their greater provision of time-consuming activities (e.g. education, counselling) may offset these gains.

Physician-availability may be enhanced through fee-for-service payment; however, capitated physicians concerned about retaining patients are motivated to increase their office hours while salaried physicians are contractually obligated to work specified hours. Fee-for-service physicians (especially solo practitioners) may be more inclined to provide greater after-hours coverage and to staff emergency rooms, thus enhancing rural patients' access to locally provided surgical and obstetrical care.

For the diagnosis and treatment of acute conditions, fee-for-service payment is thought to improve the quality of care by reducing the likelihood that beneficial care will be omitted (see Contandriopoulos *et al.* 1987, Woodward and Warren-Boulton 1984); however, it is not clear what risks patients face through exposure to unnecessary services, inappropriate prescribing of pharmaceuticals, rushed examinations, and inadequate communications (see Davidson *et al.* 1995). For the management of chronic conditions and the provision of preventive care, higher quality care may be rendered by salaried and capitated physicians not disciplined by the fee-schedule to avoid time-consuming, non-remunerative activities. Through fee-schedule reform, however, fee-for-service physicians could be *financially* motivated to provide such services (Hurley et. al. 1990).

If alternative practice-modalities restrict patients' choice of physicians, then salaried and especially capitation may undermine free choice. The patient--physician relationship is enhanced when patients and physicians develop compatible relationships. To the extent that patients prefer a regular caregiver, alternative delivery modalities not guaranteeing a consistent patient--physician relationship may reduce patient (and physician) satisfaction with the process of utilization.

The practice-style developed by physicians for dealing with clinical uncertainty appears to vary systematically with age, gender, training or other factors (see Eisenberg 1986). Although arguments that practice-style increases with clinical discretion are appealing, research focusing on physicians' discretionary use of resources demonstrates that the assumption of a logical model underlying medical decision-making does not exist (see Evans 1990, Roos 1992). While continuing education, feedback, clinical guidelines, regulations and incentives/penalties *should* influence physicians' usage of technology, these interventions have generally yielded discouraging results (Eisenberg 1986; Lomas and Haynes 1987; Lomas 1991).

UNMET PATIENTS' DEMANDS:

Rates of ambulatory visits less than levels predicted by comparative (expected) population need suggest unmet demands, possibly arising from the inequitable distribution of physicians or barriers limiting access to medical care. However, research reporting substantial variation in utilization across small areas in spite of little difference in need and access to care suggests that physicians exercise great discretion in determining their practice-styles (see Roos 1983, Roos 1992, Wennberg 1987). These findings suggest that observed patterns of visit-usage arise more from patient-physician interactions -- mostly dominated by physicians' practice-styles -- rather than residents' demands for episodes of care.

2.2.4 PATIENT--PHYSICIAN INTERACTIONS

While there is agreement that the interaction between patient demand and physician-supply generates medical care utilization, the existence and/or strength of the patient--physician *interrelationship* is a critical factor mediating these behaviours (Frankel 1988). To the extent that this interrelationship exists, demand and supply are not independent and, therefore, analysts should consider their interaction. The set of models discussed in the following section gives some indication the range of assumptions made about this (inter)relationship.

The consumption of medical services over an illness episode is influenced by patients' compliance with prescribed services and the degree to which their preferences are reflected in clinical decision-making. Following the diagnosis of disease by the physician, the patient response to this information and compliance with recommended therapy is expressed through sick role behaviour (i.e., self-care and/or compliance with medical directives). The "quality" (i.e., fit of characteristics) of the patient--physician interrelationship affects the diagnosis of illness, the recommendation of medical (and wider health) care, and patient compliance with directives (see Cockerham 1995).

Moreover, as the context in which preferences are expressed and negotiations occur, the patient--physician interaction plays an important role in the future trajectory of the patient's illness, disability and, the demand for/supply of medical and other health care (Mechanic 1992).

Differences in socioeconomic status, gender, and ethnicity between patients and their physicians predict the patients' degree of participation (or inclusion) in clinical decision-making (Frankel *et al.* 1996, Hauser 1987). Moreover, over the course of long-term treatment for chronic illness, the balance of power changes as patients become more knowledgeable about their conditions and, so, more assertive in challenging physician domination (Freund and McGuire 1995). As physicians are mostly male, white and drawn from middle to higher socioeconomic backgrounds, patients not sharing these characteristics may experience difficulties in communicating their health concerns and in obtaining what they consider adequate information about their diagnosis, prognosis and clinical management. Similarly, physicians from cities and trained in urban settings experience greater difficulties in understanding rural health problems/behaviour than those from and/or at least receiving some training in rural communities (see Ricketts and Cromartie 1992, Rosenblatt and Moscovice 1982).

Whereas the physician generally dominates the micropolitics of the patient--physician relationship (Clarke 1990; Evans 1984; Frankel *et al.* 1996; Fruend and McGuire 1995; Waitzkin 1991), the degree to which patients follow recommended therapy depends upon social and psychological factors determining their attitudes toward compliance (Friedman and DiMatteo 1989, Sheridan and Radmacher 1992). The most important predictor of patient compliance (cooperative personality) is the physician's behaviour expressed through his/her understanding of the presenting complaint, obtaining the patient's values, and in shared responsibility in managing the condition (Hulka 1979). Theory and empirical findings suggest that physicians who take time (and have the ability) to understand and act upon knowledge of

- patients' social, psychological, economic, and cultural situations, their beliefs about the illness, symptoms and their willingness to carry out recommendation,
- their values and beliefs about alternative therapies, and
- their expectation regarding treatment, outcomes as well as rights, duties, and responsibilities,

have patients who are more satisfied, achieve better outcomes and experience lower rates of malpractice (Sheridan and Radmacher 1992; Starfield 1992, Williams 1992). However, for patients not willing to provide detailed information or to engage in shared responsibility for treatment, more traditional approaches to patient--physician interaction may be required.

Kirscht and Rosenstock (1979) summarized empirical findings on the factors influencing patient adherence behaviours in following prescribed regimes, staying in treatment, and prevention. Demographic characteristics are correlated with staying in treatment and engaging in prevention. While education and income have been found to predict compliance with all three behaviours, clear evidence of socioeconomic effect has been found only for engaging in prevention. Psychological attitudes regarding beliefs about threats to health, efficacy of treatment and knowledge of treatment are associated with all three behaviours. General attitudes and knowledge are less consistent. Social context (e.g., family and social networks) has an important effect. Social support and primary group stability improves compliance in all three behaviours while social isolation has the opposite effect. For situational demands, while the severity of symptoms increase adherence, greater complexity/duration of actions -- especially those interfering with other activities -- reduces compliance. Finally, interaction with physicians and other elements of the health-care system are important. Convenience, continuity and having a regular source of care as well as supportive interaction with the provider increases adherence in all three behaviours while general satisfaction is not associated with behaviours.

In rural North Carolina, being elderly, in poorer health and having lower socioeconomic status was associated with engaging in sick role behaviour, but not in changing lifestyles (e.g., drinking, smoking) nor in complying with medical directives (Wolinsky and Wolinsky 1981). Poorer individuals responsible for key social/work functions not easily avoided/delayed/delegated and commanding fewer family/community resources, are more likely to deny the sick role and so, not to comply with physician directives (see Cockerham 1995). Alternatively, for higher socioeconomic residents, poor compliance may reflect resistance to medical authority and self-care (Mechanic 1992).

The physician's choice of treatment (technology) is also affected by the patient--physician interaction. The information obtained plus patient presentation and expectations expressed during visits influence physician decision-making -- especially for conditions characterized by greater clinical uncertainty or those arising from patients' socioeconomic fabric. Williams (1992) summarized research investigating the influence of physicians' beliefs on patients' outcomes and costs. For the wide variety of conditions seen in primary care settings (e.g., abdominal complaints, back/neck/chest pain, fatigue, headache, eye problems, rectal bleeding) the timing of resolution was related to the quality of the patient--physician relationship (Bass *et al.* 1986). Wright and Kane (1982) found that physician prediction of a poor prognosis led to higher costs, even when the prediction was wrong. Recent evidence from New Brunswick suggests that physicians managing larger patient-loads are more likely to employ pharmaceutics (and to use them inappropriately) to manage their elderly patients (Davidson *et al.* 1995). Also, ongoing claims of drugs being prescribed to satisfy patients' expectations of an office visit suggests some routine effect of the patient--physician interaction on physician behaviour.

The importance of asymmetries in the patient--physician interaction are illustrated by the medical management of patients presenting stress-related symptoms. Stress, a growing health threat, impacts disproportionally across populations. Generally, lower socioeconomic groups experience a higher burden of stress-related illness exacerbated by lower capacity for self-care, limited resources for overcoming barriers to care-seeking, and problems articulating health problems to physicians (Argyle 1994, Mechanic 1992). Rural populations, typically containing higher proportions of at-risk individuals, generally have greater mental health needs, but face substantial barriers in contacting urban-based specialists (Tataryn *et al.* 1995). Few rural Manitobans receive care from (mostly

Winnipeg-based) mental health specialists. Although trained (and motivated) generalists provide beneficial care, it is not clear how accessible such physicians are in rural Manitoba -- particularly in areas characterized by high physician-turnover. Moreover, as stress-related conditions often produce no clearly ascertainable physiological disorders, physicians depicting such conditions as trivial will likely consider these patient contacts as inappropriate. Clearly, this failure of communication affects the provision of beneficial services, with obvious implications for patient quality-of-care and health outcomes (Mechanic 1992).

2.3 CONCEPTUAL MODELS OF UTILIZATION

Conceptual models explaining the process of medical care utilization are distinguished by the behavioural (inter)relationships between consumers and providers expressed, the unit of analysis employed, and the explanatory factors included (see Table 2.2).

First, should both demand and supply behaviours be included in the model, and, if so, are they independent processes? In part, the answer to this question depends upon the analyst's assumptions about the respective behaviours of consumers, providers, and how they interact. The naive economic model and medico-technical model represent polar extremes of social science theory employed to interpret variation in medical care utilization (performance). Within the context of the naive economic model, consumers' demands (expressed needs) are pivotal -- i.e., utilization reflects consumers' perceptions of their own needs considering their preferences in the face of prevailing costs and resources. Supply behaviour (technically evaluated need by professionals) either agrees with consumers' judgements, or is irrelevant. As demand and supply are always in equilibrium (given sufficient time and flexible prices), variation in utilization reflects differences in individuals' preferences and their willingness to pay. There is no need for policy-makers to intervene as perverse effects (e.g., physician-induced utilization) do not occur. In contrast, the naive medio-technical model assumes that utilization is determined by physicians' technical evaluation of patients' needs. Variation in utilization reflects physicians' preferred patterns of practice in responding to presented need. Inadequate demands reflect unmet needs (i.e., more is always better) best redressed through policy intervention (e.g., education, more/better distributed resources, insurance) to mitigate imbalances in knowledge about, the availability of, and/or accessibility to, medical technology.

This range of conceptual models explaining *observed* utilization is consistent with the serious identification problem inherent in the analysis of collective behaviour. "In the face of incomplete information on exogenous disturbances most observed patterns of behaviour can be reconciled with a range of models and frequently with many different patterns and types of disturbances within the same model" (Turnovsky 1992, p 144). For models explaining observed patterns of medical care utilization, Evans (1984, p 23) concludes that:

> [t]he naive economic and medio-technical models could hardly be more different in appearance, yet, in fact, both share a common structure. Both start with an observed or observable statistical datum -- utilization -- and then assume its correspondence to a hypothesized behavioural concept -- consumers' demands or providers' preferred supply patterns. In each case observed utilization can fall short of, but not exceed, the hypothetical concepts, and such shortfalls represent some form of institutional failure (barriers to care, or sticky prices). Both make specific

> assumptions about the processes of care provision and consumption -- informed consumers or professional providers make the utilization decision. And both have an implicit criterion for how care ought to be allocated -- to meet technically determined needs, or to respond to the preferences of consumers as expressed in willingness to pay. Finally, neither model is particularly realistic.

While episodes of medical care are initiated by the consumer, physician behaviour influences the subsequent patterns of contacts and services. Similarly, while primary care physicians typically prescribe ambulatory care (i.e., office/clinic visits, diagnostic and therapeutic services, pharmaceuticals) and are points of access to specialists, hospitals, community-based and other health care resources, patients' preferences (compliance) influence these recommendations (consumption) of health care. Within the context of the patient--physician interrelationship, the balance of decision-making power shifts between the patient and the physician in complex, poorly understood ways. Moreover, as there is a general consensus that, for financial and other considerations, physicians can (and do) influence patients to consume more medical services than they would otherwise consume, demand and supply are not independent processes. Whereas some middle ground recognizing the interdependent roles of health-care system actors and the effects of the enveloping social, health, and other environments better reflects reality, these models -- that is, the sociology (see Berger and Luckmann 1966) and economics (see Boulding 1966, 1964, Rescher 1989) of knowledge -- must incorporate complex interactions. A more practical (and a perhaps more policy relevant) approach to analysis is to specify a model sufficiently rich, relevant and interesting as is necessary and feasible without blind adherence to specific behavioural assumptions (see Turnovsky 1992).

TABLE 2.3: CARE-SEEKING AND CARE-GIVING RELATIONSHIPS AND KEY DETERMINANTS BY MICRO-, MESO-, AND MACRO-LEVELS OF PATIENT--PHYSICIAN INTERACTION

RELATIONSHIP	CONSUMER	PROVIDER
MACRO-LEVEL: POPULATION--PHYSICIAN-SUPPLY (see Chapter 4)	POPULATION -comparative need -physician availability/accessibility	PHYSICIAN-SUPPLY -physician-competition -system incentives/constraints
MESO-LEVEL: PATIENT-PROFILE--PHYSICIAN-PRACTICE (see Chapter 5)	PRACTICE-PROFILE -determinants of profile demand and of physician evaluated need	PHYSICIAN-PRACTICE -practice payment/organization and other determinants of supply
FAMILY--PHYSICIAN-PRACTICE (not included in this research)	FAMILY -determinants of demand	
MICRO-LEVEL: PATIENT--PHYSICIAN (not included in this research)	PATIENT -perceived need/preferences	PHYSICIAN -evaluated need/preferences

Second, three levels of analytical relationships are widely employed to investigate performance. The macro-level population--physician-supply relationship (population need, physician-accessibility; see Table 2.3) emphasizes the relationships between population characteristics (e.g., comparative need), small-area characteristics (e.g., physician-availability, physician-accessibility) and patterns of medical care utilization. The meso-level patient-profile--physician-practice relationship recognizes that both patients and physicians undergo at least some self-selection in selecting their current arrangements. Physicians affect and are affected by the culture of the practice-organization and the practice-profiles that they manage. Similarly, patients affect and are affected by the physician. Finally, the micro-level patient--physician interface is critical to understanding within-practice as well as between-physician variations in utilization, quality-of-care, and outcomes. The specification of unit-of-analysis should consider what level of patient--physician interaction is needed to properly address the research question(s).

The population--physician-supply macro-level and the patient-profile--physician-practice meso-level relationships are key interfaces for research concerned with the epidemiology of rural medical care. Although individual residents' (physicians') preferences explain variation in demand (supply), it is the interaction that provides needed insights into health-care system performance. In focusing on the interface between the physician-practice and the patient-profile as the unit of analysis, variation occurring within populations is recognized, but not that occurring within the patient-profile. Is this reasonable? While a definitive answer eludes us, to the extent that physicians influence utilization, greater variation likely occurs between than within patient-profiles -- that is, physicians respond more to the aggregate demand from the entire patient-profile rather than uniquely to individual patients. We assume that the physician preferences dominate the encounter (episode) and that physicians are (more or less) consistent across patients (and encounters).

Besides theoretical assumptions, key issues in population-based research include the homogeneity within the unit-of-analysis (e.g., patient-profile, population, physician-supply), the set of indicators available to measure psychosocial variables, and the ability of analysts to desegregate secondary data to address questions not specifically considered in the design of the data collection instruments (see Corin 1994, Hertzman *et al.* 1994). For example, whereas both health status and health care utilization generally varies with increasing age, not all elderly exhibits this relationship (Roos and Shapiro 1981). While adjusting demographic structure (e.g., the proportion of elderly) controls for important differences in the needs for medical care, how the high-use users (e.g., the frail elderly) are distributed across these populations may be more important. To the extent that need and usage are (should be) related, analysis controlling for health status and comparing larger populations are likely not as affected by the presence of high-users. If self-selection mechanisms determine the composition of patient-profiles, then the distribution of elderly patients may vary substantially, at a given time, across individual physicians and, over time, among these practitioners. Research seeking detailed understanding of the determinants of health is clearly limited when this source of heterogeneity is not accounted for (Corin 1994).

Finally, while aggregate social phenomena can (and is) considered in isolation of the underlying micro-level/meso-level behaviours generating these phenomena, this separation has become a major concern of economic theory (see Boulding 1949, Galbraith 1992, Morishima 1992, Stiglitz 1992) and in applied social science research (see Conrad and Schneider 1992, Corrin 1994, Phillips 1981, Stoddart and Barer 1981). Ideally, analysis of aggregate phenomena should be based on underlying micro-level behaviours; however, as no adequate theory exists, this research can only note this limitation (i.e., the ecologic fallacy basis). Since the mid 1960s, alternative conceptual models have been developed to explain the process of health care utilization (see Table 2.4). These models explain the process of demand, supply, or utilization using one of the three levels of analysis.

TABLE 2.4: MODELS EXPLAINING THE PROCESS OF HEALTH SERVICES UTILIZATION

MODEL	CONCEPTUAL FOCUS
ROSENSTOCK 1966; BECKER 1974 (Health Belief Model; late 1950s)	Relationship among *individuals'* perceptions, modifying factors and their seeking medical care; psychological-motivational determinants of medical care utilization.
SUCHMAN 1965 a,b	Factors explaining *individuals'* decisions to seek medical care.
MECHANIC 1968	Psychosocial determinants of individuals' perception of need for medical care.
ANDERSEN 1968 (Behavioural Model One)	The role of predisposing characteristics, enabling resources and need in explaining *families' (later individuals')* utilization of services.
GROSS 1972	The effects of enabling, predisposing and accessibility factors of the translation of *individuals'* perceived needs into utilization.
DONABEDIAN 1973	accessibility and availability of health resources as a mediator between *consumers'* and *providers'* behaviours and utilization.
STARFIELD 1973	The relationship between the *person*, health-care system structure and process, the social/physical environment and the outcomes achieved.
ADAY & ANDERSEN 1974 (Behavioural Model Two)	The health-care system as a modifier of *populations'* utilization of services and consumers' satisfaction.
KOSA & ROBERTSON 1975	Factors explaining *individuals'* decisions to seek medical care.
WOLFSON & TUOHY 1980	Political/economic influences on not/opted-out physicians' practice patterns.
JOSEPH & POYNER 1981	The role of *patients'* spatial/mobility action space on patterns of utilization.
MINERS 1981	A microeconomic model of rural *familys'* demand for services.
COYTE 1981	A microeconomic model of utilization incorporating *consumer*, *physician* and *hospital* behaviours.
LEROY *et al.* 1985 (as cited/applied in Deliege 1988)	The role of *patients'* decisions, *physicians'* decisions and the health-care system in explaining utilization.
HORNBROOK & BERKI 1985	The role of practice mode and payment method on *physician* performance using a structure-conduct-performance paradigm for the physician services market.
BATTISTA *et al.* 1986	Factors bearing upon *physicians'* choice of technique (practice-patterns).
CONTANDRIOPOULOS *et al.* 1987	The determinants of *physician* behaviour underlying utilization.

PATRICK *et al.* 1988	The determinants of patterns of poverty, health services, and health status between rural *populations*.
EVANS and others 1990 (in Labelle et al. 1990)	The interrelation of the factors determining *physician and patient* behaviours in determining patterns of utilization.
EVANS & STODDART 1990	The broad determinants of *population* health and well-being.
SHAPIRO *et al.* 1993	Analysis focusing on the *physician*--practice-profile interaction.
INSTITUTE OF MEDICINE 1993	Access to personal health services and *population* outcomes.
ANDERSEN *et al.* 1994 (Behavioural Model Three)	The determinants of *population* health behaviour (including services utilization) and consumer outcomes.
ROOS *et al.* 1995	The relationship between medical utilization and *population* health.
ANDERSEN 1995 (Behavioural Model Four)	The multiple influences on *population* health services utilization and outcomes.

2.3.1 DEMAND MODELS

Important models explaining individuals' decisions to seek medical care include Suchman (1965a,b), Mechanic (1968), Minner (1981), Rosenstock (1974) and Kosa and Robertson (1975). Both the Suchman and Kosa/Robertson models focus on the demand for episodes of medical care, but differ in their theoretical focus. While Suchman conceptualizes individuals' decision-making in terms of sociological explanations, Kosa/Robertson takes a psychological focus. Although not a process model, Mechanic considers a variety of psychosocial factors influencing perceived need motivating physician contact. The Rosenstock Health Belief Model -- a psychosocial model -- has been extensively validated for its ability to explain medical care-seeking within the context of health, illness, and sick role behaviours. Social-structural and social-psychological models predicted that age, gender, point of life cycle, perceived health status, perceived barriers to obtaining/continuing care, views about medicine, and the quality of the patient-physician relationship are important determinants of patient demand and compliance behaviours (see Aday 1993).

Building upon the seminal work of Grossman (1972) and Acton (1975), the Miners' model explains rural families' demand for all medical visits in terms of the time and other costs of care-seeking. Beyond health status and having a regular source of care, microeconomic models predict income, education, and age to be important determinants of health care utilization by adults, their dependents, and entire household; the effect of time is as at least as significant as monetary costs. These models have been criticized for theoretical and empirical failings (McGuire *et al.* 1988). Using data from a single urban Canadian primary care practice, Stoddart and Barer (1981) estimated the demand for episodes of care as inversely related to family income; however, the inverse relationships of utilization with travel time and its nonlinear one with education (higher for those with either less than or more than high school completion) were not significant. Whereas the estimated regression model was significant, it offered only limited explanatory power (11% adjusted R^2).

Although yielding important insights, these models are incomplete conceptualizations of the process of medical care utilization. The Suchman, Kosa/Robertson, Stoddart/Barer models explain demand for episodes of medical care, but utilization occurring within the context of the resulting patient--physician interaction is excluded. In contrast, by focusing narrowly on the determinants of consumer demand behaviour, the Mechanic, Rosenstock and Miner models fail to consider the role of physician-supply behaviour.

2.3.2 SUPPLY MODELS

Evans (1974, 1976) argues that market failure provides an opportunity for fee-for-service physicians to adjust their practice-styles in responses to income threats from exogenous changes in competition and/or fee-levels. Such inducement, however, is limited by increasing marginal disutility of providing unnecessary services, devoting additional leisure or other time to patient care and concern over threats to collective professional independence from increasing expenditures. Besides assuming endogenous demand, the Evans model is also criticized for not fully specifying the source of physician--patient behaviour (Wolfson 1976). Traditional microeconomic analysis also finds increased utilization by fee-for-service physicians responding to decreasing fees and/or increasing competition (Coyte 1981; Dranove 1988; Wolfson 1976). Although controversial (see reviews by Feldman and Sloan 1988, Gabel and Rice 1985, Labelle *et al.* 1994a, 1994b, Pauly 1994a, 1994b, Ramsey and Wasow 1986, Reinhardt 1985, Rice and Labelle 1989, Stano 1985, 1987 and Wennberg *et al.* 1982), supplier-induced utilization is consistent with observed aggregate changes in utilization in Canada (see Barer and Evans 1986, Barer *et al.* 1988, Evans 1975, Evans *et al.* 1987, Roch *et al.* 1985). For example, medical care utilization in rural Manitoba, adjusted for population demographic changes, increased 13.1% between 1971-72 and 1981-82 -- more than exceeding the 0.6% increase in population and despite only a 2.0% growth in physician-supply (Evans *et al.* 1987; Roch *et al.* 1985). Wolfson and Tuohy (1980) developed a behavioural model of the interrelationships among the dimensions of practice -- patient-load, workload, waiting time for appointment, hours of work, practice labour resources/overhead and patient self-referrals -- and a large set of explanatory variables. This model emphasizes physician behaviour in responding to income needs in the face of financial incentives (both derived from fee-for-service payment and the ability to opt-out of Medicare in order to extract co-payments from patients) and personal, professional, and other constraints.

More recent models argue for the selective effect of financial incentives on physician decision-making. Woodward and Warren-Boulton (1984) considered physician behaviour in an uncertain world in responding to alternative payment-modalities as constrained by the opportunity cost of leisure time and professional ethics. The model predicts that physicians paid an annual salary or an hourly wage deliver less of the "right" amount of care while those reimbursed through fee-for-service payment render more of the "right" amounts of care. While the findings of a United States randomized-controlled trial of pediatric residents' compliance with standards of "correct" care under salaried and fee-for-service payment-modalities support the model (Hickson *et al.* 1987), a recent Danish study found that capitated general practitioners selectively responded to tariffs by providing more services where professional uncertainty about the appropriateness of intervention was greater (Flierman 1991).

2.3.3 UTILIZATION MODELS

The foundation of the most enduring and perhaps widely employed conceptualization of the broad process of utilization -- the Behavioural Models, versions 1 - 3 -- was laid by Andersen in 1968. These Behavioural Models provide important information on variation in access to health care, the determinants of access, and their implications to policy-making. While the first Behavioural Model focused on the family as the unit-of-analysis, analysis shifted to individuals to avoid the effects of within-family heterogeneity. The determinants of the utilization of health services were understood as a chain starting with individuals' predisposing characteristics (i.e., demographic, social structure, health beliefs); the enabling resources available to them (i.e., personal/family, community); and their needs (i.e., perceived, evaluated). Equitable access is defined in terms of demographic characteristics and needs. Inequitable access can arise from the social structure, health beliefs, and/or the availability of enabling resources. Whereas the physician's influence on individuals' use of health care is implicitly expressed through evaluative need, this role is not made explicit.

Alternative comprehensive models of the process of utilization include the Gross (1972) and Donabedian (1973) models. Gross' conceptualization, beyond the above concepts of perceived health (need), predisposing factors, and enabling resources, specifically emphasized the effect of accessibility on utilization. Moreover, the model operationalizes these conceptual factors as combinations of age, sex, family size, urbanity, race, and education (and their interactions). The Donabedian model also emphasizes the role of the accessibility/availability of health resources in mediating between individuals' and physicians' behaviours and the utilization of health services. This model delineates, in some detail, the chain of events underlying these behaviours but does not ground these behaviours in social-structural or social-psychological factors. The Leroy and colleagues (1985) model of the determinants of health services utilization distinguishes between patients' decisions, physicians' decisions, and the health-care system, but also a patient--physician interrelationship characterized by supply-induced demand. Moreover, utilization is disaggregated into contacts with physicians and prescribed consumption of health care. A recent model by Evans and others (in Labelle *et al.* 1990) provides a detailed conceptualization of the interrelationships among the determinants of the patient and physician behaviours underlying observed utilization. This model allows for financial effects, practice standards, and resource availability on physicians' behaviour, the influence of external stimulants and access costs on consumers' behaviour, the effect of technology on the patient, physician, and patient--physician interrelationship. Finally, Joseph and Poyner (1981) developed and tested a conceptual model of consumer behaviour explaining the use of particular facilities. Utilization and place of attendance depend upon the consumer's action space (delineated by their activity patterns and their degree of mobility) and their knowledge of alternative facilities, both interacting for a particular facility location. For the case studied (Erin Township, Ontario), consumers with more restricted action spaces generally use local facilities.

The second Behavioural Model (Aday and Andersen 1974) differs from the first in focusing on the population's utilization of services, in distinguishing between services (i.e., by type, site, purpose, and time), in recognizing the interrelationship between the population characteristics and the health-care system and relating patterns of usage to consumer satisfaction (i.e., with convenience, availability, financing, provider characteristics, and quality). The importance of health-care system financing, resources, and organization on demand, and satisfaction is explicitly recognized in this model. In shifting to a population focus, however, analysts must be careful when interpreting macro-level findings to smaller units-of-analysis. For example, aggregate system-level indicators of resource availability may not capture the experience of individuals in local communities and large-scale multivariate studies fail to model individuals' decision-making adequately (Mechanic 1979).

Following the broadening of thinking about the determinants of health and health services usage, the third model expands consumer satisfaction into health outcomes (i.e., perceived health status, evaluated health status, consumer satisfaction). In this model, the primary determinants of health behaviour (i.e, population characteristics, health-care system, external environment) cause health behaviour (personal health practice, utilization of health services) which, in turn, determine health outcomes. Access is evaluated in terms of effective and/or efficient relationships between utilization and the outcome(s) achieved. In further developing the broad conceptualization of health (see Evans and Stoddart 1990, Patrick *et al.* 1988), the fourth (emerging) Behavioural Model incorporates dynamic and recursive interactions among the environment (i.e., health-care system and external environment), population characteristics (i.e., predisposing characteristics, enabling resources, need), health behaviour (i.e., personal health practices, use of health services) and outcomes (i.e., perceived health status, evaluated health status, consumer satisfaction) (see Andersen 1995).

The study by Patrick *et al.* (1988) of the interrelationships between poverty, health services, and health status in rural America provides an example of the policy-relevance of broader conceptual frameworks, but also of the limitations imposed by secondary data in operationalizing model variables. The Roos *et al.* (1994) conceptual model provides an approach for employing the population health information system to investigate the relationship of health care utilization to changes of population health (and well-being) over time within the context of the broader determinants of health and health behaviour.

Through the historical development of institutional arrangements addressing externalities (public funding), uncertainty of illness incidence (health insurance) and patient-provider information asymmetry (licensure), the patient--physician relationship is determined through patients initiating episodes of care with physicians determining the subsequent utilization of health care resources. Within this relationship, patients face no out-of-pocket costs deterring unnecessary use while fee-for-service physicians face financial incentives encouraging them to provide services, but few to deliver cost-effective care. Furthermore, much (most) clinical decision-making in primary care is characterized by uncertainty. Whereas substantial theoretical and empirical research on patients' care-seeking and physicians' care-providing behaviours has identified many factors influencing the utilization process, it is not clear which model(s) best explain findings of substantial variations that are apparently endemic in the provision of medical services.

2.4 LESSONS FOR INTERPRETING PATTERNS OF PRIMARY MEDICAL CARE UTILIZATION IN RURAL MANITOBA

Lessons for interpreting patterns of utilization in rural Manitoba can broadly be classified as issues of data quality, data linkages, and primary versus secondary data -- that is, the extent key outcome and explanatory variables can be estimated from secondary data.

First, are the data valid, accurate, and reliable? Clearly, findings derived from data known (or thought) to violate these considerations will, at least, be questioned or, in the extreme, research findings will be disregarded by stakeholders.

Second, can the data be aggregated (disaggregated) to construct various units of analyses? Depending upon the questions addressed, analysts may choose to focus on micro-level (patient, physician), meso-level (family or practice-profile, physician-practice) or macro-level (population, physician-supply) relationships and the corresponding units of analyses. Clearly, the existence of individual-level data that can be aggreggated into various groupings increases the flexibility of its use. For example, while the descriptive analyses performed here for this thesis examine meso- and macro-level relationships, future analytic research will investigate micro-level behaviours among individual consumers and/or providers.

Third, are sufficient explanatory variables available to support analysis? Depending upon the conceptual model used, variables predicting (or associated) with demand, supply, and patient--physician behaviours will be needed. Depending upon the unit-of-analysis employed and the research question(s) posed, variables describing small-areas, communities, patient-profiles, families, and individuals may be needed. While no single data set contains all possible variables operationalizing all important constructs bearing upon the relationship(s) examined, analysts must determine if key variables are available consistent with the data needs of the question(s) addressed. What are the implications of missing variables? Research using administrative data cannot address all questions; rather, analysts should ask: can the data support the questions posed?

Fourth, can medical care usage occurring over time (quarters, years) and across settings (office, clinic, hospital) be linked to the patients and physicians generating these patterns of utilization? The stability of patterns of utilization is of interest to stakeholders. The stability of physician-supply is an enduring concern in many rural communities. For residents, physician turnover and coverage-gaps raise issues of medical care continuity and its local availability (especially for smaller communities). For physicians, turnover/coverage-gaps raise concern about (temporary) increases in workload and the potential loss of clients due to reduced accessibility. Depending upon the availability/acceptability of local medical care, patients will seek care from distant sources. Moreover, physicians move, both across rural settings and to urban or out-of-province locations.

2.4.1 IMPORTANT VARIABLES AND RELATIONSHIPS

For the purposes of investigating patterns of primary medical care utilization, Table 2.5 denotes broad concepts (e.g., demand), their possible constructs (e.g., demographic factors) and suggests how they could be operationalized (i.e., age, gender, ethnicity). These variables can be used as a basis for assessing the data sets used here to examine patterns of primary medical care utilization in rural Manitoba.

TABLE 2.5: OPERATIONALIZING IMPORTANT UTILIZATION BEHAVIOURS

BEHAVIOUR AND DETERMINANTS	CONTACT-RATE	PRACTICE-PROFILE	EPISODE-RATE	VISIT-RATE	FEE-RATE	EXPLANATORY VARIABLES
DEMAND: patient care- seeking attitudes predicted by DEMOGRAPHIC SOCIOECONOMIC ACCESSIBILITY FAMILY TECHNOLOGY	X		X			age, gender, ethnicity income, occupation, education income, distance, transportation # of children, resources, type knowledge, attitude
SUPPLY: physician care-giving attitudes predicted by DEMOGRAPHICS EDUCATION PRACTICE-MODALITY PRACTICE-DURATION COMPETITION RESOURCES TECHNOLOGY PRACTICE GUIDELINES		X		X	X	age, gender, ethnicity place/date under/graduate payment and organization year current setting, total years physician-supply bed-supply attitude, availability knowledge, agreement
PATIENT–PHYSICIAN: shared attitudes and expectations PATIENT COMPLIANCE PATIENT SATISFACTION PHYSICIAN COMPLIANCE PHYSICIAN SATISFACTION	X	X	X	X		participantion, knowledge, illness, symptoms quality of the process, outcomes age, sex, training, continuion education, uncertainity training, needs, respect

2.4.2 LIMITATIONS AND ADVANTAGES OF OBSERVATIONAL RESEARCH

Key methodological issues in using administrative (secondary) data to investigate patterns of utilization include:

- determining which dimension(s) of performance can be usefully investigated;

- selecting an appropriate unit-of-analysis for measuring variation;

- specifying the analytic model operationalizing variables and their relationships; and,

- explaining remaining (adjusted) differences.

First, since few data sets can be used to assess all dimensions of performance, the findings of any one analysis should be carefully considered, both in terms of the internal/external validity of the information contributed and what remains unknown. Although primary data specifically collected to assess performance could address several (all) dimensions (e.g., the RAND experiment, see Folland *et al.* 1992), because such data is very expensive to obtain, these studies typically are not replicated. Routine surveys typically report detailed data, but usually on only one aspect of the utilization process -- for example, detailed data on physician characteristics, but not about their patients nor the services rendered and/or the outcomes achieved. Comprehensive administrative data sets (e.g., Manitoba, Nova Scotia, Saskatchewan) compile population-based data on the mix/volume of services rendered (consumed) and some physician/patient/small-area characteristics, but less insight into the outcomes achieved (see Roos and Roos 1988). Research using qualitative data provides powerful insights into the determinants of behaviour, but for only a limited set of experiences and subjects (Wilms 1992). Knowledge about the process of medical care utilization is best advanced through multimethods research.

Second, Table 2.3 notes selected example relationships among alternative units-of-analysis. Although individuals act, it is variation in aggregate patterns of health care utilization that concern policy-makers, managers, and other stakeholders accountable for health-care *system* performance. As noted in Chapter 1, the macro-level population--physician-supply relationship is appropriate for investigating variation in medical care accessibility while the meso-level patient-profile--physician-practice unit-of-analysis informs on differences in physician practice-style. However, as the strength/importance of these relationships varies cross-sectionally and temporally with changes in the characteristics of

- consumers (i.e., the resident, family, patient-profile, population),
- providers (i.e., the physician, group-practice, physician-supply),
- medical technology, and
- the ambient social, physical, and formal/informal health care environments (i.e., the family, community, district, health-care system),

conceptual models should incorporate these key effects. How to operationalize these constructs and their (inter)relationships, however, is problematic. Moreover, great care should be exercised in building statistical models estimating these relationships. Model misspecification from not accounting for the effects of missing (omitted) variables, clustering, nonlinearity, simultaneity and other effects, distorts estimated relationships (coefficient values and their statistical significance) by unknown amounts. All models are incompletely specified and no data set measures all relevant variables.

Finally, the "appropriateness" of patterns of care can be usefully defined against several standards: accepted practice, comparison with other jurisdictions, comparison with epidemiology (needs-based) and statistical definition (see Anderson and Lomas 1988). The epidemiological approach -- that is, comparing observed with needed (expected) population usage of medical care -- is an increasingly popular method for informing policy-makers about performance. Indeed, needs-based planning has entered the vocabulary of those concerned with health care planning and financing. While small-area variation raises equity, outcomes, and efficiency concerns, identifying disadvantaged populations and distinguishing between competing theories explaining these differences is problematic (Evans 1981, 1984; Folland *et al.* 1993; Luft 1986; Maynard and Bloor 1994; Roos 1992; Roos and Roos 1994). Knowledge of the other key determinants of utilization enables analysts to assess the usefulness of the data sets available to estimate these relationships (see Chapter 3) and aids them in interpreting observed patterns (see Chapters 4 and 5).

2.4.3 ANALYTICAL (STATISTICAL) ISSUES

The key decision faced by analysts investigating patterns of medical care utilization is specifying the appropriate patient--physician interaction unit-of-analysis. As this thesis is concerned with the epidemiology of rural primary medical care utilization, relevant units-of-analyses include the patient-profile--physician-practice, for examining variation across physicians, and the population--physician-supply relationship, for investigating differences between small areas. To explain these differences, however, researchers are required to specify (and, so, identify) relevant groupings while reducing within-group heterogeneity (see Hertzman *et al.* 1994). Moreover, the success of the epidemiologic approach also depends upon the ability of the analyst to estimate valid, meaningful differences. This ability, of course, depends upon the state of knowledge of theoretical relationships (or at least empirical associations) inherent in the conceptual model, the extent to which the data set enables the operational model to measure key relationships and, finally, the validity of the statistical model used to estimate between-group differences.

In specifying the unit-of-analysis, however, assumptions are made that may have theoretical and methodological implications for analytical validity. For example, macro-level analysis using aggregate data to compare populations and physician-supply provides important information on aggregate behaviour; however, the well-known effects of ecological bias must be considered when making inferences to other smaller groupings (Pedhazur and Pedhazur Schmelkin 1991). Theory provides little guidance on how disaggregated data on individuals should be aggregated to investigate collective behaviour (see Andersen 1995, Bentkover 1986, Corrin 1994, Winch 1971, Schelling 1978). As such, health services researchers must operationalize relevant sets of variables using a model complying with some generally accepted, or assumed true, theory. Moreover, modelled relationships are typically estimated from incomplete data sets using analytical techniques (often) violating the assumptions of statistical methodology (Bartholomew 1996; Boulding 1949; Pedhazur and Pedhazur Schmelkin 1991).

Therefore, key concerns include the homogeneity within the unit-of-analysis (e.g., patient-profile, population, physician, physician-supply), the set of indicators that the data set will support to measure utilization and explanatory variables, and the ability of the analyst to disaggregate secondary data to answer questions beyond those for which it was compiled (see Corin 1994, Hertzman *et al.* 1994). While no easy solutions to these concerns are available, researchers should discuss the implications of their decisions.

3.0 THE MANITOBA PHYSICIAN RESOURCE DATA SET

The following sections describe how Manitoba Health and other administrative data were used to construct the Manitoba Physician Resource Data Set (MPRDS). How variables were operationalized and estimated is discussed in some detail. The closing section discusses the advantages and limitations of using administrative data to study the epidemiology or rural ambulatory medical care. Although efforts to date have focused on the delivery of ambulatory visits by rural general practitioners (i.e., general and family physicians), future work will expand the data set to include specialists.

3.1 MANITOBA HEALTH AND OTHER ADMINISTRATIVE DATA

In administrating the Medicare Programme, Manitoba Health maintains information on insured medical benefits and the corresponding tariffs paid (the fee-schedule), the physicians certified to provide these services (the master registry) and the residents eligible to receive care (the population registry). In reimbursing physicians for the care rendered to patients, settings, physicians, patients, and services are linked for each encounter (the medical claims file). Useful data is also reported by hospitals, personal care homes, the provincial (Cadham) laboratory, the pharmacare programme (computerized since July 1994) plus the childhood immunization, vital statistics, and cancer registries (Cohen and MacWilliam 1995; Roos *et al.* 1993, 1982). Data reporting population demographic, socioeconomic, and health characteristics were obtained from Manitoba Health and Statistics Canada (Cohen and MacWilliam 1995; Frohlich and Mustard 1995). Through substantial programming efforts, these registries and files are combined to construct the MPRDS. To date, data sets have been constructed for the fiscal years 1990-91 through 1994-95; however, due to concerns about our ability to place physicians during 1990-91 accurately spatially, these data were excluded from further analysis.

TABLE 3.1: DATA AND LINKAGES WITHIN MANITOBA HEALTH DATA SETS USED TO CONSTRUCT THE MANITOBA PHYSICIAN RESOURCE DATA SET

ITEM/SOURCE	POPULATION REGISTRY	PHYSICIAN REGISTRY	CLAIMS FILE
RESIDENT (PATIENT)	place of residence birth year gender		place of residence birth year gender
PHYSICIAN		birth year gender place of graduation year of graduation speciality bloc	
PRACTICE		location bloc	location bloc salary payment number in group
CARE-SETTING			hospital -outpatient -hospital visits/calls -office -home -personal care home -emergency room -after-hours
SERVICE(S) UTILIZED			service(s) tariffs(s) diagnosis(es) date billed
IDENTIFIER	MHIN PHIN	base identifier billing numbers (s)	MHIN billing number used claim number
LINKAGES TO ...	personal care home file pharmacare file home care file hospital file MIMS registry master registry	pharmacare file home care file hospital file MIMS registry population registry	prescription(s) home care services hospital admissions vaccinations provider(s) -attending physician -referring physician -anaesthesia -select other providers patient

The unique patient and physician identifiers enable researchers to combine these data for longitudinal research. Table 3.1 notes important data-items contained in the Population Registry, the Physician Registry and the Medical Claims File used to construct the MPRDS. Data confidentiality is maintained by masked patient/provider identifiers, the deletion of personal details, and on-site data processing using secured computers. As needed, reported information is combined to avoid identifying small groupings of patients or providers. Information released through publications, presentations, and other mechanisms are reviewed by Manitoba Health Access and Confidentiality Committee.

3.1.1 MASTER (PHYSICIAN) REGISTRY

Most physicians eligible to practice medicine in Manitoba (i.e., registered with the Manitoba College of Physicians and Surgeons) are enrolled in the Manitoba Health Physician Registry. Itinerate physicians providing *locum tenens* and other temporary coverage (i.e., less than two months), however, are not required to register with Manitoba Health. These physicians can use existing numbers (e.g, those belonging to the absent physicians for whom coverage is being provided, or a clinic number) for billing purposes. Other minor exceptions (mostly affecting sub-specialists) include individuals seeing patients as part of their training/research programme. While fee-for-service physicians are reimbursed based on claims made through their billing number(s), salaried physicians are also assigned a billing number and required by Manitoba Health to report all patient encounters. Overall, all physicians concerned with patient care are included in the Registry. Upon registering with Manitoba Health, physicians are assigned a unique base identifier and one (or more) billing number(s). While the base identifier remains with the physician while she or he remains registered with Manitoba Health, billing numbers are reassigned following changes in physician bloc defined by specialization (general practitioner, recognized specialist), practice location (Winnipeg, non-Winnipeg) payment-modality (fee-for-service, salary).

The Master Registry contains more than 6,000 billing numbers -- i.e., all the billing numbers ever issued. Besides physicians, the registry contains certain allied providers eligible to submit claims to Manitoba Health (chiropractors, dentists, oral surgeons, periodontist, optometrists, physiotherapists). For physicians, billing numbers granted to both general practitioners and specialists are included (from now on, the master register is called the physician registry). Among eligible general practitioners, the physician registry includes billing numbers assigned to

- full-time/part-time providers currently making claims (i.e., active physicians),
- international medical graduates granted Ministerial Waiver for up to six months to practice in under serviced settings before passing qualifying examinations (until January 1994),
- certain out-of-province physicians routinely making claims for care rendered to Manitobans, and
- individuals eligible to practice but not currently submitting any claims (i.e., inactive physicians).

The physician registry also contains

- "deleted" billing numbers of physicians whose registration has been cancelled due to death, retirement or having permanently left Manitoba, and

- "clinic" billing numbers used (often simultaneously) by several sessional physicians.

From knowledge of billing number series, date of issue, changes, and cancellation, the registry is partitioned among physicians based on speciality, activity, location, and other factors useful to researchers.

The Physician Registry contains basic data about

- physician demographics (birth date, gender),
- physician training (place/date of medical school graduation, speciality designation), and
- physician practice (location, payment, organization).

Physician-speciality (bloc) and sub-speciality (sub-bloc) is designated by a unique series of codes. While not as detailed as the set of specializations recognized by the Manitoba College of Physicians and Surgeons, general practitioners are distinguished from specialists while major specialities (e.g., internal medicine) and some sub-specialities (e.g., geriatrics) are noted (see Table 3.1). Change in physician-speciality is denoted by a change in the reported bloc.

Manitoba Health distinguishes among general practitioners based on several grouping (sub-blocs):

- type (general practitioner, emergency room physician),
- practice location (Winnipeg, non-Winnipeg), and
- payment-modality (fee-for-service, salary).

Physicians certified by the Canadian College of Family Medicine are not identified. Also, not all salaried practitioners were assigned numbers denoting assignment to the salaried sub-bloc. Due to the shortages of these numbers, some salaried physicians were assigned fee-for-service sub-bloc numbers. Therefore, salaried and fee-for-service physicians are distinguished by the code denoting salaried practice.

Several issues were resolved in constructing the MPRDS. First, the medical claims made by a single provider using several billing number (e.g., clinics, laboratory, teaching, sessional in addition to private practice) were combined using the base identifier. Typically, there are 25% more billing numbers than general practitioners. Identifying individual sessional physicians who use the same clinic number is more problematic. While the few clinics present in rural Manitoba were identified (based on missing physician age and sex) and used to estimate physician-supply, they were excluded from the analysis of individual physicians. Physicians and their *locum tenens* cannot be distinguished when the same billing number is used to file medical claims; however, all salaried physicians are identified by a code recorded in the medical claims.

While most physicians promptly report changes in mailing addresses to Manitoba Health to ensure continuity of income, some misclassification occurs from physician and/or administrative delay. Moreover, for physicians periodically going into other areas to provide care (e.g., Winnipeg physicians flying into remote communities, rural physicians attending outlying satellite clinics, itinerant physicians providing *locum tenens* coverage), the registry does not record these changes in practice location. Also, billing number assignment (cancellation) may lead (lag) practice initiation (end). Although Manitoba Health continuously updates the Physician Registry, the version provided each April to MCHPE since 1991 is correct only for the date compiled. As a computerized log tracking revisions is not maintained by Manitoba Health, the medical claims data are used to verify practice initiation and termination, to define the date(s) of practice relocation, and to identify inactive periods.

3.1.2 MEDICAL CLAIMS FILE

Over a fiscal year some 16 million claims are filed by physicians for medical services rendered to Manitobans and certain out-of-province users. Each claim identifies the physician, the patient (if a Manitoban), the setting, the specific service(s) rendered along with one diagnosis (see Table 3.1). For surgery, the anaesthetist and surgical assistant are noted, while for consultations, the referring physician is identified. From knowledge of the date of service, the patient's place of residence and the physician's location of practice, the utilization of medical care is both temporally and spatially delineated. As needed, these data can be aggregated to several levels: the population, the patient-profile, the patient, the physician-supply, the cluster (physicians practicing in the same site), the practice (physicians belonging to the same organization) and the physician.

Reported medical services can be aggregated into categories of (mostly) similar activities using the denoted National Grouping Codes or other classifications: ambulatory-visits, consultations, and hospital-visits, diagnostic/therapeutic services, surgical, anaesthesia, and obstetrical procedures. As all reported care must correspond to the items recognized for payment, telephone contacts, and other non-billable services are not reported (Edwards 1991). Moreover, services must be performed by the physician (or his or her *locum tenens*) to be claimed for reimbursement. While salaried physicians face no loss of income from delegating care to nurse practitioners and in following-up patients through telephone contacts, fee-for-service physicians are motivated by financial and other consideration to render all billable care and services (see Evans 1984).

Some under reporting of ambulatory visits occurs because fee-for-service and salaried physicians staffing hospital outpatient clinics and emergency rooms under part-/full-time contractual arrangements are not required to file medical claims with Manitoba Health. From comparing physician claims against hospital statistics, deficits in visits were calculated and converted into an "equivalent" number of physicians for each hospital (Marian Shanahan memorandum, February 16, 1996). While estimates of physician-supply were corrected for these "missing" providers, the workloads of individual physicians could not be adjusted for this source of unreported care. In most rural areas, physician under-reporting of hospital-based ambulatory visits underestimates physician-supply by less than 10%; however, in areas E8, IS, P4 and PS, physician-supply is underestimated, respectively, by 27%, 16%, 12% and 11%.

A second source of physicians under-reporting of ambulatory visits stems from the role of financial incentives in motivating practitioners to report patient contacts. Although Manitoba Health requires physicians to report all eligible medical care/services rendered, the claims filed by salaried practitioners may not be as accurate as those reported by fee-for-service physicians. To assess the accuracy of physician claims, Tataryn and colleagues (1994) showed that between 90% and 98% of all ambulatory visits are documented in Manitoba Health data sets (also see the discussion in Roos et al. 1996). Also, previous work in Central and Westman Regions comparing fee-for-service and salaried physicians found little evidence of under-reporting by salaried physicians (Wall *et al.* 1994).

While International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM) diagnoses are denoted, only one can be reported per ambulatory contact (but up to 16 can be noted per hospital admission). Patient-profile case-mix severity will be underestimated for physicians managing patients suffering with multiple conditions (e.g., diabetes and heart disease) unless multiple visits -- one for each problem -- are used. The accuracy of diagnostic coding varies between conditions and across physicians. Comparison of diagnoses reported by physicians to the "gold standard" of hospital abstracts finds good agreement for unambiguous conditions, but greater variability with increasing diagnostic uncertainty (Shanahan *et al.* 1994). As there currently are no incentives motivating physicians to manipulate the system for financial gain, variation reflects error and uncertainty rather than bias.

3.1.3 POPULATION REGISTRY

The population registry contains basic demographic data (year of birth, gender) and notes place of residence (postal code, rural municipality) of all Manitobans eligible to receive health care services. With few exceptions (e.g., out-of-province students) the entire population is enrolled. Although Manitoba Health requires notification of change of address, birth and death, the registry is in error until notification is received/processed. An alternative approach is to check other administrative data sources for current information. Through linkages to Vital Statistics and medical claims data, however, the MCHPE annually updates the registry for births, deaths, movement, and other changes.

The great stability of the rural Manitoba population (see Roch *et al.* 1985, Roos *et al.* 1996) reduces misclassification error.

One exception, however, is the large number of Treaty Status Indians residing in off-reserve communities (mostly in Brandon and Winnipeg). Because Status Indian place of residence is always reported in the Registry as the Treaty Reserve, medical claims and hospital abstracts were searched for more recent postal codes to identify the current place of residence. Also, the listing of Status Indians in the Registry may be incomplete. From a comparison with data compiled by the Federal Department of Indian and Northern Affairs, the populations of the some rural areas are underestimated (see Roos *et al.* 1996).

Individuals are assigned to rural municipalities based on reported residence codes. Although postal codes are also reported, these areas typically encompass several rural municipalities. Alternative groupings of these building blocks into small areas include health care planning regions (Tataryn *et al.* 1995), rural/Winnipeg/Brandon (Roch *et al.* 1985), communities defined by type/location (Michael Loyd & Associates 1993), selected rural communities (Horne 1987), and the physician service areas used here (Wall and Bogdanovic 1993). Through linkages to Statistics Canada, Vital Statistics, and other data, important demographic, socioeconomic, and health indicators are estimated for these populations. These populations include individuals contacting the health-care system and current nonuser.

3.1.4 POPULATION HEALTH STATUS AND SOCIOECONOMIC STATUS

Alternative measures of population health status include self-reported health or observed morbidity/mortality rates, the prevalence of known risk factors, the detection of sentinel events and adverse outcomes, socioeconomic, and other important correlates.

Although self-reported health, an important measure of actual health status, is highly correlated with health care utilization (see Aday 1993, Patrick and Erickson 1993), health surveys are infrequent and do not sample sufficient numbers of residents to portray conditions in small areas or practice-profiles accurately.

From combining survey and administrative data, Wilkins and Adams (1987) found that population health status, estimated as life expectancy weighted for disability-days, varied by community size and income in all provinces, with rural areas consistently faring worse. Recent cross-sectional analyses for Manitoba found differences in population health status (measured using 102 standardized indicators of morbidity, mortality and sentinel events) across the eight planning regions (Cohen and MacWilliam 1995). Compared with Winnipeg, non-Winnipeg residents generally (but not consistently) exhibit poorer health. The residents of the remote Thompson and Norman Regions exhibited the poorest health while those of the rural Central and largely rural Westman Regions displayed superior health (at least as estimated by the standardized mortality ratio and percentage of low birth-weights; see Cohen and MacWilliam 1995). Eyles and colleagues (1991) argue that the standardized mortality ratio of the 0 - 74 years of age cohort is the best *single* measure for operationalizing population expected need for health care.

In Manitoba, the prevalence of the major (hypertension, smoking, serum lipids, all three) and most minor (physical inactivity, obesity, drinking, poor diet, family history) risk factors for cardiovascular diseases were consistently higher in small rural communities (less than 2,000 residents), with regional centres (including the larger towns) having comparable or lower rates than the Winnipeg Region (Young *et al.* 1991). Although useful for calculating the need for health care, such data is not routinely collected and the sampling frame is usually designed for populations larger than physician service areas and practice-profiles.

Overall, population health status is highly correlated with measures of socioeconomic status (see Aday 1993, Clarke 1990, Dutton 1986, Grant 1988, Manga 1987, Patrick and Erickson 1993, Ujimoto 1988). The prevalence of health risk factors is greater among populations characterized by high unemployment, frequent work interruptions, low job demands, and low educational attainment (see Birch and Eyles 1990). Moreover, health status is generally poorer among the elderly (Meade 1992; Ujimoto 1988), native Canadians (Young 1994), and the unemployed (D'Arcy and Siddique 1985). Using data from the 1986 Statistics Canada survey (and updated using 1991 findings), Frohlich and Mustard (1995) constructed a socioeconomic risk index (SERI) incorporating the effects of family structure, education, housing value, and employment on population health. Although not the cause of poor health, these factors summarized by the index are highly predictive of population health, short-term hospital days, and ambulatory visits in the Manitoba Health Planning Regions for FY92 (see Frohlich *et al.* 1995).

3.1.5 DATA ACCURACY AND RELIABILITY

The reliability of Manitoba Health data has been shown repeatedly (Roos *et al.* 1993, 1989, 1985, 1984, 1982, 1979). First, by comparing alternative Manitoba Health files containing common items, reliability is assessed through the consistency and comparability of the appearance of these data. For example, surgical procedures reported to Manitoba Health by the hospital (the hospital abstract), the surgeon (the medical claim), the assisting surgeon (the medical claim), and the anaesthetist (the medical claim) could be compared to detect errors in reported diagnosis and procedure across these settings and providers. Second, the logical sequencing of reported events is also examined. For example, pregnancy care following hysterectomy is a concern. Finally, the administrative data is compared with medical charts (physician and clinic) and population-based surveys (Young *et al.* 1991). For ambulatory medical care, comparison of Manitoba Health medical claims to physicians' medical records showed few differences in the number of visits or episodes (Roos *et al.* 1979).

3.2 COMPILING THE MANITOBA PHYSICIAN RESOURCE DATA SET

The MPRDS is developed in three stages. First, physician service areas (small areas) suitable for investigating the epidemiology of rural primary medical care are constructed. Second, physician movement is tracked to assign medical care utilization accurately to the physician service area in which patient--physician contact occurred. Finally, important variables concerning the micro-level, meso-level, and macro-level relationships identified in the conceptual model are operationalized using the above Manitoba Health and other data sources. The relevance of these variables to the conceptual model developed Chapter 2 is also examined.

3.2.1 SPATIAL CONSIDERATIONS: PHYSICIAN SERVICE AREAS

Analysis informing policy-making on the availability, accessibility, and utilization of primary medical care in rural settings requires data on consumers, providers, and the health-care system summarized at the level of the physician service area (PSA). Through including/excluding residents and physicians, the specification of rural markets affects the quantification of variables estimating utilization and its determinants.

PSAs typically consist of one or more sites containing physicians (city, town and/or village) plus the surrounding hinterland (smaller villages and more sparsely settled areas) whose residents obtain medical care from providers. The approach developed here constructs PSAs (economic markets) by satisfying two rules: i) most residents obtain care from in-area physicians while ii) few visits are rendered to out-of-area patients (see Morrisey 1991). Because of their key role in the delivery of medical care to surrounding (and beyond) rural areas, influential towns, and the two cities were also identified as PSAs. The underlying philosophy is that out-of-area and in-area patterns of utilization are distinct processes that should be distinguished to understand rural issues better.

PSAs were constructed by testing alternative combinations of rural municipalities for the proportion of ambulatory visits provided to (by) area residents (physicians) by (to) in-area physicians (out-of-area residents). The final grouping was selected based on the best overall configuration defined as the minimum error from misclassifying patterns of utilization. From the population perspective, misclassification was defined as the percentage of all ambulatory visits made to out-of-area physicians while, from the physician-supply perspective, it was defined as the percentage of the workload rendered to out-of-area residents.

STEP 1: Count primary care ambulatory visits utilized in all municipalities.

The measure of medical care utilization used to construct physician service areas is the ambulatory visit. This definition, which encompasses all visits made to physicians while the patient is not an inpatient (Tataryn *et al.* 1995), includes patient--physician interactions occurring in the physician's office, the patient's home (including long-term care facilities), and hospital outpatient clinics/emergency room. Unless otherwise indicated, ambulatory visits include consultative care. Ambulatory care rendered as part of global tariffs (e.g., postoperative care, prenatal/postpartum care) is excluded. The ambulatory visit is the foundation for all subsequent medical care utilization -- both during contact (e.g., diagnostic and therapeutic services) and beyond (e.g., referral to a specialist, admission to hospital for medical or surgical care, follow-up ambulatory visits). Ambulatory visits made by rural residents during the fiscal years 1990-93 was used to identify the patient's place of residence and the general practitioner's location of practice (see Wall and Bogdanovic 1994).

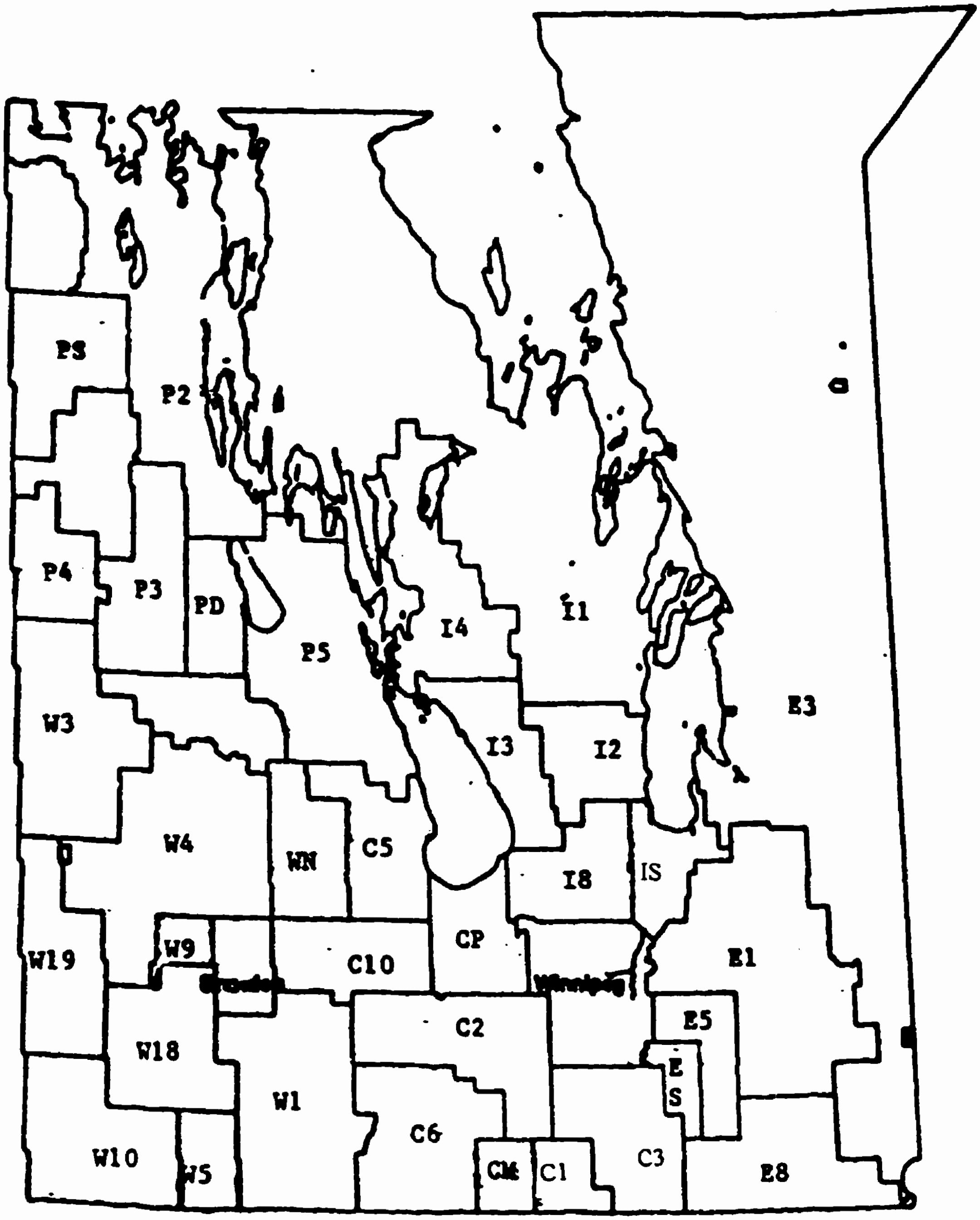
Because of high physician-turnover in rural settings, particular attention was paid to tracking physician movement to assign visits to PSAs accurately. This three-year period yields stable estimates of patterns of utilization. Patterns estimated for shorter periods may be unduly influenced by gaps in practice-coverage during periods of physician-turnover while longer time-series increasingly incorporate conditions no longer relevant to the current (and future) situation. Because more than 90% of Manitobans contact a physician at least once within a two year period (Tataryn *et al.* 1995), these patterns are stable and, so, unlikely to change over the study.

STEP 2: Combine municipalities to construct the preliminary PSAs.

The small areas defined by Zajac (1991) provide a starting point for grouping rural municipalities into physician service areas. Southern Manitoba (everything south of the 53rd parallel of latitude) was partitioned into rural, rural influential and urban areas (see Figure 3.1). The two cities and certain rural towns (characterized by large concentrations of physicians and hospital beds providing more than 100,000 visits over the three years) were collectively identified as influential communities -- that is, communities in which patients from adjacent (and more distant) areas obtain medical care. The city of Winnipeg exhibits a province-wide influence on patterns of care-seeking. Both the city of Brandon and the town of Portage-La-Prairie (CP) provides care within their respective regions. The towns of Morden-Winkler (CM), Steinbach (ES), Selkirk (IS), Dauphin (PD), Swan River (PS) and Neepawa (WN) exert important, but more localized, effects on patterns of care-seeking.

As the Zajac small areas were not adjusted for actual patterns of utilization, however, rural municipalities were regrouped to ensure that most visits occurred within these PSAs. From the population (physician-supply) perspective, goodness-of-fit was assessed as the proportion of ambulatory visits made to in-area physicians (proportion of ambulatory visits rendered to in-area patients). Although goodness-of-fit assessment

FIGURE 3.1: RURAL MANITOBA PHYSICIAN SERVICE AREAS



found that these groupings satisfied the plurality rule, substantial misclassification (i.e., greater than 10%) occurred from both care-seeking and care-giving crossing boundaries between adjacent rural areas (see Wall and Bogdanovic 1995).

STEP 3: Combine/reassign municipalities to form larger PSAs.

Building on Step 2, alternative combinations of rural municipalities were considered to represent patterns of both population care-seeking better and physician care-giving. First, three influential areas were reduced in size by reassigning municipalities with at least 10% out-of-area care-seeking to the appropriate rural PSAs. Next, alternative combinations of selected rural municipalities (high out-of-area care-seeking and/or care-giving) were tested. Overall, substantial improvement was afforded through these revised areas. See Figure 3.1 for the final spatial configuration of rural PSAs.

From both the care-seeking and care-giving perspectives, misclassification error was reduced to less than 10% (see Wall and Bogdanovic 1994), except I4 (11.04% for care-seeking); however, merging I4 with I3 would create an excessively large PSA. From the physician perspective, while some care-seeking misclassification remained, most error was less than 10%. In drawing patients from more distant rural settings, the influential PSAs were expected to exhibit high out-of-area care-giving. Only Selkirk (IS) exhibited a low value (less than 30%) for which little improvement would be derived by combining adjoining PSAs. As expected, the combinations of municipalities forming these PSAs clearly reflect the underlying influence of the rural highway system on patterns of primary medical care utilization.

3.2.2 TIME CONSIDERATIONS: TRACKING PHYSICIAN MOVEMENT AND PATIENT CONTACTS

Because the unique physician and resident identifiers are consistent over time, longitudinal analysis is possible. The accurate recording of patient place of residence and physician location of practice depends upon voluntary updates to Manitoba Health. Therefore, some misclassification error is expected. As noted above, misclassification is limited by several mechanisms. Although the size/distribution of the rural Manitoba population is markedly stable (see Roch *et al.* 1985, Roos *et al.* 1996), the physician stock is highly volatile, both in terms of within-rural movement as well as migration to Winnipeg and out-of-province settings (see Postl *et al.* 1994). Three concerns were addressed:

- are timely updates provided by physicians and residents to Manitoba Health? ;
- are changes in specialization, practice location, payment-modality and/or group membership accurately recorded?; and
- how can periods of physician inactivity be identified?

Since the April version of the physician registry provided annually to the MCHPE includes all changes reported during the proceeding fiscal year, this information is timely. The contribution of this information to the accurate sequencing of important events was examined through comparison to medical claims data. First, as the date of change in physician payment, speciality status, Winnipeg/non-Winnipeg practice along with their previous status is noted, the sequencing of these events can be usually reconstructed.

The accuracy of the reported dates of physicians' change of practice-modality --

payment, organization, and/or specialization -- was verified through comparison to the medical claims. Physicians included in the salaried payment-modality should not be found in PSAs that are exclusively fee-for-service. Fee-for-service physicians in organized practice should report group numbers consistent with the PSA. Finally, physicians moving between PSAs should report changes in payment-modality and practice-organization. For example, salaried physicians moving to PSAs exclusively staffed by fee-for-service practitioners should report a change in payment-modality and location whose dates agree with that of practice relocation. Similarly, physicians moving and entering organized practice should report consistent dates and the appropriate group number.

Whereas the date of billing number initiation or cancellation typically corresponds to the start or end of recorded medical care billing, some misclassification occurs because of physician and administrative delay in reporting and then processing these updates. More critically, however, the Registry does not denote temporary periods of physician inactivity. Also, while reported dates of physician relocation to (from) Winnipeg and out-of-province (bloc cancellation) correspond well to changes in the patient-source identified from the medical claims, the registry does not retain previous location for other within-Manitoba movement. Therefore, as physician movement across non-Winnipeg sites cannot be tracked, these providers are assigned to the rural municipality (PSA) noted in the registry. As this source of error may bias estimates of physician-supply and physician-workload in areas of high physician-turnover, the medical claims data were employed to track physician activity and movement.

Reviews of patterns of monthly billings identified inactive periods and the month in which turnover was initiated. To reduce error (and possible bias), inactive periods were excluded from analysis. By considering physician-practice in units of quarters -- three contiguous months, April to June, July to September, October to December and January to March -- physician-quarters were included only when the physician (or *locum tenens*) was active for all three months. Although practice initiation/termination generally corresponds to the start/end of a quarter, initiation can start on any day while IMGs failing their qualifying examinations and physicians dissatisfied with rural practice may terminate practice within a quarter. Quarters in which turnover occurred or other changes in practice happened (start/stop, change in payment-modality and/or group membership) were flagged. For quarters in which turnover occurred, the physician-quarter is included if at least two out of three months were in a single rural site. Using this framework, analysis focuses on the physician-quarter rather than the physician -- that is, while the physician is the consistent factor throughout analysis, quarterly changes in practice-modality, location, and other explanatory factors are accurately incorporated into analysis.

3.2.3 HIERARCHIAL CONSIDERATIONS: OPERATIONALIZING POPULATION, PATIENT-PROFILE, PATIENT, PHYSICIAN-SUPPLY, PRACTICE, AND PHYSICIAN VARIABLES

Table 3.2 lists the variables included in the MPRDS by type (utilization, consumers, physician, practice, system, time) and hierarchial relationships (micro-, meso-, macro-level). For example, consumers' need for ambulatory medical care is estimated for both the physician service area population and the individual physician practice-profiles within these areas.

Consistent with the focus of this research on the determinants of observed physician visit-workload and population realized physician-accessibility, MPRDS variables are mostly estimated for meso-level (patient-profile--physician-practice) and macro-level (population--system) relationships using respectively quarterly and annual data. Most variables are appropriately estimated while a few concepts are omitted, or cannot be determined from administrative data. Moreover, certain meso-level variables concerning patient-profile behaviour are estimated from population (macro-level) values. Rather than designating variables as outcome/explanatory or exogenous/endogenous, variables are described and the conceptual model is used to link them together using meaningful (inter)relationships.

TABLE 3.2: MPRDS VARIABLES BY CONCEPT REPRESENTED AND MICRO-, MESO-, AND MACRO-LEVEL RELATIONSHIPS

CONCEPT REPRESENTED	MICRO-LEVEL	MESO-LEVEL	MACRO-LEVEL
MEDICAL CARE UTILIZATION:		practice-profile	PSA population
-ALL PHYSICIAN BILLINGS		$BILLINGS; Q	$MC/R;A
-% NON-AMBULATORY BILLINGS		%NAC; Q	
-AMBULATORY VISITS BILLINGS		$AV;Q	
-AVERAGE VISIT FEE PAID		$AV/AV; Q	
-AMBULATORY CONTACT		AV;Q	AV/R;A
-PATIENT-LOAD		AP; Q	AP;A
-VISIT-INTENSITY		AV/AP;Q	AV/AP;A
-CONSULTATIVE BILLINGS		$CV; Q	
-AVERAGE CONSULTATION FEE		$CV/CV	
-RATE OF CONSULTATIONS		CV/AP;Q	
-AVERAGE CONTACT-FREQUENCY		Q/FY;Q	
-INPATIENT VISIT BILLINGS		$IV;Q	
-AVERAGE FEE PAID		$IV/IV;Q	
-RATE OF VISITS		IV/00AP;Q	
-REFERRALS		RV;Q	
-RATE OF REFERRALS		RV/00AP;Q	
-TOTAL VISIT IMPACT (AV+RV+ IV)		TV	

CONSUMERS' DECISION-MAKING:			
-PERCEIVED NEED FOR CARE	latent variable		
-EXPECTED NUMBER OF VISITS		PPEAV:Q	PSAEAV;A
-ACCESSIBILITY (PHYSICAL ACCESS)		not estimated	not estimated
-EFFECTIVE PHYSICIAN-SUPPLY		#	EFTE/000;A
-NEED--USAGE CLASSIFICATION			PSA-TYPE;A
-FAMILY STRUCTURE		#	not estimated
-PHYSICIAN COMMONALITY	not estimated	not estimated	%IA;A
PHYSICIAN'S DECISION-MAKING:			
-ATTITUDE TOWARDS PRACTICE	latent variable		
-EVALUATED PATIENT NEED	not estimated		
-AMBULATORY PRACTICE STYLE	not estimated		
-HOSPITAL PRACTICE STYLE	not estimated		
-ATTITUDE TOWARDS INCOME	latent variable		
-ATTITUDE TOWARDS RURAL CARE	latent variable		
-AGE	AGE,AGESQ		
-GENDER	SEX		
-FEMALE, CHILDBEARING AGE	FCBA;AMMG,CM		
-MEDICAL SCHOOL	MG,CMG,IMG		
-CCFM REGISTRATION	unavailable		
-ANY ADVANCED TRAINING	unavailable		
-DATE OF GRADUATION	not used		
-LENGTH OF MANITOBA PRACTICE	LOM:Q		
-LENGTH OF RURAL PRACTICE	LOR:Q		
-LENGTH OF CURRENT MODALITY	LOP;Q#		
-PATIENT COMMONALITY	not estimated		
PRACTICE:			
-PRACTICE-MODALITY		FFSS,FFSG,SCHC:Q	
-PAYMENT-MODALITY		FFSP,S(not used):Q	
-DELIVERY-MODALITY		SOLO;GRP;CHC;Q	
-NUMBER OF MEMBERS		PRACTIC-SIZE:Q	
-PRACTICE VISIT-INTENSITY		not estimated	
-ANY PRACTICE CHANGES		CGN;Q	
-START		not used	
-STOP		not used	
-MOVE TO/FROM RURAL SETTING		not used	
-MOVE TO/FROM URBAN SETTING		not used	
-CHANGE PAYMENT-MODALITY		not used	
-CHANGE DELIVERY-MODALITY		not used	
-WITHIN 6 MONTHS OF STOP		END	
-TIME DEVOTED TO ALL ACTVITIES		unavailable	
-TIME DEVOTED TO DIRECT CARE		unavailable	
-FULL-TIME EQUIVALENT STATUS		FTE;Q	
-PART-TIME		PT;Q	
-TOP 10% OF BILLINGS		TOP10%;Q	
-ISOLATED PRACTICE		#	ISOLATED;S

Health-care RESOURCES: -PHYSICIAN-SUPPLY -AVERAGE WORKLOAD -PHYSICIAN-AVAILABILITY -% IN-AREA WORKLOAD -PHYSICIAN-COMPETITION -EFFECTIVE POPULATION SERVED -AVERAGE RATE OF TURNOVER -AVERAGE RETENTION -AVERAGE COVERAGE-GAPS -HOSPITAL BED SUPPLY -FEE-SCHEDULE INDEX -AMBULATORY VISITS -CONSULTATIVE VISITS -INPATIENT VISITS -SALARY INDEX -FEE-FOR-SERVICE CLAWBACK -LICENCING CHANGES -COST-OF-LIVING CHANGES			 FTE/000R;Q FTE/#;Q IAFTE/000R;Q IAFTE/FTE;Q FTE/E000R;Q 000R/E000R;Q TO;S Q/GP;S Cgs;S BEDS/GP;S not estimated AVFEE;Q CVFEE;Q IVFEE;Q SALPYMT;Q FFSCB;Q MCP&S;Q CPI;Q
TIME: -QUARTER -SEASON -FISCAL (OR CALENDAR) YEAR -TIME			 QUARTER SEASON FY TIME

#, HIGHER ORDER HIERARCHICAL VARIABLE USED (e.g., a population-based estimate substituting for a missing patient-profile value).
*, INCOMPLETE OPERATIONALIZATION OF THE UNDERLYING CONSTRUCT
Q, ESTIMATED FROM QUARTERLY DATA
A, ESTIMATED FROM ANNUAL DATA (FY93)
S, ESTIMATED FOR THE ENTIRE STUDY PERIOD

AMBULATORY MEDICAL CARE UTILIZATION

Utilization, a comprehensive abstraction summarizing the mix and volume of reported medical services arising from complex interrelationships between patient care-seeking (demand) and physician care-giving (supply), can be aggregated for the individual patient (physicians), the practice-profile (physician), or the population (physician-supply). Consistent with the study's analytic focus on investigating physician visit-workload and population realized physician-accessibility, medical claims data are aggregated at the levels of the physician patient-profile and the area population.

PHYSICIAN WORKLOAD

Given the wide range of care provided (consumed) by rural primary physicians (residents) an appropriate set of weights is required to aggregate these diverse services meaningfully. Lacking values derived from time-and-motion studies, two approaches are widely used to estimate total physician-workload. First, assuming that all services consume equal time, output can be estimated as the unweighted service-count. While straightforward, to the extent that the mix of services varies across physicians, error will be introduced into analysis. If service-mix differs systematically between physicians because of age, gender, practice-modality and other factors, then analysis comparing these groups may be biased. Alternatively, by assuming that fee-schedule tariffs accurately value the physician's time used in producing these services, the services produced (output) can be estimated as total-cost -- that is, the multiplicative product of the vector of services (number by type) times its corresponding vector of tariffs, summed over all fee-schedule items. For study duration greater than one fiscal year, comparable tariffs should be employed as weights and adjustment made for the bundling (or unbundling) of services. If physicians adjust their service mix in response to financial incentives available through fee-for-service payment, then these tariffs should be used to weight service-counts.

Analysis of all services rendered (counts or billings) to summarize physician-activity is problematic because of unknown distortions in the relationship between the time used (input) and the services rendered (output) across the diverse set of activities characterizing rural general practice. Clearly, not all services require equal physician time or other practice inputs for their execution nor are they reimbursed in proportion to the time used or the value provided. Also, the reporting of diagnostic/therapeutic services varies systematically with practice-modality.

Whereas rural physicians may order comparable volume/mix of tests, fee-for-service physicians face financial incentives to perform, and so to bill for, diagnostic services. Furthermore, because of their formal associations with local hospitals, salaried physicians generally do not perform diagnostic tests. Similarly, measured differences between salaried and fee-for-service physicians in the provision of vaccinations, PAP smears, and other preventive services are potentially distorted in the medical claims compiled by Manitoba Health by the greater use of nurse-practitioners and public health nurses to provide these services. The true usage of diagnostic and therapeutic services is likely under reported for salaried physicians in larger towns, and younger female physicians who are more likely to use outside laboratories and/or to employ substitute providers.

Although total services (estimated as a count or billings) are comprehensive measures of physician-workload, because of these above concerns about missing data and adjusting for inputs, other approaches to measuring physician-workload have been employed. Following Roos (1980), physician-workload is operationalized as the total ambulatory patient contact. Ambulatory visits are the key constituents of generalist physician-workload (i.e., exceeding 70% of all billings and counts for most physicians). The definition of ambulatory care used here focuses on patient--physician interactions occurring through office visits, visits to outpatient clinics, and emergency-rooms, and house-calls to private homes/institutions. Ambulatory visits delivered as part of global tariffs (prenatal and post surgical care) are excluded because the number of visits made during these episodes is unknown (see Roos *et al.* 1996). For the reasons noted above, diagnostic/therapeutic services are excluded, as are the more 'specialized' surgical, obstetrical, gynaecological and anaesthesia dimensions of rural practice. Changes over time in the distribution of physician activity between ambulatory and non ambulatory care are accounted for by the variable measuring the proportion of non ambulatory care activities (NAC). NAC is operationalized quarterly as the ratio of billings for all non ambulatory care to total billings.

A broader operationalization of ambulatory visit-workload includes all patient visits generated by physicians, either through direct patient care rendered in ambulatory and inpatient settings, or indirectly, through referrals made to "specialists." Depending upon patient-profile expected need for contacts, attitudes towards care, and other considerations, physicians differ in their approach to patient management. Although an ambulatory contact, consultations are distinguished from other visits because of their "speciality" nature -- that is, not all general practitioners engage in "specialized" care, the referring physician rather than the patient initiates contact, and follow-up care is usually provided by the referring physician. The composition of 'specialist' workload is expected to include more discrete patients but fewer visits per patient.

Consumers demand episodes of care: bundles of medical services deemed by their physicians (or themselves) as able to treat their presenting health problem(s) (Feldstein 1966; Evans 1984; McGuire *et al.* 1988). As noted above, utilization data is generated by complex (inter)relationship between patient care-seeking and physician care-giving behaviours. Therefore, ambulatory care billings (utilization) data was used to operationalize:

- episodes of care as corresponding to a quarter (i.e., only one episode per quarter),
- patient demand as the initial contact (i.e., the discrete patient-count), and
- physician response as the resulting number of visits rendered per contact (i.e., the visit-count) and the fee claimed (i.e., billings).

Components of ambulatory visit-workload are noted by the accounting identity,

$$\$AV = \$AV/AV \times AV/AP \times AP.$$

Physician ambulatory visit patient-load (AP) is the count of discrete patients contacting a physician during the quarter. For these patients, visit-intensity (AV/AP) is measured as the ratio of total visit-count to the patient-load making these visits while the average fee charged ($AV/AV) is calculated as the ratio of total billings for ambulatory care divided by the visit-count generating these claims.

In order to link patient--physician interactions occurring over the fiscal year, patient contact-frequency (sum AP/DP) is estimated as the ratio of the discrete quarterly patient-contacts summed over the fiscal year (sum AP) to the discrete annual patient-load managed (i.e., all patients making at least one contact during the year; DP). The fiscal (or the calendar) year is a convenient period for capturing seasonal variations in ambulatory contacts made for acute (e.g., the flu season) and chronic (e.g., asthma) conditions. Over a year, patients demand medical care (make contact) by responding to perceived symptoms while physicians schedule follow-up visits to monitor acute and chronic conditions.

Although included under ambulatory care, consultative billings ($CV) by general practitioners are distinguished from the other ambulatory care. First, patients seen on a consultative basis are typically returned to the referring physicians for follow-up care. Second, physicians rendering greater amounts of consultative care are acting more like specialists than as general practitioners. Important components of the quarterly consultative workload are expressed by the accounting identity,

$$\$CV = \$CV/CV \times CV/00AP \times 00AP.$$

The average fee charged for consultations ($CV/CV) is calculated as the ratio of the billings for consultations ($CV) divided by the visit-count (CV) generating these fees. Visit-intensity (CV/00AP) is estimated as the ratio of the consultation visit-count (CV) to the ambulatory patient-load, expressed per one hundred patients (00AP).

Besides rendering treatment on an ambulatory basis, rural primary physicians also manage patients as inpatients and/or through referrals made to 'specialists'. In assuming that all inpatient visits and referrals attributed to a physician derive from an initial ambulatory contact, a key measure of physician practice-style is the rate of usage of hospital and specialist resources.

Components of billings for inpatient visits ($IV) are explained by the accounting identify,

$$\$IV = \$IV/IV \times IV/00AP \times 00AP.$$

Physician billing-intensity for inpatient visits ($IV/IV), the average fee charged, is estimated as the ratio of the billings paid ($IV) to the corresponding visit-count (IV).

Inpatient visit-intensity (IV/00AP) is estimated as the ratio of the number of inpatient visits (IV) to the ambulatory visit patient-load managed, expressed per one hundred ambulatory patients (00AP).

For referrals made to 'specialists', components of referral-counts are explained by the accounting identify,

$$RV = RV/00AP \times 00AP.$$

Referral-intensity (RV/00AP) is estimated as the ratio of the number of referrals to the patient-load managed, expressed per one hundred ambulatory patients (00AP). Beyond the total referrals made, the proportions made to general practitioner and specialist are also reported.

Finally, the total visit-count (TV) attributed to physicians is calculated as the sum of ambulatory-visits (including consultations) plus inpatient-visits,

$$TV = AV + IV + RV.$$

The identity defined for ambulatory visits (see above) can also be employed to investigate variation across physicians in the total count of visits.

CONSUMERS' BEHAVIOUR

Important factors characterizing consumer behaviour include the expected need for ambulatory medical care, accessibility to physicians, and family structure.

THE EXPECTED NEED FOR AMBULATORY MEDICAL CARE:

In operationalizing the need for medical care, researchers usually distinguish between individuals' perception of health (perceived need) and physicians' diagnosis of disease (evaluated need). Residents' perceived need for medical care is operationalized as a latent variable. In focusing on collective behaviour, however, analysis shifts from individuals' perceptions of their needs for medical care to (normative) aggregate expectations of demand in light of population' characteristics (Ellencweig 1991; Joseph and Phillips 1984).

Population and practice-profile expected need for ambulatory medical care is poorly understood because

- of the wide range of problems (and severity) typically seen in primary care settings,
- of the ongoing nature of the physician--patient relationship,
- of the difficulty of delineating care episodes, and
- of the role of substitute/complementary care.

As universally applicable instruments cannot be employed to operationalize need (May 1993; Wilkin *et al.* 1992), proxy measures are used. Important correlates of practice-profile (users and nonusers) expected (comparative) need for ambulatory medical care includes demographic structure, socioeconomic status, and self-reported or other measures (morbidity, mortality) of health.

Measurement of population expected need for ambulatory medical care is a poorly understood idea because of:

- the wide range of problems (and severities) typically seen in primary care settings;
- the ongoing nature of the physician--patient relationship;
- the difficulty of delineating care episodes; and
- the role of substitute/complementary care.

The approach used to measure need for physician services in this thesis drew upon methods developed as part of a larger research programme focussing on needs-based planning of physician services. Results of work using these approaches are just beginning to be published (see Frohlich and Mustard 1996, Mustard and Frohlich 1995, Roos *et al.* 1997, forthcoming and Tataryn *et al.* 1995), but are consistent with an emerging British and Canadian literature that focuses on using comprehensive measures sensitive to variation in populations' differing requirements for health care services. The general approach is outlined below, but a more detailed description is available in Frohlich and Carriere (1997).

Presumably any population will have a basic level of need for physician services. Even individuals who are healthy will need to be seen by a physician occasionally to ensure that they make themselves available for preventive services and for the diagnosis of conditions for which early treatment might be of help. Evans (1988) identified the importance of age and gender differences across areas for influencing the need for physician services. Thus very young children frequently contact physicians, as do the elderly. Other studies have also demonstrated that age, gender, socioeconomic status and health status are important factors in determining need for physician services (Birch *et al.* 1995, 1996; Wisconsin Health Services Research Group 1975).

Population socioeconomic status is also strongly related to the need for ambulatory medical care (Birch *et al.* 1996; Frohlich and Mustard 1996). To account for differences in socioeonomic status, census data were used to develop a Socioeconomic Risk Index (SERI). This index is developed from data at the municipal level, but has been aggregated to both regional (Frohlich and Carriere 1997) and the PSA level (Roos *et al.* 1997, forthcoming). Index components -- the rate of unemployment, the proportion of single female parent families, the percentage of high school graduates, area housing values, and the rate of female participation in the labour force -- were combined into a composite score standardized to the provincial average (Frohlich and Mustard 1995). High scores on the index identify areas whose residents have high unemployment rates, high rates of single female parent families, low housing values, and/or low participation in the labour force by women. Construct validity has been assessed by regression on which the index explained 91% of regional and 60% of municipality variation in premature mortality (i.e., the "gold standard"; see Birch *et al.* 1996, Frohlich and Mustard 1996). The SERI has been shown to be stable over time and it has been applied in research investigating population health status, the use of health services, and in needs-based planning for generalist physicians (Frohlich and Mustard 1996; Mustard *et al.* 1995; Roos *et al.* 1996, 1997, forthcoming).

The influence of age, gender, and SERI was used to estimate PSA level need for physician ambulatory visits using regression analysis of actual 1993-94 visit rates applied to each area's age/gender structure and SERI score (Step 1). This model, consisting of 21 age groups, two genders, and all interactions, essentially describes the Manitoba population's usage of physicians during 1993/94 according to demographic and socioeconomic factors and provides the first estimate of need for ambulatory physician visits for each PSA. The regression analysis estimates the proxy for need based on existing patterns of visit usage -- but these patterns may not be optimal.

Previous research has shown that often those who need medical care do not get enough -- though having poorer health, they receive fewer preventive services and are less likely to receive the recommended number of prenatal care visits (Mustard and Roos 1994). The premature mortality rate in Winnipeg's inner core is 2.8 times higher and hospitalization rates are 55% greater than for residents of more affluent sections of the city, yet the core area population make only 31% more physician visits, suggesting a low contact rate compared with their poorer health status. The mortality rate for individuals aged 0 - 74 has been suggested as the best single indicator of health status capturing the need for health care (Carstairs and Morris 1991; Eyles *et al.* 1993). It is currently used in the British formula for allocating funds from the Department of Health to regional health authorities. It has been shown to be strongly associated with self reported variables and physical measure in the Health and Lifestyle Survey, including self-assessed health, number of symptoms, self reported rheumatism and temporary sickness (Mays *et al.* 1992).

To generate a final estimate of each PSA's comparative need for physician visits, an adjustment was made to the first estimates to account for differences in premature mortality. Therefore, the first estimates of population need for physician ambulatory visits were adjusted in a second regression using the premature mortality rates of each area (Step 2). Areas with residents in poorer health (premature mortality rates exceeding the provincial mean of 3.6 deaths per 1000 residents aged 0 - 74) had their estimated need for physician visits increased, and those populations who seemed healthier than average had their need values reduced.

Therefore, the final estimates of each area's comparative need for physician ambulatory visits accounts for age, gender, socioeconomic status, and health status, and is expressed as the average number of visits needed per resident per year across the province. Estimated values range from 8.9 expected visits per year for residents of Norway House/Cross Lake (an area where residents are at high socioeconomic risk, in poor health, and where children under age three comprise almost 10% of the population) to 2.5 expected annual contacts for residents of Winnipeg South West (an area where lowest socioeconomic risk, in good health, and where neither children nor the elderly comprise high proportions of the population). Variation across rural PSAs was less extensive.

Although the populations of the PSAs are not large (ranging in size from 2,973 to 29,423 residents), special attention was paid to developing stable estimates of relevant parameters. The SERI, in particular, was developed from the 20% of the residents of each municipality (each PSA incorporates several municipalities) required to respond to the census long form and aggregated to the larger PSA level. Also, because mortality rates for small populations can be unstable, the premature mortality rates used in Step 2 were calculated over five years, instead of three years (as for regional rates).

For this thesis, the above two-stage approach was modified to provide quarterly estimates for the patients of physician practices, an even smaller population base. First, for each physician, quarterly patient-profiles were created and categorized into groupings based on age/gender and PSA-of-origin. Using the expected values generated from Step 1 of the PSA level calculations, a mean value of expected number of visits for the patient-profile (i.e., the population of discrete patients seen by the physician during each quarter) was calculated. For Step 2 adjustments, estimates of premature mortality were taken from the PSA in which the study physicians are found. (Error introduced by out-of-area care-seekers is minimal because all rural physicians (even those in influential communities) see mostly in-area patients (i.e., more than 80% across rural settings) and premature mortality does not vary excessively across rural Manitoba.) The resultant estimates of expected need of ambulatory visits are sensitive to both temporal and spatial changes in practice-profile demographic and socioeconomic structure.

This application represents the first extension of the methodology to Manitoba physician-profiles. There are no existing alternatives except age/gender adjustments (see Wall *et al.* 1994) -- an adjustment much less sensitive to important variation in the determinants of populations' need for health care services (Birch *et al.* 1996; Frohlich and Carriere 1997; Hutchinson *et al.* 1997).

The measure of expected need for ambulatory physician visits (EAV) developed for this thesis has a number of advantages over other approaches used as proxy measures to estimate population need. First, it provides an approach that incorporates multiple dimensions previously shown to, and expected to, influence the use of health care services. Second, it has greater explanatory power than demographic or mortality approaches, either alone or in combination (see Birch *et al.* 1996, Carr-Hill 1987, Carstairs and Morris 1989a, 1989b, Frohlich and Carriere 1997, Mays *et al.* 1992) and it recognises the emerging literature on the important role played by social and material deprivation as determinants of health. The underlying philosophy is that individuals with similar characteristics require comparable numbers of ambulatory physician visits no matter where they reside, and that populations in poorer health should use more care than those areas with healthier residents. Third, the approach produces a measure that is easily understood for planning purposes. The resultant best estimate of a population's need for physician contacts is presented as an expected number of visits per resident per year, a rate that can readily be compared with actual numbers of visits per resident per year for the same population. Finally, while the approach was developed for regional analysis of larger populations (Roos *et al.* 1997), it can be applied to a wide range of populations groupings, such as regions, PSAs, municipalities, and physician practice-profiles. This issue is of fundamental importance for studying physician services, where population denominators are often small and can lead to unstable estimates.

REALIZED ACCESS TO AMBULATORY MEDICAL CARE:

Population access to general practitioners is a complex phenomenon reflecting how residents experiencing symptoms or seeking preventive services overcome barriers limiting their use of needed (and beyond) primary medical care. In the context of universal first-dollar health insurance, distance becomes an important consideration -- imposing both time and out-of-pocket costs on care-seekers. Realized accessibility (utilization) is determined by in-area physician-availability and residents' willingness (ability) to seek care from all sources of ambulatory medical care (in-area and beyond). As information describing the complete practice-profile (i.e., users and nonuser) is not available, physician-accessibility reflects that of the PSA in which the physician practices. Population-based measures of physician-accessibility (i.e., all sources of care) include residents' rate of physician-contact, residents' utilization of ambulatory medical care, health care expenditures, and the effective physician-supply seen by residents.

For each PSA during the 1993-94 fiscal year, the residents' rate of contact with physicians (AP/R) is estimated as the ratio of the number of residents making at least one visit to a physician (AP), no matter location, to the number of residents (R). Variation in this measure of physician-accessibility reflects differences across populations in the perceived need for medical care and barriers limiting contact with physicians. Also, for each PSA, the residents' utilization of ambulatory medical care (AV/R) is estimated as the ratio of all ambulatory visits made to all physicians (AV), no matter practice location, to the number of residents (R). This measure of physician-accessibility reflects differences in rates of physician-contact and the subsequent usage of medical visits. Beyond differences in the perceived need for medical care and barriers limiting access, practice-style and financial incentives bearing upon physician behaviour also determine patterns of utilization.

In investigating population utilization of ambulatory medical care, analysts should distinguish between the average number of contacts *per capita* (AV/R), the rate of initial contact within the population (AP/R) and the resulting usage of ambulatory visits by these patients (AV/AP). The following accounting identity relates these concepts,

$$AV/R = AP/R \times AV/AP.$$

As for the practice-profile, initial contact is thought to be determined by the residents while the subsequent utilization of ambulatory medical care (visit-intensity) is held to be mostly influenced by physicians. These values, which were estimated using FY93 data, compare well to regional values calculated for the 1990-91 fiscal year (Tataryn *et al.*

1995). Moreover, as PSA physician-supplies are stable between the 1993-94 and 1994-95 fiscal years in most areas (see Roos *et al.* 1996), variation in realized physician-accessibility cannot be attributed to temporal changes in physician-distribution.

An alternative measure of realized accessibility is the total expenditure *per capita* on all (generalist and specialist) physicians seen by PSA residents through ambulatory visits ($MC/R). Although measuring equity in aggregate resource allocation, important imbalances in the mix of medical care are masked.

While travel distances and poor in-area physician-availability are important constraints, these factors are but part of a broader, complex process determining physician-contact and the subsequent utilization of medical care. Rural areas differ as to the expressed relationship between the expected need for ambulatory medical care, and realized physician-accessibility (medical care utilization). Using this approach, Roos and colleagues (1996) classified PSAs according to population physician visit usage higher than expected need for ambulatory medical care (H), usage in balance with need (B) and usage less than need (L). The advantage offered by using a broader classification scheme is that areas sharing common need--usage relationships can be more meaningfully grouped than planning regions and other more arbitrary schemes. The disadvantage, of course, is that usage is endogenous. However, as the scheme incorporates two policy-relevant measures of ambulatory care delivery -- the need for and the use of physician visits -- this classification is employed to stratify the analysis of observed patterns of medical care usage by high, balanced and low usage groupings to control for between-grouping differences in utilization behaviour.

FAMILY STRUCTURE:

Although its definition is changing, the family is the basic decision-making unit of society. Theoretical and empirical research for rural populations suggests that family structure (number of members, number of dependent children) moderates collective demand for medical care. For example, working mothers with several children are less likely to contact a physician for a single instance, instead, 'group' visits are made when more than one child/adult requires care (Aday 1993; Miners 1981). While the Population Registry could potentially be employed to link family members together into a family unit, the methodology was not sufficiently developed to cluster rural residents into family units for this research.

PHYSICIAN CHARACTERISTICS

Physician attitudes towards practice-style, income and rural practice are co-varying latent variables correlated with measured attributes of physician care-giving behaviour. Following contact, the physician's evaluation of the patient's need for medical care (ambulatory, hospital or specialist) is widely held to be the key determinant of medical care utilization (Aday 1993, Evans 1984). Physician evaluation of the patient's need for medical services is operationalized as a latent variable that is highly correlated with diagnosis (the usual measure). Diagnosis is influenced by the physician's attitudes toward practice-style and income, patient characteristics and symptoms, and the information exchanged during the patient--physician interaction. Due to administrative requirements limiting medical claims to a single diagnosis, this information is limited. Moreover, as diagnostic coding varies across physician and presenting conditions, this information incorporates varying amounts of misclassification error (see Black 1990, Black *et al.* 1992, Shanahan *et al.* 1994). Because payment is not adjusted for patient case-mix/severity, however, reported diagnoses are likely not biased by physician response to financial incentives.

Recent approaches using administrative (diagnosis) data to adjust for differences in physician evaluated need include ambulatory case-mix groupings (Kolb and Clay 1994) and illness scales (Mossey and Roos 1987). Although these approaches offer great promise for controlling for patient-profile physician-evaluated need, ambulatory visit groups have not yet been constructed using Manitoba Health data and the development of the most recent version of the illness scale is incomplete. Moreover, the reporting of only one diagnosis per encounter complicates estimating patient-profile severity when important comorbidities are 'missing;' however, tracking patient history over time may yield insights into the full burden of chronic illness managed by physicians. Therefore, the physician-evaluated need for medical services is currently an omitted variable.

Physician age (AGE) is estimated in years from date-of-birth reported by the registry. Because the month of birth is not specified, calculated age does not vary across the quarters withing the fiscal year. Age-squared (AGESQ) was also included as a main effect to account for nonlinearities in the physician age--activity profile. Male/female gender (SEX) is also derived from the registry. The effect of childbearing/child raising on female physician visit-workload was operationalized as the interaction of female gender and age 40 years or less (FCBY).

While place of undergraduate medical training is noted in some detail, we distinguish between Manitoba, other Canadian and international medical graduates (respectively, MMG, CMG, IMG). No information is reported on the completion of specialized training, membership in the Canadian College of Family Medicine, or any additional training in surgery, obstetrics, anaesthesia, etc. enabling practitioners to engage in more "specialized practice. Although date of medical school graduation measures career experience, it is highly correlated with AGE and, so, was not used (Wall *et al.* 1994).

PRACTICE CHARACTERISTICS

Important attributes of practice include payment-modality and organization that, in combination, define practice-modality. Using codes contained in the physician registry, we define practice-modality in each quarter as: fee-for-service solo practice (FFSS), fee-for-service group practice (FFSG), salaried solo practice (SS), salaried community health centre practice (SCHC). Although the payment and practice variables are included in the MPRDS, practice-modality is the key variable distinguishing between physician groupings. For organized practice, the number of group/community health centre members is estimated quarterly as the count of active physicians having the same identifier. (Note: While SS physicians are identified, as they are emergency room physicians in the larger rural hospitals, they are included in physician-supply but excluded from the analysis of individual physicians.) For physicians in organized practice, the number of member physicians is counted quarterly (PRACTICE-SIZE). Although not estimated, the mean within-practice visit-intensity may be important for distinguishing between within-cluster and between-cluster effects (i.e., over time, the members converge).

Over the duration of their careers in rural Manitoba, some physicians practice in several remote, rural, and/or urban sites. In one or more episodes of rural experience, practitioners change location and/or practice-modality. Change of practice-modality is noted when either a change in payment and/or organization occurs. Length (time) of practice in Manitoba (LOM), rural settings (LOR) and practice-modalities (LOP) are respectively estimated from knowledge of the date

- that the base identifier was assigned,
- that the current bloc (billing) number was assigned, and
- that physicians move and entered their present payment-modality and practice-organization.

The time (in quarters) between the date of base identifier assignment and a quarter estimates the full practice-duration in Manitoba. For physicians in practice before Medicare (1971 in Manitoba), the date of payment-modality is used to estimate Manitoba practice-duration. Similarly, length of rural practice is calculated as the time difference (in quarters) between the date that the base identifier was issued, or when a more recent change in bloc (billing number series) occurred (physician moving from a Winnipeg to a non-Winnipeg setting), and a quarter. Finally, from monitoring the date(s) of changes in payment-modality and/or group organization, length of practice-modality is computed as the difference between the date of the most recent configuration and the quarter of interest. Estimated Manitoba rural and practice-modality time-durations do not distinguish between active and inactive periods.

The physician's career is bounded by practice initiation, termination and a possible move to another rural setting (this, continuing the cycle). Moreover, within the context of practice in a given PSA, a physician may change practice payment and/or organization. Quarters in which these events occur (during or at the end of) are operationalized as categorical (yes/no) variables. The start of rural practice (START) is noted by the initiation of medical claims and verified against the physician registry. For new physicians, the base identifier date should correspond to the start of billings while, for physicians moving from Winnipeg, the date of change of bloc should agree. Similarly, the end of rural practice (STOP) is also denoted by the termination of billings (for two contiguous quarters or more). Physicians moving to other rural areas (MR) are distinguished from those moving to urban sites (MU). Finally, changes in payment-modality (CPM) and practice-organization (CPO) are calculated from the reported dates. To simplify analysis, quarters in which one or more of the above changes occur are denoted by the variable 'CGN'. Because the effects of the physician preparing to end practice may lead the termination by some time, the last two quarters (including the period of change) are denoted by the variable 'END'. Whereas the reported dates of these events are accurate, 'END' cannot be estimated if a practice ends within six months after April 30, 1995. These variables denote quarters in which physician performance may be lesser or greater than expected for an 'established' practitioner. To enhance comparison, both across PSAs and physicians, these atypical periods can be eliminated from analysis.

Because use of time is not known, the time devoted by physicians to direct patient care is imputed as full-time equivalence (FTE) status estimated using the Health Canada (national) methodology (see Roos *et al.* 1996). This methodology differentiates active from inactive physicians based on at least one medical claim being made in each quarter and then classifies these active physicians into three groupings by workload ranking: those falling below the 40th percentile, those falling between the 40th and 60th percentiles, and those falling above the 60th percentile. The FTE status of individual physicians is

- set equal to 1 for physicians whose annual billings fall within the benchmarks,
- assigned a fractional value calculated as the ratio of his/her billings to that of the lower benchmark workload for physicians whose billings are less than the 40th percentile or
- calculated as 1.00 plus the logarithm of the ratio of his/her payment to the upper benchmark for physicians whose billings exceed the 60th percentile.

Because this variable consists of three distinct phases with two break points (i.e., the benchmarks), it is considered trichotomous rather than continuous.

Some revision to the national methodology was done to adapt to the characteristics of rural practice and to distinguish time effects. First, estimation proceeds quarterly in order not to exclude physicians practising for at least one quarter but not present in all four. Second, rather than anchoring the benchmarks using historic 1985-86 values adjusted for fee increases, they are calculated separately for each quarter. In essence, the benchmarks for physician practice are estimated quarterly from the prevailing norms.

Hurley and colleagues (1996) and Woodward and Hurley (1995) developed a rule distinguishing between part-time and full-time physicians by comparing self-reported practice status from the CMA survey to Ontario claims. They found that billings less than 40% of the median best classified physicians as part-time (PART-TIME). Hurley and colleagues (1996) also identified physicians ranking in the top 10% (90th percentile) of billings (TOP 10%). These categories could be used alone or in combination with estimated FTE status to distinguish relevant groupings of physicians as for these behaviours.

HEALTH-CARE SYSTEM

Physician-supply -- the traditional physician-to-population ratio -- is employed to estimate both physician-availability and physician-competition. While policy-makers are concerned about the numbers and distribution of physicians across rural areas, local physician-availability is a key concern of area residents and physicians. To rural residents, the local (in-area) availability of physicians facilitates access to medical care (especially for emergency care) and ensures the continued use of the community hospital. To rural physicians, however, physician-supply is a measure of the competition over area patients. For low competition, physicians may have to see more patients than they prefer; for high competition, physicians may have problems securing sufficient numbers of patients to maintain clinical skills and to generate desired income.

Quarterly physician-supply, the traditional measure of physician-availability, is estimated as the ratio of in-area FTE physicians to the number of residents (FTE/000). This thesis calculates quarterly "physician-availability" (IAFTE/000) as physician-supply, but with the numerator reduced by the proportion of visits to in-area physicians made by out-of-area patients. This adjustment is particularly important for influential areas seeing many patients from adjacent (and beyond) rural areas. Quarterly "physician-competition" (IAFTE/E000) is measured as physician-supply, but with the denominator adjusted for the net-population served -- that is, the proportion of the area population seen by in-area physicians plus the number of out-of-area residents also seeing these providers. The number of out-of-area residents was estimated based on the distribution of patient care-seeking -- for example, if 5% of the patients of an adjoining area sought care from another area's physicians, then 5% of the population was also assumed to seek care there. While numbers of FTE physicians were calculated quarterly, counts of populations were from the 1993-94 fiscal year.

The in-area physician-supply available to meet population medical care needs (IAFTE/000) is determined by the components

- the ratio of the number of in-area practitioners to the population served (#/000), (the traditional measure of physician-supply),
- the average in-area physician FTE workload (FTE/#), and
- the proportion of the physician-workload allocated to in-area residents (IAFTE/FTE).

The accounting identity,

$$\text{IAFTE/000} = \text{\#/000} \times \text{FTE/\#} \times \text{IAFTE/FTE},$$

provides insights into the relationship between physician-competition and its components.

Physician-competition typically estimated as the ratio of the in-area physician head count to the number of residents (#/000) is biased by numerator and denominator effects (see Contandriopoulos and Fournier 1988). First, while most physicians achieve full-time equivalent status, their average total-workload (FTE/#) varies, with some providing only limited amounts of care to those rendering amounts of care "equivalent" to 1.5 (or more) providers. As for estimating physician-availability, unless head count closely approximates activity, the estimated ratio is in error and may be biased. Second, the consumers of the physician output may not correspond to the in-area population (000/E000). This is especially critical for influential areas that, by definition, provide substantial amounts of care to out-of-area patients. Moreover, for certain areas, physicians from certain influential communities, staff clinics in adjacent rural areas, thereby augmenting (or providing) the local supply (e.g., C1 staffed by CM, C5 staffed by CP, P2 staffed by PS). The accounting identity,

FTE/E000 = #/000 x FTE/# x 000/E000,

highlights relationships between physician-competition and its components.

Important dimensions of PSA physician-supply relating physician practice-duration to the number of staffed-positions include practice-turnover (changes/position), physician-retention (months/physician), and practice coverage-gaps (months/change). For physicians in practice for at least three contiguous months (usually, but not necessarily corresponding to a quarter), the number of staffed-positions is estimated as the quotient of the total months of practice-duration divided by the corresponding number of physicians, rounded to the nearest integer. While these variables are estimated for the full in-area physician-supply, they can also be calculated for FFSS, FFSG and SCHC physicians, where applicable.

Physician-turnover within the PSA physician-supply is estimated as the mean number of changes per position per fiscal year. Changes occur when physicians initiate, terminate, or relocate their practices. For absences greater than six months in duration, turnover is deemed to occur even when the same physician returns to staff the position. To account for turnover spanning year-end, termination and the subsequent initiation is each assigned a value of 0.5 -- that is, these two activities constitute one full event (1 = 0.5 + 0.5), but unknown bias derived from (arbitrarily) assigning turnover to one year is avoided. While the full four-year study period was used to calculate stable estimates of turnover, retention, and coverage-gaps, these figures were divided by four (the number of fiscal years) to calculate an average annual rate.

Physician-retention in each physician service area is estimated as the mean of the practice-durations of the in-area physicians over the study period, divided by the four years to calculate a "representative" annual value. As this calculation excludes both short-term and longer periods of physician inactivity, physician-retention is over estimated when *locum tenens* cannot be identified by their billing number. Physician length of rural practice (LOR, see above) provides an alternative estimate of physician-retention.

Finally, the average practice coverage-gaps for each PSA is estimated as the difference between the numbers of staffed and filled positions divided by the number of staffed-positions. To increase accuracy, monthly differences were summed over the full four years of the study. These standardized differences are then divided by four years to calculate a "representative" annual value.

HOSPITAL INPATIENT BED-SUPPLY

The hospital inpatient bed-supply is estimated from active bed counts made by Shanahan and colleagues (1993) for the FY92. In assuming that physicians exclusively use local resources, hospital-beds are assigned to the PSAs in which the hospitals are found. The corresponding bed availability to these physicians (BEDS/FTE) is estimated quarterly as the ratio of the in-area bed-count to the number of FTE physicians. The supply of staffed-beds was stable throughout the study, but their availability to physicians varied with the quarterly physician-supply

HEALTH-CARE SYSTEM POLICY ENVIRONMENT

For fee-for-service physicians, changes in fee-schedule tariffs paid for all ambulatory and consultative and for inpatient visits were tracked over the study time duration. While fee-schedule tariffs vary with the politics of fee-schedule negotiation, including the contracts between the Manitoba Medical Association and Manitoba Health for the 1993-94 and 1994-95 fiscal years reducing the reimbursement paid to physicians for many services, including office visits. Following Hurley and colleagues (1996), a fee index was calculated to capture these effects for ambulatory-visits (AVFEE), consultation (CVFEE) and inpatient-visits (IVFEE). Moreover, to compensate for lower than expected savings, a 3.5% claw-back was imposed on all billings for the first six months of 1995 to achieve the contracted expenditure reduction. As this period overlapped with the study, the fourth quarter (January to March) of the 1994-95 fiscal year was identified by the variable, FFSCB. For salaried physicians, an index

(SALPYMT) was calculated to express changes in the payments made to these practitioners arising from inflation (deflation).

Policies likely affecting the aggregate physician-supply during the study include licensure changes by the Manitoba College of Physicians and Surgeons affecting both the entry of IMGs and MMGs into practice. The one-time one-year delay on the Class of 1994's entry into practice would constrain the physician-supply only in the 1994-95 fiscal year, while the restrictions limiting IMG recruitment would extend into the future years. For this study, however, both effects are concurrent throughout FY94 and are identified as the categorical variable, MCP&S.

The consumer price index (CPI), estimated quarterly by Statistics Canada, estimates changes in the cost of living in Manitoba (see Grant 1992). Although the Manitoba CPI does not specifically report the experiences of rural residents (nor those residing within specific physician service areas), it does show the overall magnitude and direction of changes in the cost-of-living that may affect physicians' care-giving behaviours. The CPI can be used to deflate reported billings to a base year (i.e., "constant" versus "real" dollars) to enhance the fairness of comparison of physicians over time and between-modalities, to determine if physicians are gaining over inflation (see Evans *et al.* 1986).

TIME

While the definitions of utilization, patient-profile and physician-practice employed here all use the quarter as the dimension of time (QUARTER), other important measures include the season, fiscal-year and calendar year. For quarterly effects, time is recorded as 1 for the first quarter (April to June 1991) and 16 for the last quarter (January to March 1995). For seasonal effects, time was measured as spring (April to June), summer (July to September), fall (October to December) and winter (January to March). For annual effects, time is operationalized as FY91 (April 1, 1991 to March 31, 1992), FY92 (April 1 1992 to March 31, 1993), FY93 (April 1, 1993 to March 31, 1994) and FY94 (April 1, 1994 to March 31, 1995). Finally, calendar year and quarter are combined to calculate an increasing measure of time starting at 1991.25 (the second quarter of 1991, April to June), 1991.50 (the third quarter of 1991, July to August), 1991.75 (the fourth and final quarter of 1991, September to December 1991), 1992.00 (the first quarter of 1992, January to March) and finishing at 1995.25 (the first quarter of 1995, January to March 1995).

3.3 ADVANTAGES AND LIMITATIONS OF THE DATA SET

The major advantage of using administrative files/registries for health services research is the linkage of data simultaneously compiled on encounters, physicians, patients, and settings. In contrast, survey research typically focuses on physicians, patients (residents) or settings, but rarely reports on all three. For example, a study using data from the American Medical Association's Periodic Survey of Physicians to investigate the effects of practice-modality (payment and organization) on physician performance could not adjust for differences in patient characteristics (Wolinsky and Marder 1985). Similarly, while the Canadian Medical Association databank contains detailed self-reported data on physician/practice characteristics, no data is available on the patients seen by the respondents nor about the service mix/volume rendered. To the extent that the determinants of physician-contact and medical care usage vary systematically across the unit of analysis (physician, physician-supply), the internal validity of the study findings is weakened. Other advantages offered by secondary data include:

- bringing system and population perspectives to data analysis;
- the large number of physicians (active and nonactive) and residents (users/nonusers);
- observation both over time (up to 20 years) and cross-sectional comparisons;
- data reported on most encounters with the health-care system;
- reported data not affected by possible subject recall bias;
- little unexplained physician and resident loss to follow-up;
- the unobtrusive nature of data collection not disturbing the system observed;
- multiple comparisons testing hypotheses across several sub-groupings; and
- design flexibility (Black *et al.* 1992, Roos *et al.* 1990).

Major limitations on the use of administrative data arise from the design of the underlying information. In providing information to administrators on

- the residents eligible to receive care,
- the physicians credentialed to provide care, and
- the services rendered and how much they cost,

the data collected is limited, both in content and in structure (Black *et al.* 1992, Roos *et al.* 1990). Moreover, the effect of the administrative process on the service mix, volume and billings reported by physicians should be considered. Finally, analysts deciding among alternative operationalizations of variables must balance tradeoffs between the accuracy gained and the computational effort required. Although congruence between administrative data and theoretical constructs is not assured because "[w]e are looking in a dark room for a black cat that left before we got there" (Robinson 1960, p 275), conceptual models, appropriate analytic techniques, and the wealth of measured attributes correlated with consumer and provider decision-making behaviours can compensate for these data limitations (Johnston 1992).

Four issues confront researchers using administrative data to investigate physician performance. First, can important spatial and time effects in the data be distinguished? Second, is medical services utilization a valid measure of primary physician performance, population accessibility to medical care and/or other outcomes of concern to policy-makers (construct validity)? Third, can comprehensive sets of variables be constructed to represent conceptually causal (inter)relationships between utilization and its determinants (internal validity)? Finally, will these findings generalize to other settings (external validity)?

Unlike survey inquiry where the sampling framework is constructed and the key variables operationalized specifically for the questions addressed, research using secondary data is constrained by what is routinely collected. The effects of missing and omitted variables are discussed in the following sections. Linkages to survey and clinical data sets further strengthen health services research. For example, Black (1990) linked the Manitoba Health administrative data and the Manitoba Longitudinal Survey on Aging to operationalize key constructs of the primary care. Following the examples of Saskatchewan (Buske *et al.* 1994) and Ontario (Hurley *et al.* 1996) linkage of medical claims and the Canadian Medical Association data bank provides additional variables (e.g., the time devoted to direct patient care) for the subset of physicians included in both data sets.

SPATIAL AND TIME EFFECTS

Approaches used by medical geographers and other health services' researchers to construct service delivery areas include the patient origin, geopolitical, and geographic distance method (Simpson *et al.* 1994). For the purposes of *describing* ambulatory medical care utilization and for *investigating* the determinants of small area variation when residents choose their providers and physicians select their practice locations, the patient origin method offers the advantage of reflecting actual patterns of usage (Simpson *et al.* 1994; Wennberg and Gittelsohn 1982). For care-giving, rural residents were assumed to obtain medical care from either in-area sources *or* from rural/urbal influential communities. For care-giving, rural physicians were assumed to provide medical care to in-area residents *and*, for influential communities, to care-seekers from rural settings. The "optimal" configuration defining rural areas should minimize how much care is obtained from, or provided to, other *rural* areas.

Although the widely used plurality rule (i.e., where the majority of residents obtain care) provides a simpler approach for defining small areas (mainly for hospitals, but also for primary care; see Wennberg and Gittelsohn 1980) estimates of medical care availability and physician-competition are typically inaccurate when high proportions of residents contact outside providers and/or when practitioners render large amounts of care to outside patients (Morrisey 1991). This criticism particularly pertains to rural Manitoba where residents travel widely to obtain medical care (Contandriopoulos and

Fournier 1986; Horne 1987; Michael Loyd & Associates 1993; Wall and Bogdanovic 1994). While the plurality rule improved upon the Zajac (1991) areas, misclassification error was further reduced to less than 10% for patterns of care-seeking and care-giving by examining alternative groupings of rural municipalities (see Wall and Bogdanovic 1994).

All other things being equal, a physician in practice for less than (say) one year because of turnover and/or periods of inactivity cannot achieve workloads comparable to colleagues remaining in place for the full period. Because turnover typically does not coincide with fiscal year-end/start, the timing of practice initiation/termination/absences has severe implications for the calculation of physician-supply, individual physician workload, patient visit-counts, service-counts, and the calculation of ratio variables (e.g., visit-intensity). Workload and other analyses would greatly benefit from distinguishing between time and intensity effects. For example, differences in full-time equivalent (FTE) counts of physician-supply estimated on a quarterly and annual basis increasingly differ with greater turnover because the contribution of physicians not present for the full year are underestimated -- that is, a full-time physician practising for (say) six months would be credited as a 1.0 FTE for the two quarters present but only as a 0.5 FTE for the year.

From changes in physician sources of patients observed in the medical claims, we detected physician practice moves -- both for temporary periods spent staffing clinics in adjoining (under serviced) areas and permanent moves to other rural, urban or out-of-province sites. Although arbitrary, the 'quarter' rule criterion strikes a balance in excluding physicians providing only temporary coverage while including permanent practitioners intending to practice in rural Manitoba but exiting because of violating the terms of entry under Ministerial Waiver (for some IMGs) or from dissatisfaction with rural practice (overall, or the current site, in particular). Although at most, two months of data are lost by excluding incomplete quarters, this loss is small and usually occurs at the start and/or the end of practice (i.e., atypical periods of physician-activity).

In summary, a spatial and temporal framework was successfully developed for the analysis of administrative data specifically to inform policy-making on physician resource management. Compared to research data sets used elsewhere, "background" noise is substantially reduced by carefully tracking physician movement across areas and over time. Not only does the framework distinguish between active/inactive periods and permanent/temporary physicians, it accurately matches physicians to prevailing practice and health-care system conditions presumedly influencing their behaviour. These features are essential to the success of research investigating the determinants of rural patterns of medical care utilization.

UTILIZATION

Utilization -- the mix and volume of medical services rendered by physicians and consumed by patients -- is derived from the interaction of residents' care-seeking and physicians' care-providing behaviours, both modified by health-care system constraints and incentives. Beyond income considerations, physicians' recommendations for care are also influenced by their evaluation of patient needs, knowledge of alternative treatments, access to technology, malpractice concerns, opportunity costs, and the availability of supporting health care resources. Patient care-seeking and compliance with the recommended care reflect perceptions of therapeutic efficacy, perceived health status, and the costs of physician access. Research using utilization data to investigate the determinants of physician performance, however, must adequately account for these complex, dynamic behaviours (see Battista 1986, Contandriopoulos *et al.* 1987, Deliege 1988; Labelle *et al.* 1990). The Manitoba Physician Resource Data Set (MPRDS) addresses these issues by

- focusing on ambulatory visits, the core aspect of physician performance, and
- distinguishing between patient-initiated contacts and the resulting, mostly physician-determined utilization of ambulatory medical care.

In focusing on the analysis of ambulatory visits, the substantial heterogeneity typically characterizing rural primary practice is reduced. Moreover, by including all ambulatory contacts, no matter what setting (physicians' office, outpatient clinics, emergency room, patients' residence), the wide spectrum of ambulatory patient--physician visit relationships are captured. Ambulatory medical care utilization, both as an indicator of residents' physician-accessibility and as a measure of physicians' visit-workloads, is clearly policy-relevant. As ambulatory visits comprise 66% of rural physicians' billings, focusing on this single measure of physician-activity provides important insights into patterns of rural medical care. Distinguishing between consultative and non consultative visits identifies the source of patients. Finally, in linking together all ambulatory, inpatient (medical) and referral visits, researchers can assess differences in physicians use of these alternative options available to them for treating ambulatory patients.

While substantially reducing the problem of combining the diverse mix of service into a single measure summarizing performance (physician-acativity or physician-accessibility), analysis comparing individual physicians should adjust for the distribution of physician time between ambulatory and non ambulatory activities. For this study, the proportion of billings for ambulatory and non ambulatory care are employed to (crudely) account for this time distribution. Also, some between-physician variation remains from differences in the provision of visits, consultations. and the mix of regional/full assessments. Although the MPRDS provides a framework for investigating the utilization of ambulatory medical care, missing or incomplete data (e.g., diagnostic/therapeutic services provided by hospitals, prescribed drugs) may limit research applications.

Besides providing a framework for identifying physician change in practice, denoting inactive periods and discriminating permanent physicians from those providing only temporary (short-term coverage), the physician-quarter unit-of-analysis provides a convenient approach for distinguishing between initial and subsequent contacts. Although methodologically inferior to approaches grounded in episodes of care, the limited explanatory power gained by the episode approach is at the expense of extensive computation. Using rules based on the type of disease diagnosed (acute, chronic, pregnancy), the perseverance of the diagnosis over successive contacts, and the time elapsed between contacts, Stoddart and Barer (1981) estimated patient demand for episodes of care using medical chart data from a single British Columbia salaried primary care practice. While the model estimating the demand for episodes of ambulatory care was statistically significant, little additional explanatory power was gained over models based on the usual measures of utilization ($R^2 = 0.11$ for episodes compared to 0.074 for contacts and 0.044 for "dummy" billings). More recently, population-based analysis used linked administrative and survey data to investigate the utilization of ambulatory medical care by elderly Manitobans found no advantage in replacing the usual measure, total-visits, with episodes of medical care (Black 1990). While this finding may reflect the limitations of administrative data, the conceptualization of primary care, and/or in the ability of clustering algorithms to distinguish among episodes, consistently high level of patient-contact suggests that patient initiation of specific episodes may be difficult to distinguish from ongoing contacts for chronic and acute conditions.

Although financial considerations motivate fee-for-service physicians to report patient-contacts accurately and the services rendered, salaried practitioners were also found to report their provision of medical care accurately (see Roos *et al.* 1996). Compared with fee-for-service physicians, who are motivated to render billable services, the workloads of salaried practitioners may be underestimated by the greater use of telephone-contacts to follow-up patients (Edwards 1991). To the extent that the substitution of telephone-contacts for office visits is cost-effective and differs systematically by payment-modality, comparison of fee-for-service and salaried physicians is biased by this missing data.

While patient-load, visit-intensity and billing-intensity are meaningful constructs of key components of physician visit-workload, the interpretation of patient contact-frequency is more ambiguous. Patient contact-frequency measures patterns of discrete episodes of care (contact plus related visits) occurring over the fiscal year. Contact-frequency is estimated as the number of quarters (episodes) in which a patient contacts the same physician. For the physician patient-profile, average contact-frequency is estimated as the ratio of the number of quarters in which distinct patients' contact the physician to the number of discrete patients seen over the fiscal year (four quarters). This approach assumes that within the quarter, all patient visits are for the same problem. Patterns of contact-frequency reflect patients' attitudes and physicians' preferences for monitoring patients. Misclassification error occurs if episodes initiated in one quarter continue into the following period. Moreover, patient-profile contact-frequency is biased when physicians are not present for the full fiscal year. For patients whose series of contacts are incomplete, contact-frequency is underestimated.

EXPLANATORY VARIABLES

Using Manitoba Health and other secondary data, a rich set of variables on key micro, meso, and macro relationships was operationalized. Most meso-level variables were estimated quarterly, while maro-level ones were calculated for the 1993-94 fiscal year. The following sections discuss the advantages and limitations of this set of practice-profile (patient-profile), physician, practice and physician-supply variables for research investigating dimensions of physician performance.

CONSUMERS:

Ideally, researchers would have data on the full *practice-profiles* (patients and current nonusers) managed by physicians. Because Manitobans are not rostered to specific primary physicians, however, administrative information systems can only report data on the patient-profiles seen by physicians. As most residents eventually contact a physician, however, the practice-profile could be estimated by noting all individuals contacting a physician over time. Alternatively, as employed here, analysis focuses on the known patient-profile (current users) and assumes no difference for current nonusers. While the former approach enables analysts to estimate differences in practice-profile accessibility and to calculate the need for ambulatory care better, it requires substantial computation effort and the assumption of stable practice membership. As 80% of Manitobans contact a physician annually compared with 90% within two years, the marginal gain in accuracy was not deemed worth the additional data processing costs. The patient-profile is a representative sample of the full practice membership (i.e., current users and nonusers).

In moving from awareness of illness to patient status, the consumer's decision-making process encompasses a host of factors ranging from attitudes towards the underlying health risks to the response to symptoms motivating physician contact and deciding which practitioner to see. These behaviours, collectively operationalized by the latent variable perceived need, are not easily estimated from any primary or secondary data set. However, using Manitoba Health and Statistics Canada data, the comparative need for ambulatory medical care and its accessibility to rural residents was estimated.

Techniques used to estimate practice-profile need for ambulatory care range from an aggregation of individuals' self-reported health, to epidemiological identification of small area variation in ambulatory-sensitive (sentinel) events, to goal setting by professionals (Starfield 1992). While the mortality rate for individuals between 0-74 years of age is suggested as the best single indicator of population need for health care (Carstairs and Morris 1991; Eyles *et al.* 1991) and it has been strongly correlated to other measures of perceived/evaluated health (see Mays *et al.* 1992), premature mortality is thought to reflect the effects of underlying morbidity only for conditions generating major service usage and for which substantial variation in prevalence occurs (i.e., severely debilitating chronic and/or permanent sickness; see Eyles *et al.* 1991). Moreover, in extrapolating these population estimates down to the level of patient-profiles, the effects of ecologic bias should be considered. Standardized rates of utilization are incomplete measures of need (i.e., only reflecting demographic factors) that are likely unstable when estimated for practice-profiles.

As self-selection influences how physicians and their practice-profiles come together, the health status of these sub populations varies around the values estimated for the small areas. For example, female physicians may see greater proportions of female patients, older practitioners may manage a generally older practice-profile, and providers in influential communities also typically see out-of-area patients.

The high correlation between socioeconomic status and population health (see Aday 1993, Clarke 1992, Dutton 1986, Grant 1988, Manga 1987, Patrick and Erickson 1992, Ujimoto 1988) suggests an alternative technique for operationalizing patient-profile need for ambulatory care. Socioeconomic factors should be useful estimates of the health status of the small numbers of patients and the less severe morbidity typically seen by general practitioners in ambulatory care settings.

Although the need for medical care differs between consumers (perceived) and providers (evaluated), administrative data alone cannot easily operationalize these concepts. Population and practice-profile need for ambulatory medical care is estimated as the number of expected ambulatory physician visits. This comparative measure combines important demographic, health, and socioeconomic correlates of ambulatory medical care usage to estimate a standard against which population and practice-profile patterns of utilization can be compared (see Chapter 2). Given the historic focus of Canadian policy-making on equity and, more recently, its concern with reducing variation in utilization, this measure is appropriate for research on both population realized accessibility and physician performance.

All calculations of the quarterly patient-profile need for, and the usage of, ambulatory medical care are both temporally and spatially matched -- that is, accounting for physician movement and variation over time in the mix/volume of patients presenting for care. Estimated need is determined by the characteristics of individual patient-profiles while expressing important demographic, socioeconomic, and health status characteristics of the overlying population. Whereas the SERI weights reflect patterns of usage only for the 1993-94 fiscal year, because socioeconomic conditions and physician-supply are markedly stable during the study, little error was expected in estimated values over time. This assumption was verified by comparing indices estimated using the 1986 and 1991 census data (correlation r = 0.95 at the PSA level; see Roos *et al.* 1996). Estimation not accounting for time trends between 1986 and 1991 underestimated need in only three rural PSAs: C5, E8, W9 -- areas containing high proportions of status Indians. While the rate of utilization of ambulatory visits increased among the fee-for-service physicians (but not for the salaried practitioners), this change likely reflects physician response to fee reductions more than any increase in population need for medical care (see Roos *et al.* 1996).

Physical distance from sources of medical care is thought to limit rural residents' access to physicians and, therefore, to influence patterns of ambulatory medical care usage by affecting practice-profiles' rates of physician-contact, patients' contact-frequency (number of episodes) over the year, and the utilization of visits within these episodes. Overall population (and, so, practice-profile) access to physicians is crudely operationalized as the physician service area usage--need classification (PSA-type). Although this crude categorization reflects several factors bearing upon relationships between the usage of, and the expected need for, ambulatory physician visits, this partitioning of rural Manitoba into essentially homogenous physician service areas (markets) emphasizes important between-PSA differences. Population values are reasonable estimates of practice-profiles' experiences since 80% or more of the patients are drawn from within these areas.

Physician-commonality -- the phenomenon of patients simultaneously seeing several physicians -- arises from both demand and supply behaviours and can only be fully appreciated by tracking patients' contacts with physicians over time. Patients may contact more than one physician for a variety of reasons: convenience, history, to obtain a second opinion, dissatisfaction or during periods of physician-turnover. Physicians may "share" patients with their colleagues because of formal and informal practice-coverage arrangement, while fee-for-service practitioners may do so to increase the effective numbers of patients seen for income considerations. Physician-commonality is crudely operationalized as the populations' proportion of out-of-area care-seeking. Areas with higher out-of-area care-seeking suggest a greater likelihood of physician-commonality (for whatever reason) occurring. Overall, while this measure reflects important between-area differences in consumer care-seeking, it is at best a crude approximation.

PHYSICIAN AND PRACTICE:

Physician behaviour reflects underlying concepts operationalized as three co-varying latent variables: attitudes towards practice-style, income, and rural practice. Although these attitudes are not measured, the usual physician and practice correlates are estimated as well as several additional factors suggested by the conceptual model. Place and date of medical school graduation specifies shared knowledge (and professionalization) among the members of a physician cohort. Physician gender consistently predicts important within-cohort differences.

Variables measuring physician response to diagnostic uncertainty are omitted because of computation issues. To the extent that these variables measure invariant (personal) attributes, omitting them reduces our analytical ability to explain variation across physicians -- that is, analysis could have further reduced the amount of unexplained error. Moreover, if physicians who are more aggressive (conservative) in the face of diagnostic uncertainty self-select into fee-for-service (salaried) and/or solo (organized) practice, then analysis focusing on practice-modality is confounded. While physician-evaluated patient need is operationalized as a latent variable, estimating case-mix would aid analysts to distinguish better between physician and patient evaluated need. With increasing uncertainty, aggressive (conservative) physicians may diagnose (i.e., label their patients) a more (or less) serious disease at the onset of treatment. Although subsequent testing may refine patient classification, this initial diagnosis has important implications for both physician and patient behaviours during treatment. While the omission of these variables reduces our ability to distinguish among competing explanations, to the extent that these factors are highly correlated, little additional information is gained.

Starting from a shared experience defined by common age, gender, and place of graduation characteristics, variation develops within these cohorts over time from differences in the members' career and life experiences. Important measure of time-dependent factors bearing upon physicians' careers include cumulative rural experience and the time spent in the current practice and the time spent in the most recent practice-modality. In assuming that physicians are affected by their career experience, but adapt to the prevailing conditions of practice, these variables account for important within-cohort differences associated by career experience.

Missing correlates of physician behaviour include:

- registration with the College of Family Physicians denoting family medicine training;
- advanced training in surgery, obstetrics, and other areas relevant to rural practice; and
- entry into rural Manitoba practice through "Ministerial Waiver".

Important dimensions of practice-modality (payment, organization, and number of members) are accurately estimated quarterly. The time devoted by physicians to direct patient care, however, is unknown (see Wall *et al.* 1994). Full-time equivalent

(FTE) status (less than, equal to, greater than) is defined quarterly. Although a useful 'global' explanatory variable, because time is not measured, physician productivity in the use of this scarce resource (input) and the quality of care rendered (time per patient contact) cannot be calculated. Also, physician-accessibility through extended office hours is unknown while, off-hours coverage and emergency room coverage is not estimated. To the extent that these factors are characteristic of practice-modality, analysis is not confounded from grouping them into a single variable.

Although a Saskatchewan study comparing FTE status estimated from claims data found only a weak correlation with physicians' self-reported time (Buske *et al.* 1994), this finding may arise from poor adjustment for practice-duration (months in active practice) and/or unexplained variation arising from differences in service intensity/mix. Moreover, as physician workload varies seasonally and the perception of full-time status evolves over time, the benchmarks were calculated for each quarter to reflect these sources of variation. How a physician compares with his or her peers as to perceived FTE status (i.e., time devoted to practice) should change consistently over time in step with the views of one's colleagues. Any error from using these 'flexible' benchmarks is limited by their stability (comparability) over the study period.

Physician/patient commonality is a complex phenomenon that can be only fully appreciated by tracking patients' contact with physicians over time. In assuming that rural providers in organized settings (groups, community health centres) practice independently, physician commonality (patient-sharing) occurs naturally during physician turnover, informally through off-hours coverage, emergency room staffing and periods of temporary absence (i.e., not greater than three contiguous months) and formally through referrals made to "specialists" (in-area and beyond). For this research, physicians in regular practice are assumed to manage a core patient-profile and to share some patients through formal/informal arrangements governing off-hours, emergency room, and vacation coverage. Physician motivated commonality is denoted by referrals made to general practitioners identified from the medical claims. Although some referrals are made to generalists with advanced training, income considerations may be important considerations (Evans *et al.* 1987; Roch *et al.* 1985). The increasing proportion of out-of-area care-seeking suggests a greater likelihood of physician commonality, but it is also possible that the population is partitioned into residents mostly seeing in-area physicians and those managed by outside providers. While these measures likely reflect important between-area differences in the consumer/provider behaviours underlying physician commonality, they are at best crude approximations.

HEALTH-CARE SYSTEM:

Both physician-supply and the hospital bed-supply were estimated quarterly to reflect changes in physician stock over time accurately. Physician-availability faced by PSA residents is distinguished from physician-competition encountered by in-area practitioners. Physician-turnover, physician-retention, and practice coverage-gaps are calculated for the full study period to estimate more representative (stable) values, both for the aggregate PSA physician-supply and by practice-modality. Finally, changes in the fee-schedule, salaries, and the overall cost-of-living also bearing upon physician performance were estimated using appropriate indices.

TIME:

As a variable, time is estimated as ordinal (year, quarter) and nominal (year, quarter) values.

4.0 DESCRIPTIVE ANALYSIS OF MACRO-LEVEL PATTERNS OF AMBULATORY MEDICAL CARE UTILIZATION

Chapter 4 describes macro-level patterns of ambulatory visit utilization occurring across rural Manitoba physician service areas (PSAs). In recognition of the role of the patient--physician interaction in generating observed medical care utilization, these patterns of ambulatory physician visits are investigated from the perspectives of both the population and the physician-supply. A critical step in the development of the Manitoba Physician Resource Data Set was the specification of rules defining the construction of the PSAs. Section 4.1 discusses the success of the match between patterns of utilization from the perspectives of both the population and the physician-supply. Moreover, important patterns of care-seeking/care-giving are identified. Section 4.2 investigates patterns of population care-seeking by paying particular attention to two policy-relevant determinants of patients' collective demand behaviour: the expected need for ambulatory physician visits and physician-availability. However, as other factors may be more important determinants of utilization, patterns of realized physician-accessibility are also examined. Finally, Section 4.3 investigates patterns of physician-supply care-giving by paying particular attention to the effects of physician-competition over patients on physician-activity, especially on visit-intensity.

Several data sets were used for Chapter 4. Besides the Manitoba Physician Resource Data Set (see Chapter 3), data were also obtained from the Roos and colleagues (1996) study examining the need for physicians in Manitoba. Also, data reporting patterns of population care-seeking and physician-supply care-giving were obtained from Wall and Bogdanovic (1994). Estimates of residents' expected need for ambulatory medical care, their usage of physicians, and the in-area physician-supply was derived from the Roos *et* al. (1996) study. Physician-availability, physician-accessibility, physician visit-workload, and physician-competition were estimated from data reported by Roos and colleagues (1996), adjusted for patterns of care-seeking/care-giving estimated by Wall and Bogdanovic (1995). Finally, physician practice-stability was estimated from data compiled by Wall (1995).

4.1 PHYSICIAN SERVICE AREAS: THE MATCH BETWEEN PATTERNS OF POPULATION CARE-SEEKING AND PHYSICIAN-SUPPLY CARE-GIVING

As noted in Section 3.2.1, four types of small areas were defined: rural, influential-rural, urban, and remote. Although this research is concerned with rural patterns of utilization, the remote settings are noted as sources of patients for some southern settings while the two urban sites (Brandon and Winnipeg Region) are important destinations of rural residents' care-seeking. Although the focus of analysis is the PSA, some readers may be interested in comparison across Manitoba Health Regions. Whereas each PSA is denoted by the Region containing it, those areas spanning administrative boundaries are denoted by alphabetic ranking -- for example, C10 was constructed from rural municipalities in both the Central and Westman Regions and, as "c" precedes "w", this PSA is denoted by the prefix "C" rather than "W".

For each rural PSA, Table 4.1 denotes the residents' sites of ambulatory visits made to all generalist physicians and the sources from which the physician-supply obtain its patients. These patterns of care-seeking/care-giving are denoted as the number of

TABLE 4.1: PHYSICIAN SERVICE AREA PATTERNS OF AMBULATORY PHYSICIAN VISITS BY ANALYTICAL PERSPECTIVE, GROUPED BY REGION

PSA	DISTRIBUTION OF POPULATION CARE-SEEKING						DISTRIBUTION OF PHYSICIAN-SUPPLY CARE-GIVING					
	RESIDENTS	INAREA	NEXT	IRURAL	URBAN	SUM	PATIENTS	INAREA	NEXT	IR/U	REMOTE	SUM
C1	6991	75.11%	0.89%	18.52%	5.17%	99.70%	5999	85.38%	11.06%	3.56%	0.00%	100.00%
C2	13165	72.81%	3.80%	8.81%	9.00%	94.42%	10861	89.09%	9.32%	0.81%	0.00%	99.23%
C3	14856	56.10%	7.91%	7.16%	26.59%	97.77%	9587	88.29%	1.20%	7.72%	0.14%	97.35%
C5	5961	42.84%	1.38%	42.90%	10.86%	97.97%	3148	81.86%	14.32%	2.90%	0.23%	99.30%
C8	9141	67.41%	7.91%	12.65%	8.54%	96.51%	7106	87.63%	11.16%	1.14%	0.00%	99.93%
C10	7603	52.46%	2.85%	30.43%	12.44%	98.18%	4115	92.50%	1.70%	5.48%	0.09%	99.77%
CM	18985	93.12%	1.78%	0.35%	4.07%	99.31%	21139	81.63%	16.54%	0.40%	0.00%	98.57%
CP	20543	88.42%	0.62%	0.26%	9.58%	98.88%	24243	76.91%	7.54%	0.71%	0.40%	85.57%
E1	26559	67.69%	2.26%	2.59%	26.81%	99.36%	19268	93.20%	0.47%	3.16%	0.02%	96.84%
E3	10702	57.44%	6.03%	2.15%	32.76%	98.38%	6672	97.10%	1.22%	0.59%	0.61%	99.51%
E5	15076	41.32%	0.81%	19.99%	36.86%	98.97%	8399	70.12%	8.93%	16.92%	0.02%	95.98%
E8	3266	69.38%	3.65%	15.42%	10.92%	99.37%	2952	80.00%	18.34%	1.49%	0.04%	99.87%
ES	19166	75.28%	12.66%	0.25%	11.21%	99.40%	19251	73.59%	23.57%	0.27%	0.08%	97.52%
I1	9757	67.42%	10.35%	1.80%	18.37%	97.94%	7642	91.31%	7.41%	0.26%	0.56%	99.55%
I2	8045	70.34%	7.14%	1.82%	11.07%	90.36%	7194	79.97%	14.48%	5.19%	0.33%	99.97%
I3	4018	63.46%	7.25%	1.06%	26.11%	97.89%	3181	88.50%	10.60%	0.16%	0.52%	99.79%
I4	5213	66.25%	11.04%	1.10%	19.60%	97.99%	3774	86.23%	11.92%	0.10%	0.74%	98.99%
I8	14911	67.33%	0.62%	1.74%	29.37%	99.07%	11483	83.52%	10.39%	3.19%	0.72%	97.82%
IS	29423	50.74%	6.00%	0.17%	42.07%	98.98%	16282	90.47%	5.50%	0.16%	0.27%	96.40%
P2	7669	26.85%	9.25%	51.84%	11.07%	99.00%	2979	78.08%	4.85%	15.41%	1.42%	99.76%
P3	4524	60.97%	0.83%	34.26%	2.89%	98.97%	3012	90.38%	6.79%	2.73%	0.10%	100.00%
P4	4456	78.94%	7.16%	4.02%	7.42%	97.54%	3841	89.17%	0.59%	1.60%	0.41%	91.76%
P5	8114	59.46%	6.19%	23.62%	8.59%	97.86%	5050	85.34%	8.77%	2.13%	0.12%	96.36%
PD	11236	92.07%	1.75%	0.36%	3.92%	98.34%	17384	64.51%	30.46%	0.88%	1.65%	97.50%
PS	9890	90.38%	5.11%	0.66%	3.32%	99.48%	12471	65.72%	22.21%	0.63%	1.19%	89.67%
W1	10460	76.74%	6.03%	0.57%	9.12%	92.47%	8731	92.63%	5.72%	1.62%	0.00%	99.97%
W3	9161	83.06%	6.64%	0.96%	8.23%	98.92%	8243	92.53%	6.46%	0.77%	0.08%	99.84%
W4	15215	77.80%	6.83%	1.61%	12.58%	98.82%	12481	94.32%	3.21%	2.16%	0.18%	99.88%
W5	2381	83.76%	9.92%	0.46%	5.11%	99.24%	2260	87.78%	10.89%	1.32%	0.00%	100.00%
W9	2973	62.14%	2.25%	1.61%	32.49%	98.48%	2279	84.44%	10.56%	2.88%	0.17%	98.05%
W10	5855	87.25%	6.37%	0.32%	6.84%	100.00%	5552	90.06%	9.16%	0.71%	0.07%	100.00%
W18	5847	69.80%	8.55%	0.25%	20.38%	98.98%	4910	84.15%	12.35%	2.66%	0.00%	99.16%
W19	8539	77.26%	6.69%	0.53%	11.91%	96.38%	7113	89.47%	9.32%	8.20%	0.23%	99.83%
WN	6861	91.51%	2.65%	0.34%	4.45%	98.95%	8663	74.35%	22.26%	1.24%	0.20%	98.06%

contacts as a percentage of the total number of visits. For patterns of population care-seeking (physician care-giving), category INAREA includes all care rended by (given to) the PSA physician-supply (population) while NEXT includes all care rendered by (given to) adjacent physician-supplies (populations). These two categories were employed to estimate misclassification of the rural municipalities used to construct the study PSAs (see Section 3.2.1). For population out-of-area care-seeking, the effects of the seven influential rural communities and the two cities (Brandon and Winnipeg) are respectively denoted as IRURAL and URBAN. However, for physician-supply care-giving rendered to out-of-area patient, these influential rural/urban sites are collectively denoted as IR/U. Also, as the residents of some remote areas (i.e., north of the 53rd parallel) contact physicians in certain PSAs, this source of patients is reported as REMOTE. Finally, SUM -- the arithmetic sum of the previous groupings -- is included to identify PSAs in which significant amount of care is derived from, or provided to, areas not included above -- that is, percentages less than 100% indicate contributions from/to sites other than those above. SUM provides another estimate of the misclassification of patterns of care-seeking/care-giving.

Rural PSAs were successfully defined from both the population and the physician-supply perspectives (see Section 3.2.1 and Table 4.1). Based on the percentages of utilization lost to/gained from adjacent non influential PSAs, misclassification was minimized (see columns NEXT in Table 4.1) -- that is, no other configuration of rural municipalities exhibited less total misclassification error. Only 90.36% of population care-seeking in I2 and 84.57% of physician care-giving in CP was respectively accounted for. Unaccounted utilization in these two PSAs suggests that more distant rural areas (i.e., beyond adjacent and non influential) influence patterns of care-seeking/care-giving. Finally, as PSAs were constructed using all contacts with general practitioners, these areas accurately represent the distribution of rural ambulatory visits, except for areas obtaining high amounts of care from urban specialists. For these PSAs, this unmeasured primary medical care underestimates the total volume of ambulatory visits and the proportion of patients (see Roos *et al.* 1996).

Observed patterns of ambulatory visits to general practitioners strongly support the posited model explaining patterns of rural primary medical care utilization in which

- populations seek primary medical care from in-area physicians, but residents of areas adjacent to influential communities seek care from these out-of-area sources, and
- physicians in rural non influential sites provide care mostly to in-area residents, and
- physicians within influential communities provide care to patients drawn from in-area, adjacent, and more distant areas.

Out-of-area ambulatory care obtained from all sites ranges between

- 18% and 54% in Central Region;
- 26% and 57% in Eastman Region;
- 13% and 31% in Interlake Region;
- 11% and 63% in Parkland Region; and
- 5% and 34% in Westman Region.

These findings are consistent with previous research in Manitoba and Quebec reporting out-of-area care-seeking compensating for poor in-area physician-supply (see Home

1986, Renault *et al.* 1986).

While influential areas clearly affect rural patterns of care-seeking, this effect varies, with

- Winnipeg exerting a strong effect throughout the Central, Eastman, and Interlake Regions,
- Brandon, exhibiting a role restricted to certain Westman Region areas (i.e., W9, W18), and
- most (but not all) rural influential communities drawing in patients from surrounding rural areas.

Table 4.1 highlights interesting patterns of care-seeking in select PSAs. Using an arbitrary rule-of-thumb of 70% or greater of population care-seeking being made to in-area physicians, C1, C2, I2, P4, W1, W3, W4, W5, W10, W18 and W19 -- that is, 11 out of the 27 non-influential rural PSAs -- rely upon local physicians for at least some primary medical care. While the seven influential rural communities should, by definition, exhibit high proportions of in-area care-seeking, IS is a noted exception. High physician-access and/or other factors may explain the 42% of physician-contacts occurring in Winnipeg. In contrast, some non influential PSAs exhibit unexpectedly high percentages of in-area utilization. Whereas care-seeking by C1 residents to the adjacent rural influential community, CM, comprises 18.52% of total utilization, a stronger effect had been anticipated. Part of the explanation is likely the clinic in C1 staffed by CM physicians. Also, only a low amount of C2 utilization is explained by out-of-area care-seeking to the adjacent influential areas, CP and Winnipeg. Distance and patterns of

TABLE 4.2: PHYSICIAN SERVICE AREA NEED FOR AND USAGE OF AMBULATORY PHYSICIAN VISITS, PHYSICIAN-SUPPLY, AND INPATIENT BED-SUPPLY, GROUPED BY REGION

PSA	AMBULATORY PHYSICIAN VISITS			PHYSICIAN-SUPPLY			INPATIENT BED-SUPPLY		
	NEEDED	USAGE	PSA-TYPE	COUNT	ACTIVITY	SUPPLY	COUNT	SUPPLY	PER MD
	EAV/CAPITA	AV/CAPITA	L,B,H	MDs	FTE MDs	FTE/'000	BEDs	BEDs/'000	BEDs/FTE
C1	3.94	3.22	L	4.75	4.71	0.67	32	4.58	6.79
C2	3.98	4.03	B	13.17	12.75	0.97	52	3.95	4.08
C3	3.71	4.21	H	9.42	8.09	0.54	61	4.11	7.54
C5	4.17	4.97	H	2.58	2.90	0.49	20	3.36	6.90
C6	3.89	4.47	H	6.33	6.96	0.76	46	5.03	6.61
C10	4.00	4.29	H	4.00	3.67	0.51	35	4.60	9.04
CM	3.88	3.36	L	17.08	20.66	1.09	128	6.74	6.20
CP	4.47	4.74	H	11.58	20.56	1.00	131	6.38	6.37
E1	3.28	4.58	H	13.33	14.49	0.55	56	2.11	3.86
E3	5.97	4.47	L	7.75	9.69	0.91	35	3.27	3.61
E5	3.37	3.79	H	7.75	7.39	0.49	23	1.53	3.11
E8	6.67	4.85	L	2.58	3.34	1.02	11	3.37	3.29
ES	3.81	3.65	B	13.50	18.57	0.97	80	4.17	4.31
I1	6.44	4.76	L	8.17	7.86	0.81	32	3.28	4.07
I2	5.26	5.55	B	5.67	6.95	0.86	35	4.35	5.04
I3	6.79	5.34	L	3.08	3.34	0.83	17	4.23	5.09
I4	6.41	4.51	L	3.33	3.03	0.58	16	3.07	5.28
I8	3.61	4.09	H	9.58	9.35	0.63	38	2.55	4.06
IS	4.01	4.31	H	14.67	20.99	0.71	75	2.55	3.57
P2	6.45	4.72	L	1.50	3.06	0.40	16	2.35	5.88
P3	5.25	4.76	L	3.08	2.97	0.66	18	3.98	6.06
P4	5.98	4.58	L	2.33	3.79	0.85	25	5.61	6.60
P6	5.43	4.65	L	6.17	7.09	0.87	81	9.98	11.42
PD	4.89	4.44	L	15.00	21.23	1.89	124	11.04	5.84
PS	4.88	4.68	B	8.92	12.28	1.27	92	9.49	7.49
W1	3.99	4.43	H	12.50	10.15	0.97	65	6.21	6.40
W3	4.48	5.22	H	6.33	8.72	0.95	67	7.31	7.68
W4	4.64	4.46	B	14.83	13.24	0.87	65	5.59	6.42
W5	4.62	4.72	B	2.08	2.33	0.98	12	5.04	5.15
W9	7.19	5.72	L	2.06	2.57	0.86	16	5.38	6.23
W10	4.18	4.16	B	8.25	5.56	0.95	31	5.29	5.58
W18	3.85	4.55	H	5.25	5.49	0.94	30	5.13	5.46
W19	5.08	3.76	L	4.25	5.76	0.67	42	4.92	7.29
WN	4.62	4.86	B	6.67	8.80	1.28	38	5.54	4.32

sparse settlement may be a barrier to out-of-area care-seeking.

The high percentage of in-area utilization common to E8, I2 and P4 likely arises from the shared characteristics of distance from influential communities, adequate levels of physician-supply (respectively, 1.02, 0.86, 0.85 FTE/'000; see Table 4.2), and of hospital inpatient bed-supply (respectively 3.37, 4.45, 4.61 BED/'000; see Table 4.2). In Westman Region, most rural PSAs exhibit high proportions of in-area care-seeking, despite location near Brandon or Winnipeg. Even W9, located directly adjacent to Brandon, and the only exception to the 70% rule-of-thumb, still exhibits a moderate (62.14%) level of in-area care-seeking.

For rural PSAs characterized by high proportions of population out-of-area utilization, interesting differences are observed in patterns of care-seeking to influential rural/urban sites (see columns IRURAL and URBAN in Table 4.1). For Central Region, four out of six PSAs seek the greater proportion of their ambulatory visits to influential sites. The residents of C5 and C10 obtain moderate amounts of primary medical care from CP while individuals residing within C6 contact CM physicians for 13% of their ambulatory visits. For C3, a moderate amount of ambulatory care is obtained from adjacent Winnipeg. While these sources dominate patterns of utilization, however, ambulatory visits are also made to other influential rural/urban sites. Patterns of care-seeking are likely influenced by the closeness of influential areas. For example, while C3 residents obtain care from Winnipeg, they also contact physicians in CM and, to a more limited extent, ES. This within-area variation likely reflects differences in residents' place of residence within C3.

Whereas Winnipeg exerts a large influence throughout all Eastman Region, ES draws patients from adjacent E5 plus the more isolated E8. Similarly, Winnipeg affects patterns of care-seeking throughout the Interlake Region, except for I2 (see above). IS may fail to draw patients in from Interlake Region because of overshadowing by Winnipeg and the access highway bypassing Selkirk. Patterns of care-seeking in Parkland Region are influenced by proximity to the PD and PS influential areas; Brandon also has a limited effect on P2 ambulatory visit utilization. The 32.49% of W9 care-seeking directed towards Brandon may reflect preferences of Status Indian residents and access facilitated by location on the Trans-Canada Highway. Overall, however, Brandon exerts little influence on rural areas in Westman Region and beyond.

Now consider physician-supply patterns of care-giving. The amount of care rendered by PSA physicians to out-of-area patients ranges between:

- 7% and 17% in Central Region;
- 2% and 26% in Eastman Region;
- 8% and 20% in Interlake Region;
- 3% and 22% in Parkland Region; and
- 6% and 18% in Westman Region.

As expected, at least 80% (typically, much more) physician-workload in most rural PSAs is derived from in-area patients. In contrast, physicians in influential communities see higher proportions of out-of-area patients (more than 20%). Exceptions include the rural areas, E5 and P2, and the influential communities, CM and IS. The residents/physicians of E5 and Winnipeg exhibit a unique interrelationship.

While 38% of E5 population care-seeking occurs in Winnipeg, 17% of the visits made to the E5 physician-supply are derived from Winnipeg residents. For some Winnipeg residents, the single cluster of E5 physicians may be a convenient source of primary medical care. The provision of care by P2 physicians to patients from PS may reflect the close interrelationships between these areas -- specifically, the staffing of the P2 clinic by PS physicians. In contrast, the IS influential community renders little medical care to out-of-area patients. As noted above, proximity to Winnipeg and the access highway bypassing Selkirk are likely key explanations. Finally, only 18% of the total physician-contacts within CM are generated by out-of-area patients -- mostly from adjacent rural areas. Contrary to expectation, CM physicians do not provide substantial amounts of ambulatory care to the surrounding rural areas.

While care-seeking by remote residents to southern rural communities is not extensive, patients from Northern Manitoba contribute to the workloads of physicians practicing within P2, PD and PS. To a much lesser extent, most of the Interlake Region PSAs and E3 are also affected. In general, these PSAs are directly adjacent to Northern Manitoba, or, for PD and PS, are, themselves, important sites of care-seeking by residents living in northern rural PSAs (i.e., just south of the 53rd parallel).

Besides the above patterns of rural population care-seeking and physician-supply care-giving, substantial differences are also observed in expected population need for ambulatory visits, the actual utilization of medical care, and in the availability of medical and hospital resources (see Table 4.2). Table 4.2 displays selected PSA characteristics: population expected (comparative) need for, and actual usage of, ambulatory physician visits; in-area physician-supply and hospital inpatient bed-supply. Both the expected need and actual utilization are reported as average visits *per capita* (resident). The relationship between patterns of utilization and estimated need is classified as PSA-TYPE: high usage relative to need (H), balanced usage and need (B) and low usage relative to need (L). In-area physician-supply is reported as the count of physician, this count adjusted for full-time equivalent status (FTE) and physician-supply -- that is, the ratio of these FTE providers to the in-area population. Finally the in-area hospital bed-supply is reported as the count of staffed beds and physician-supply -- that is, the ratio of these beds to the in-area-population. Also, as general practitioners determine the use of rural hospital resources, the average number of inpatient-beds per FTE physician is also calculated (i.e., bed-availability).

Using 6.0 visits *per capita* as an arbitrary cutoff, certain PSAs -- E3, E8, I1, I3, I4, P2, P4, W9 -- were identified as particularly high expected need for ambulatory visits (see column NEEDED in Table 4.2). Other than above, the PSAs in Central, Westman and Eastman Regions generally exhibit lower need while the areas in Parkland and Interlake Regions are characterized by greater need. The relationship between need and usage is complex (see column TYPE in Table 4.2). No consistent findings were detected for the rural influential areas:

- CP and IS exhibited patterns of visit usage greater than expected need;
- ES, PS and WN were characterized by balance between actual usage and expected need; and,
- PD exhibited a lower than expected level of utilization.

Rather than exhibiting regional patterns, however, the usage--need relationship appears to be influenced by proximity to Winnipeg or, to a lesser extent, Brandon.

The availability of health care resources is a key concern of rural residents, planners, and policy-makers. Wide variation in physician-availability -- estimated as the count of doctors, this count adjusted for physician activity, and for both activity and population size (see columns COUNT, ACTIVITY, and SUPPLY in Table 4.2) -- quantifies this concern. Physician-supply adjusted for physician-activity estimated as the full-time equivalent (FTE) count of physicians per thousand residents varies from 0.40 (in P2) to 1.89 (in PD). In general, Westman Region is characterized by uniformly high physician-supplies while the other Regions exhibit greater variation. Similarity, hospital bed-availability estimated as the count of beds, bed-count adjusted for population size, and bed-count adjusted for physician-supply (respectively, see columns COUNT, SUPPLY, and PER MD in Table 4.2) exhibits great variation, ranging from 2.11 (in E1) to 11.04 (in PD) beds per thousand residents, or from 3.11 (in E5) to 11.42 (in P5) beds per FTE physician.

The interpretation of these differences benefits from considering the effects of patterns of residents' care-seeking and physicians' care-giving across rural PSAs' boundaries. The interpretation of the simple relationship between population comparative need for ambulatory medical care and the supply of health care resources is clearly complicated by these flows. Crude macro-level relationships typically used for health-care planning can better illuminate policy-making, however, when estimates of populations and physician-supplies are adjusted for these movements. These adjustments have methodical implications for estimates of standardized rates of utilization. Therefore, variations in crude estimates of in-area physician-availability (FTEs/000) and staffed hospital-beds (BEDs/000) should be cautiously interpreted.

In summary, the lessons gained from examining data presented in Tables 4.1 and 4.2 emphasize the complex patterns of ambulatory visits made to general practitioners in rural Manitoba. Patterns of utilization vary by region, but also within regions. Although differences in population expected-need for ambulatory physician visits and in-area resource-availability *should* be key factors explaining variation in primary medical care utilization, macro-level analysis finds little evidence of such relationships. Patterns of care-seeking/care-giving found in rural Manitoba emphasize the importance of influential communities in redressing imbalances in physician-supply in more poorly staffed areas -- that is, the focus of policy-making shifts from redressing imbalances in the distribution of general practitioners to facilitating rural residents to access primary medical care. These cross-sectional data, however, do not distinguish between those residents' periodically seeing physicians in influential communities because of *poor local physician-availability* and those consistently contacting out-of-area practices to *obtain higher quality care*. In the first instance, improved physician-availability would likely be beneficial while, in the second, additional physicians may not change existing patterns of care-seeking. In these areas, stable (and continuing) patterns of out-of-area care-seeking may generate high physician-turnover within the augmented physician-supply when physicians understand the "true" numbers of residents severed. In order better to inform policy-making, the following sections discuss the determinants of ambulatory visit utilization, first from the perspective of population care-seeking and then from the viewpoint of physician-supply care-giving.

4.2 DETERMINANTS OF POPULATION CARE-SEEKING

As noted in Chapter 2, important determinants of population collective care-seeking explaining patterns of ambulatory contacts with generalists physicians include:

- population expected need for ambulatory visits;
- local (in-area) physician-availability and, more broadly; and
- access to both local as well as more distant sources of medical care.

While policy-makers historically have been concerned with achieving equity in the distribution of physicians (as a measure of equal physician-availability; see Lomas and Barer 1986, Lomas *et al.* 1985), this focus has more recently shifted to the needs-based allocation of generalist physicians (Birch and Eyles 1990; Roos *et al.* 1996) and to achieving equity in physician-accessibility (Joseph and Phillips 1984; Manitoba Health Advisory Network 1993, 1992, 1991; WESTARC 1994).

4.2.1 POPULATION EXPECTED NEED FOR PHYSICIAN VISITS

Population expected need for ambulatory physician visits is a key concept explaining patterns of primary medical care utilization. Most conceptual models incorporate need (or elements thereof) and analyses excluding this factor are deemed incomplete. Moreover, comparative need is increasingly the basis of policy-making concerned with health care resource allocation. Comparative need for medical care reflects differences in population demographic structure, socioeconomic status, and health status (see Section 3.1.4). In this study, populations (PSAs, patient-profiles) characterized by

- higher proportions of the very young (i.e., 2 years of age and younger), and/or
- higher proportions of the very old (i.e., 75 years of age and older), and/or
- higher proportions of the socially disadvantaged residents as measured by the standardized socioeconomic risk index (i.e., SERI > 0), and/or
- higher rates of premature mortality in excess of the provincial mean as estimated by the age-sex standardized mortality ratio (i.e., SMR > 3.6/'000),

are deemed to have greater expected need for ambulatory physician visits. The very young and the very old age-groupings were also combined to construct a broader demographic category, high-users (HU).

The comprehensive global measure of comparative population need used here -- the expected number of annual ambulatory physician visits -- varies with demographic, socioeconomic, and health determinants (EAV; see Chapter 3). Table 4.3 lists the global estimate of the expected need and its components by PSA. Figure 4.1 graphically displays these values by PSA in descending order of expected population need. Depending upon the presence of other factors also influencing demand/supply behaviours, however, observed patterns of physician visits may differ markedly from levels predicted by expected need.

Except Parkland Region, which exhibits consistently greater expected need for ambulatory physician visits, and Central Region, which displays uniformly lower need, the remaining three Regions incorporate mixes of PSAs characterized by wide ranges of population need for physician visits. Heterogeneity in population need is an inherent characteristic of rural Manitoba PSAs. Even for Westman and Central Regions,

TABLE 4.3: DETERMINANTS OF POPULATION EXPECTED NEED FOR AMBULATORY PHYSICIAN VISITS, GROUPED BY REGION

PSA	POPULATION	PERCENTAGE HIGH USERS BY AGE-GROUPING AND TOTAL			HEALTH STATUS	SOCIAL STATUS	AMBULATORY VISITS: EXPECTED	AMBULATORY VISITS: USED	AMBULATORY VISITS: PSA-TYPE
	RESIDENTS	0-2 YEARS	75+ YEARS	HU	SMR	SERI	EAV/CAPITA	AV/CAPITA	L,B,H
C1	6918	4.27	6.75	11.02	3.10	-0.02	3.94	3.22	L
C2	13046	3.95	9.03	12.96	3.06	-0.09	3.98	4.21	H
C3	14748	4.56	6.01	10.57	2.44	0.21	3.71	4.97	H
C5	5940	6.84	5.82	12.66	3.74	-0.14	4.17	4.47	H
C6	9056	4.34	8.50	12.84	3.26	-0.29	3.89	4.29	H
C10	7517	4.20	7.37	11.57	3.19	-0.05	4.00	4.03	B
CM	18805	4.79	7.20	11.99	2.72	0.17	3.88	3.36	L
CP	20355	4.46	6.76	11.22	4.26	-0.19	4.47	4.74	H
E1	26007	3.36	5.11	8.47	3.10	-0.66	3.28	4.58	H
E3	10631	6.97	3.33	10.30	4.20	1.99	5.97	4.47	L
E5	14837	4.82	2.79	7.61	2.62	-0.03	3.37	3.79	H
E8	3250	3.26	10.09	13.35	4.63	1.71	6.87	4.65	L
ES	18735	5.13	5.19	10.32	2.93	0.10	3.81	3.65	B
I1	9722	5.40	5.38	10.78	4.34	2.24	6.44	4.76	L
I2	7912	3.37	8.94	12.31	4.10	0.44	5.26	5.55	B
I3	5218	3.97	6.18	10.15	4.84	2.11	6.79	5.34	L
I4	3981	5.19	5.31	10.50	4.97	1.74	6.41	4.51	L
I8	14502	3.88	5.01	8.89	3.42	-0.20	3.82	4.09	H
IS	29669	3.56	5.15	8.71	3.96	-0.40	4.01	4.31	H
P2	7703	5.89	5.65	11.54	4.16	2.39	6.45	4.72	L
P3	4560	1.95	11.18	13.13	3.43	0.78	5.25	4.76	L
P4	4427	4.13	9.71	13.84	3.38	1.74	5.96	4.58	L
P5	7837	4.41	7.46	11.87	3.56	1.32	5.43	4.65	L
PD	11435	3.19	11.11	14.30	3.68	0.32	4.89	4.44	L
PS	9610	3.80	9.89	13.69	2.97	0.77	4.88	4.68	B
W1	10422	3.82	8.93	12.75	2.76	0.06	3.99	4.43	H
W3	9114	3.93	8.10	12.03	3.40	0.23	4.48	5.72	L
W4	15120	3.25	10.64	13.89	3.35	0.29	4.64	4.16	B
W5	2363	3.39	10.66	14.05	3.15	0.42	4.62	4.55	H
W9	2922	5.48	6.91	12.39	3.66	3.36	7.19	3.76	L
W10	5922	3.48	10.05	13.53	2.53	0.29	4.18	5.22	H
W18	5921	3.77	8.28	12.05	3.48	-0.48	3.85	4.46	B
W19	8402	3.78	10.44	14.22	3.21	0.87	5.08	4.72	B
WN	6812	3.02	11.13	14.15	3.27	0.33	4.62	4.86	B

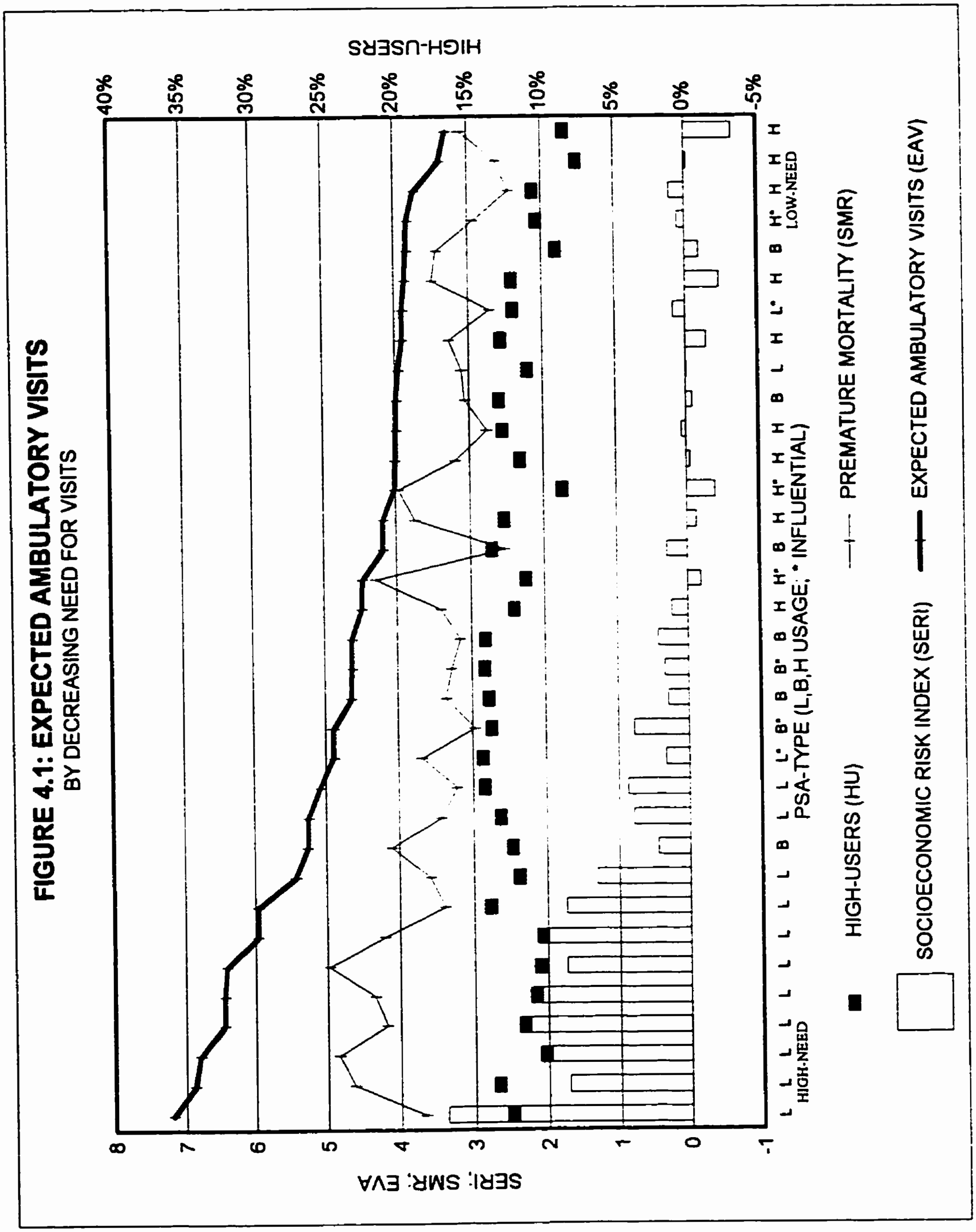


FIGURE 4.1: EXPECTED AMBULATORY VISITS
BY DECREASING NEED FOR VISITS

important (small) differences may explain variation in patterns of medical care utilization. Nevertheless, what is the role of demographic, health, and socioeconomic determinants in explaining these differences?

Central and Westman Regions provide insights into the contrasting role of demographic structure on population need for physician visits (see Table 4.3). As noted above, both the very young (0 - 2 years of age) and the very elderly (75+ years of age) are generally high users of medical care. While Central Region consistently has more very young residents while Westman Region generally has a greater proportion of elderly denizens, on balance, Westman overall has the highest proportion of high-users. However, the proportion of high-users exhibit no association with expected-need for physician visits (see Figure 4.1). Therefore, adjustment for age, alone, is not sufficient to correct for differences in the expected utilization of ambulatory medical care.

Other research in Manitoba and elsewhere shows the importance of population health and social status as determinants of the need for medical care (see Chapter 3). Health status, measured using premature mortality as a proxy, is calculated as the standardized mortality rate. Social status, measured by socioeconomic status, is calculated as the socioeconomic risk index. According to these proxy measures, PSAs within Central and Westman have the highest health and social status while those in Interlake and Parkland are generally the most disadvantaged (see Table 4.3). In Figure 4.1, PSAs with higher need for physician visits generally have lower social status and poorer health. SMR is invariant with respect to increasing need, except for a marked increase among the most needy PSAs. For the 17 lowest need areas, the SERI is either small or negative; however, for the 17 highest areas, SERI is positive -- starting small, but rapidly increasing with need. Overall, the comprehensive measure of population comparative need for ambulatory physician visits used here -- the expected number of visits per resident -- appears to be heavily influenced by the proxies for health status and, especially, social status used here.

Finally, with respect to expected need for physician visits, influential rural communities have more in common with each other than with their respective regions. While influential PSAs typically exhibit the lowest need for physician visits in their respective regions, CP exhibits the greatest need in Central Region (see Table 4.3). However, variation exists within this grouping. In Figure 4.1, influential communities span the spectrum from mid to low need, with 5 of 7 PSAs clustered in the mid-level.

The above analysis finds:

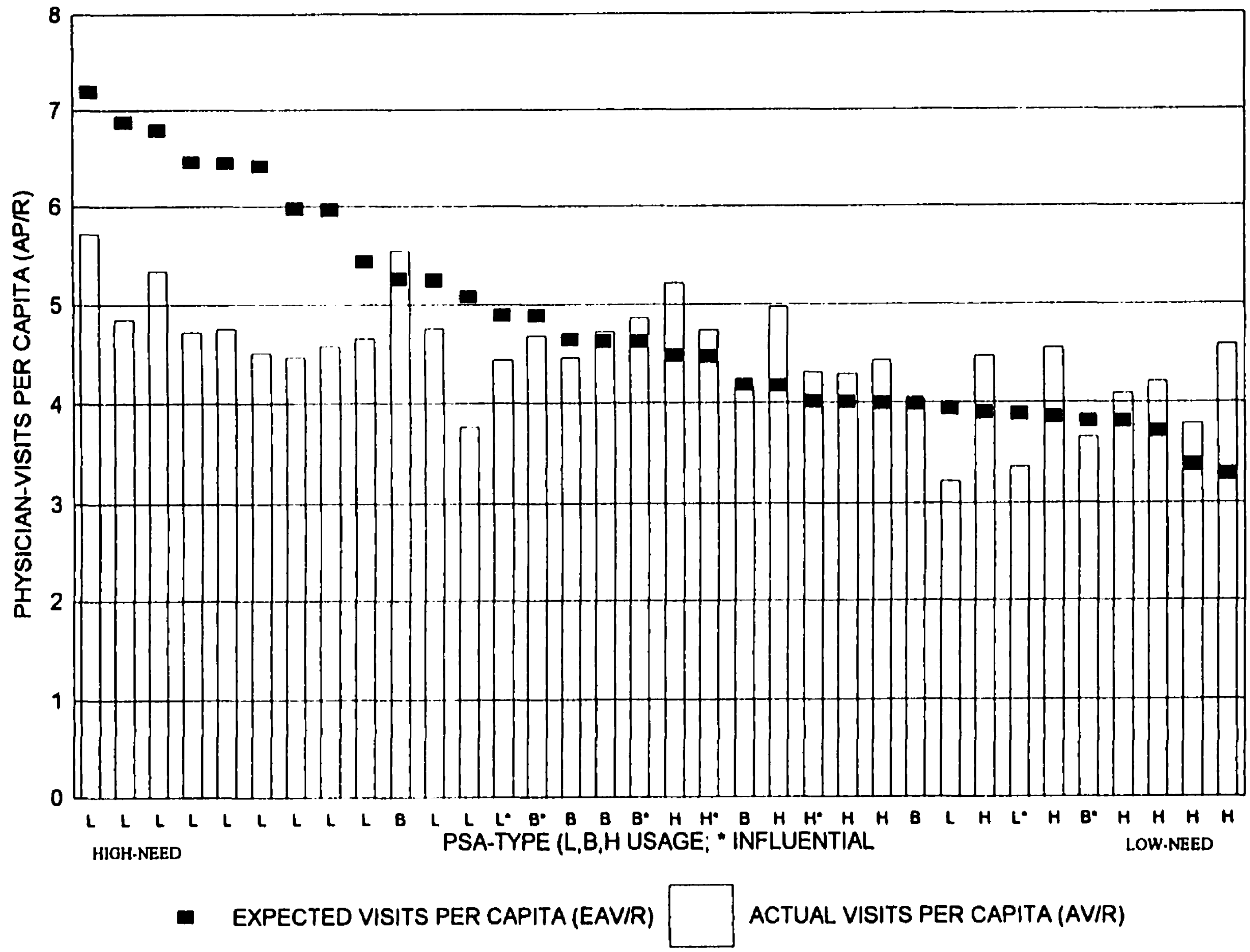
- that certain Regions exhibit consistently lower and greater patterns of need;
- that, overall, important heterogeneity exists within Regions;
- that need varies across PSAs, with large differences in health and social status; and
- that while influential communities share common factors, they also share the characteristics of their respective regions.

Although analysis focusing on Regions (or other aggregation suitable for planning purposes) may be of greater interest to policy-makers, greater insight into rural patterns of care-seeking/care-giving is gained from analysis employing the PSA as the unit-of-analysis.

But does comparative (expected) population need for ambulatory visits explain

FIGURE 4.2: NEEDED VERSUS USED VISITS

BY DECREASING EXPECTED NEED FOR VISITS



observed (actual) patterns of primary medical care utilization? Insight into sources of variation in the usage--need relationship is gained through examining within-region differences reported in Table 4.3 and Figure 4.2. As noted above, the Parkland and Central Regions respectively display the highest and lowest consistent patterns of expected need for physician visits across within-area PSAs (see column NEEDED). In contrast to expected need, however, observed patterns of utilization are comparable (see column USED). The Appendix contains a correlation matrix of relevant relationships.

Figure 4.2 graphically displays population expected need for, and the observed use of, physician visits, ranked in descending order by PSA need for ambulatory medical care. Both measures are expressed as average ambulatory physicians visits per resident. PSAs are denoted by their patterns of usage compared with need: lower (L), balanced (B) and higher (H) rates of usage than expected. Also, influential communities are identified (*). While actual utilization is higher among the more needy populations ($r = 0.63$, $p < 0.0001$) this relationship exhibits substantial variation and gaps between expected and actual usages are found for these areas (with converse for less needy PSAs). While detecting comparable patterns of utilization across rural PSAs is commendable, the finding that the usage of medical care is not predicted by need for is a concern. Most high need PSAs exhibit levels of utilization far less than that predicted by the comparative needs while the remaining areas are characterized by excess usage. Many of these latter areas obtaining large amounts of medical care from Winnipeg physicians (e.g., E1, C3, E5, I8, IS).

Partitioning the 34 PSAs into two portions, based on the distribution of PSAs by the expected need for ambulatory medical care, yields important insights (see Figure 4.2). The portion containing the 17 lower need PSAs is characterized by areas with utilization greater than expected while the portion containing the 17 higher-need PSAs is characterized by areas with utilization less than expected.

TABLE 4.4: DISTRIBUTION OF PHYSICIAN SERVICE AREAS BY AMBULATORY PHYSICIAN VISIT USAGE –NEED CLASSIFICATION AND PSA-TYPE

PSA USE–NEED CATEGORIES		HIGH NEED	MIDDLE NEED	LOW NEED	TOTAL
LOW USE	RURAL IRC	9 0	2 1	1 1	12 2
BALANCED USE (USAGE +\- 5% OF NEED)	RURAL IRC	0 0	4 2	1 1	5 3
HIGH USE	RURAL IRC	0 0	4 2	6 0	10 2
TOTAL	RURAL IRC	9 0	10 5	8 2	27 7

Estimated using data from the 1993 fiscal year data; adapted from Roos *et al* (1996), Table 5.
PSA, physician service area.
IRC, influential rural community (PSA).

Table 4.4 displays the distribution of PSAs by physician ambulatory visit usage--need classification (Low, Balanced or High usage relative to the expected number of contacts; see Roos *et al.* 1996) and community-type (rural/influential-rural). Rural Manitoba is characterized by a wide range of physician visits compared with the expected need for ambulatory medical care. Out of the 34 rural PSAs, only eight PSAs achieved a "balance" between usage and need. Overall, the nine low use--high need PSAs and the six high use--low need areas are of particular concern to policy-makers. These findings are contrary to patterns of visits suggested by the naive epidemiologic or other models explaining variation of utilization from population expected need for ambulatory physician visits. Clearly, other considerations explain these patterns of rural medical care utilization.

First, consider the low use row in Table 4.4. All of these PSAs are characterized by visit deficits, but they differ as to the expected need for ambulatory medical care. For the cell, low usage--low need, the two communities consist of the influential rural community, CM, and adjacent rural area, C1. These two areas constitute a unique configuration influenced by the physician cluster in CM and possibly cultural factors influencing the demand for medical care (e.g., Mennonite ethnicity). Support for the influence of culture (or other associated factors) on demand is provided by the finding of low visit utilization in spite of high physician-availability (see below). In contrast, the low usage--high need cell consists of 9 rural PSAs, all of which are characterized by high proportions of in-area care-seeking and distance from influential communities. Although utilization in these PSAs arises from in-area patient--physician interactions, it is not clear which of population response to perceived need (i.e., demand behaviour), physician-supply practice style (i.e., supply behaviour), or their interaction determines these findings.

The low use--middle need grouping includes the influential rural community, PD, along with adjacent rural areas P4. Also, W19, a PSA distant from the City of Brandon (the closest influential community) is also included in this group. Again, it is not clear if population response to perceived need (i.e., demand behaviour), physician-supply practice-style (i.e., supply behaviour), or their interrelationship explains these visit deficits.

The balanced use--need groupings is made up of 50% influential rural communities and includes areas from all regions characterized by a wide spectrum of expected need for physician visits. Overall, the PSAs in this grouping are characterized by high within-area utilization. For example, while ES and C2 are low need areas (predominantly Mennonite in culture), these residents' greater use of primary medical care compared to nearby CM and C1 may reflect a higher proportion of out-of-area care-seeking to Winnipeg. The practice-patterns of Winnipeg physicians differ significantly from those of their rural colleagues in terms of the frequency of contact and the number of visits rendered per contact (see Evans *et al.* 1986, Roch *et al.* 1985, Roos *et al.* 1996, Tataryn *et al.* 1995).

Finally, the high use row includes areas characterized by high proportions of out-of-area care-seeking to Winnipeg, Brandon, or the influential rural area, CP. For these areas, patterns of utilization may reflect, at least in part, the practice-patterns of physicians practicing within these influential rural and urban communities. While the high use--low need grouping includes Brandon and certain Winnipeg areas (see Roos *et al.* 1996, Table 5), no rural influential communities fall into this category. Perhaps physician-supply or attitudes towards care explain these rural--urban differences among influential areas. Of the rural PSAs included in this category, only W1 and W3 exhibit high proportion of in-area care-seeking. The high rates of visits among these two Westman Region areas likely reflect prevailing physician practice-patterns, possibly arising from the response to large in-area physician-supply (competition; see below).

In summary, while comparative (expected) need for ambulatory physician visits should be a key factor explaining patterns of primary medical care utilization, little support is found for this hypothesis in rural Manitoba. Patterns of visits greater than expected levels of usage in PSAs adjacent to CP, Brandon and, especially, Winnipeg as well as within more distant, but well-staffed areas, suggest that other factors in addition to need determine patterns of visit utilization. The effects of high in-area physician-availability and low distance barriers to out-of-area care-seeking on residents' demand behaviour as well as the effects of physician-competition on physicians' supply decision-making should be considered. In contrast, poor physician-accessibility typical of distant, more sparsely settled areas may explain patterns of visit usage less than expected. Also, physician practice-style may differ systematically across areas.

4.2.2 PHYSICIAN-AVAILABILITY

The availability of general practitioners in rural communities is thought to influence patterns of ambulatory medical care utilization. The residents of areas well supplied with physicians face greater opportunities to obtain needed (and beyond) primary medical care. Hence, an enduring concern of both rural residents and health care policy-makers is the poor availability of physicians -- especially in isolated or otherwise historically under serviced areas. Physician-availability -- traditionally estimated as the number of physicians per 1000 residents (i.e., the physician-supply; see Lomas and Barer 1986) -- focuses attention on the size/distribution of the physician-stock practicing within rural settings.

However, what is the meaning of physician-availability and what are its determinants? At the level of individual towns/villages, physician-availability is perceived as having a physician(s) within the community; within rural setting, availability is typically perceived as having a physician(s) within the nearest town/village. This concept of availability is especially true for the large number of settings traditionally staffed by solo general practitioners. As every town/village cannot support a physician(s), however, a more representative unit-of-analysis becomes the PSA -- an aggregation of rural municipalities typically encompassing more than one village/town. Moreover, as not all practitioners are equally active and some physicians see out-of-area patients, a simple count of in-area stock typically under/over estimates physician-availability. In this study, physician-availability -- estimated as in-area full-time equivalent physicians per thousand capita (IAFTE/000) -- is determined by

- in-area physician-supply calculated as the ratio of the count (#) of physicians per thousand capita (#/000),
- average physician-activity estimated as the ratio of full-time-equivalent status of the physician-supply to the count of physicians (FTE/#), and
- the proportion of physician-activity attributed to in-area residents (IAFTE/FTE).

Physician-availability and its components are related by the identity,

$$\text{IAFTE}/000 = \#/000 \times \text{FTE}/\# \times \text{IAFTE}/\text{FTE}.$$

Physician-availability, which depends upon in-area (local) physician-supply, physician-activity and the proportion of this workload generated by in-area patients, measures the *potential* of rural residents to obtain medical care from local sources. Because residents also get care from out-of-area sources, however, physician-availability estimated as the "core" physician-supply is also reported -- that is, the ratio of the full-time equivalent physician-supply, adjusted for the proportion of physician activity attributed to in-area

TABLE 4.5: PHYSICIAN-AVAILABILITY AND COMPONENTS, GROUPED BY REGION

PSA	AMBULATORY VISITS			PHYSICIAN-AVAILABILITY : POTENTIAL & CORE				
	NEEDED	USED	PSA-TYPE	AVAILABILITY	SUPPLY	%ACTIVITY	% INAREA	CORE-SUPPLY
	EAV/R	AV/R	L,B,H;*	IAFTE/000	#/000	FTE/#	IAFTE/FTE	IAFTE/IA000
C1	3.94	3.22	L	0.59	0.68	99%	88%	0.77
C2	3.98	4.03	B	0.87	1.00	97%	90%	1.19
C3	3.71	4.21	H	0.47	0.63	86%	87%	0.86
C5	4.17	4.97	H	0.39	0.43	112%	81%	0.93
C8	3.89	4.47	H	0.66	0.69	110%	87%	0.99
C10	4.00	4.29	H	0.49	0.53	97%	97%	0.90
CM	3.88	3.36	L*	0.91	0.90	121%	84%	0.95
CP	4.47	4.74	H*	0.75	0.56	177%	75%	0.87
E1	3.28	4.58	H	0.51	0.50	109%	93%	0.75
E3	5.97	4.47	L	0.83	0.72	125%	92%	1.53
E5	3.37	3.79	H	0.36	0.51	95%	74%	0.83
E8	6.87	4.85	L	0.78	0.79	129%	77%	0.95
ES	3.81	3.65	B*	0.73	0.70	138%	75%	1.18
I1	6.44	4.76	L	0.69	0.84	96%	86%	1.09
I2	5.26	5.55	B	0.68	0.70	123%	79%	0.98
I3	6.79	5.34	L	0.67	0.77	108%	80%	1.16
I4	6.41	4.51	L	0.53	0.64	91%	92%	0.76
I8	3.81	4.09	H	0.55	0.64	98%	87%	0.78
IS	4.01	4.31	H*	0.65	0.50	143%	92%	1.27
P2	6.45	4.72	L	0.28	0.20	204%	69%	1.16
P3	5.25	4.76	L	0.60	0.68	96%	92%	0.97
P4	5.96	4.58	L	0.78	0.52	162%	92%	0.96
P5	5.43	4.65	L	0.83	0.76	115%	96%	1.25
PD	4.89	4.44	L*	1.13	1.33	142%	60%	0.92
PS	4.88	4.68	B*	0.89	0.92	138%	70%	1.32
W1	3.99	4.43	H	0.89	1.20	81%	92%	1.17
W3	4.48	5.22	H	0.88	0.69	138%	92%	1.06
W4	4.64	4.46	B	0.83	0.97	89%	95%	1.06
W5	4.62	4.72	B	0.86	0.87	112%	87%	1.03
W9	7.19	5.72	L	0.70	0.70	123%	81%	1.17
W10	4.18	4.16	B	0.87	1.41	67%	92%	0.98
W18	3.85	4.55	H	0.78	0.90	105%	83%	1.13
W19	5.08	3.76	L	0.63	0.50	136%	93%	0.78
WN	4.62	4.86	B*	0.93	0.97	132%	72%	1.04

care-seekers, divided by the "core" population, adjusted for the proportion of residents obtaining care from out-of-area sources. This ratio measures the physician-supply *actually* used by (and, so, available to) residents contacting in-area physicians.

Table 4.5 reports PSA physician-availability (and its components) and "core" physician-supply, grouped by Region. Expected and actual numbers of visits used, along with the corresponding PSA usage--need classification (Low, Balanced, High usage relative to expected need), are also denoted.

Influential communities generally exhibit greater physician-availability -- mostly achieved by physician-activity exceeding the proportion of physician-contacts attributed to out-of-area patients (see Table 4.5). Poor physician-availability in IS is explained by a smaller physician-supply. Compared with influential areas, however, some rural PSAs (e.g., most of Westman Region) have comparable/higher levels of physician-supply. These levels are achieved by the interaction of the size of physician-supply and the proportion of physician-activity generated by out-of-area residents -- that is, areas with lower physician-supply also exhibit greater out-of-area care-seeking by their residents. Patterns of physician-availability within other Regions -- particularly Eastman and Central -- exhibit greater variation and generally lower levels.

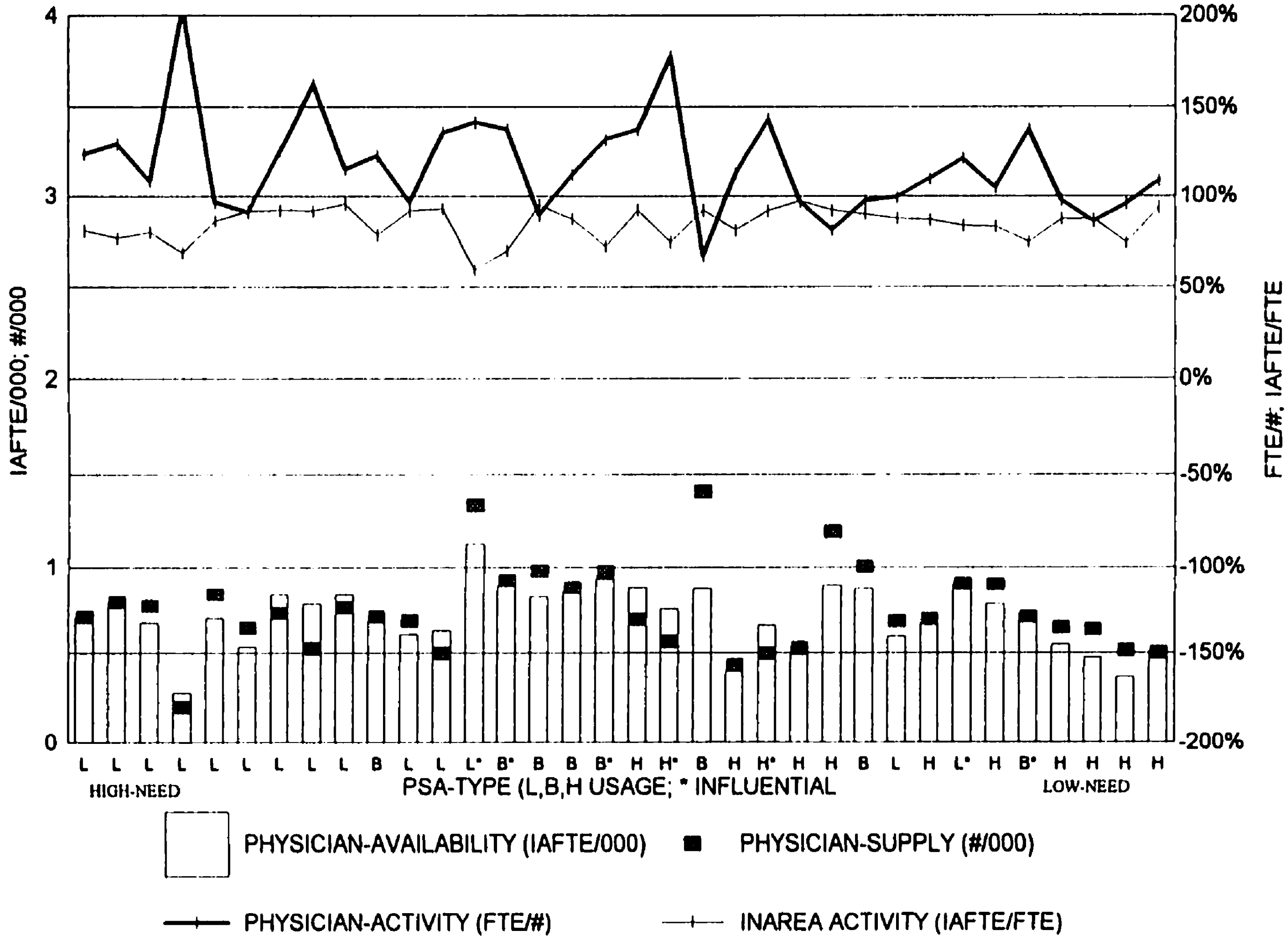
Surprisingly, physician-availability is very strongly correlated with physician-supply ($r = 0.84$, $p < 0.0001$). Only 9 out of 34 PSAs exceeded an (arbitrary) difference of 25% between physician-supply and availability (see Table 4.5). In general, variation in physician-supply is compensated for through the interaction between physician-activity and the proportion of physician-contacts attributed to in-area patients ($r = -0.39$, $p =$

0.023). Consistent with the methodology employed to calculate physician-availability, areas exhibiting close agreement between estimates of supply and availability are characterized by a balance between physician-activity (around 1.0 FTE, or 100% FTE) and the proportion of physician-workload generated by in-area patients (around 100%). Areas in which physician-availability exceeds physician-supply by more than 25% (i.e., CP, IS, P2, P4, W3, W19, WN) are characterized by physician-activity greater than 1.0 FTE, offsetting the effect of physician-contacts attributed to out-of-area patients. In contrast, PSAs in which physician-availability is lower than physician-supply by 25% (i.e., C3, E5, W1, W10) are characterized by physician-activity less than 1.0 FTE, not offsetting the effect of physician-contacts attributed to out-of-area patients.

"Core" physician-supply -- an alternative measure of physician-availability focusing on the subset of patient care-seeking and patient care-giving occurring within PSAs -- estimates higher levels of physician-availability and lower variation across rural Manitoba. At least as estimated for these "core" patterns of utilization, the availability of physicians is comparable across rural Manitoba settings. Whereas physician-availability is comparable among the proportion of the population obtaining care from in-in-area sources, these data do not consider the spectrum of ambulatory medical care obtained by the full population. Clearly, patterns of care-seeking as well as care-giving should be examined when assessing population access to physicians (see below).

Figure 4.3 graphically displays PSA physician-availability and its components, ranked in descending order by population expected need for ambulatory physician visits. PSAs are denoted by PSA-TYPE (usage higher than, in balance with, or less than,

FIGURE 4.3: PHYSICIAN-AVAILABILITY
BY DECREASING EXPECTED NEED FOR VISITS



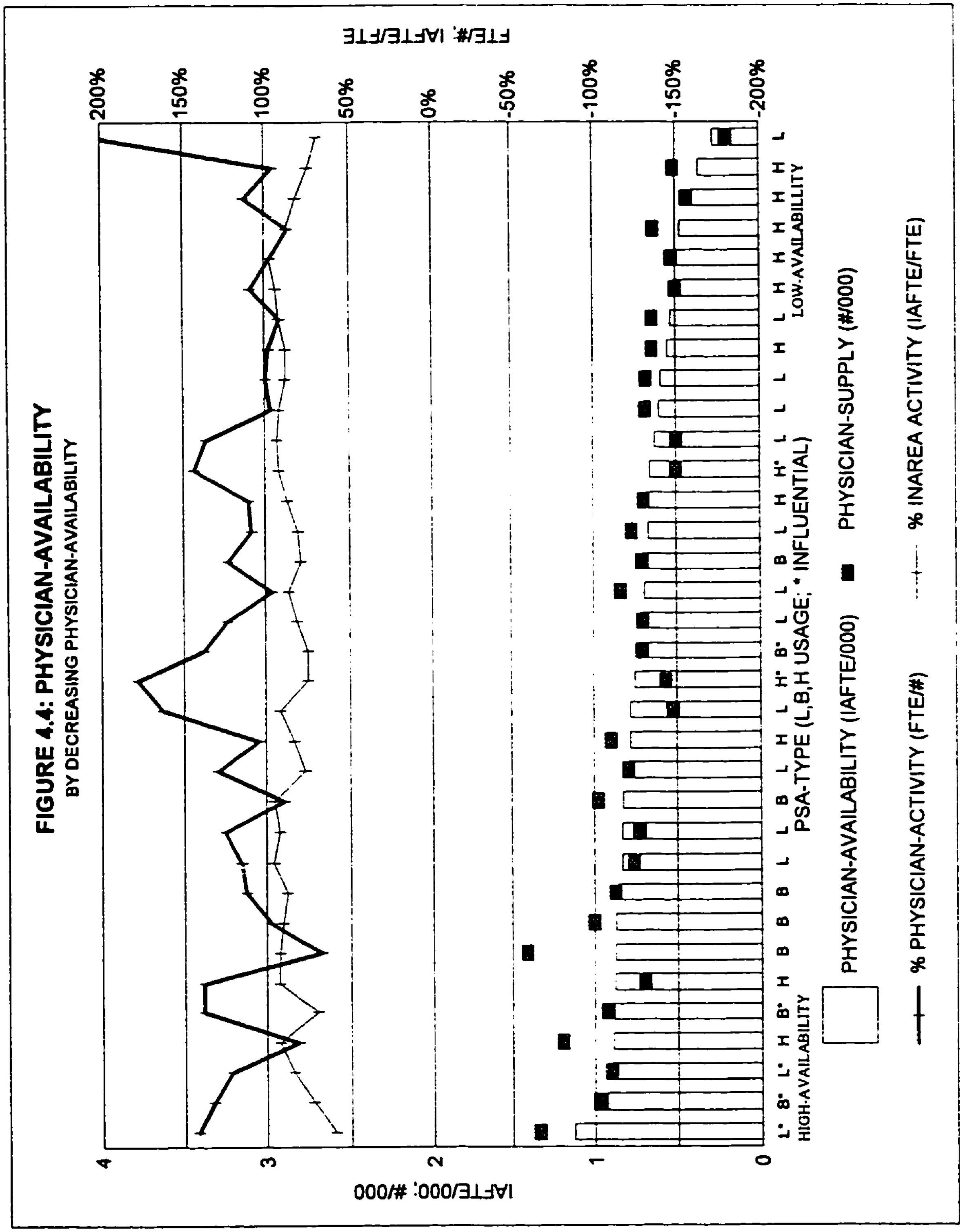


FIGURE 4.4: PHYSICIAN-AVAILABILITY
BY DECREASING PHYSICIAN-AVAILABILITY

expected levels). The generally close agreement between physician-availability and physician-supply as well as the role of percentage physician-activity and percentage in-area physician-activity are displayed. Physician-availability ranges widely across rural Manitoba (0.28 to 1.13 IAFTE/000), but variation exhibits little association with population expected need for ambulatory medical care ($r = 0.14$, $p = 0.42$). The distribution of physicians -- estimated both as physician-supply ($r = 0.11$, $p = 0.55$) and physician-availability ($r = 0.14$, $p = 0.42$) -- exhibits little association with population expected need for primary medical care. Although adjustment for the proportion of physician-activity directed towards in-area patients marginally increases the strength of correlation, the distribution of physicians across rural Manitoba clearly is not predicated on the need for medical care. Few areas exhibit excessively high (PD) or low (C3, C10, E5) levels of physician-availability. An inverse relationship between physician-activity and the proportion of this activity attributed to in-area patients offsets variation in physician-supply (see above).

Physician-availability and its components are also graphically displayed by decreasing physician-availability (see Figure 4.4). Through emphasizing the distribution physician-availability across rural Manitoba, insights into the relationship between physician-availability and its components are gained by considering groupings of PSAs: the 10 areas exhibiting high availability, the 10 areas with the low availability and the 14 areas between these extremes.

As expected, influential areas are confined to the higher physician-availability portion of the distribution, with four out of 10 high availability areas and three out of 14 mid availability areas drawn from these communities; four of the five highest physician-availability PSAs are influential communities. Physicians practicing in both the top and the bottom five areas of physician-availability provide substantial amounts of care to out-of-area patients. In the former case, these (mostly) influential sites are important sources of ambulatory care to both in-area residents and patients drawn from surrounding rural PSAs. In the latter case, although high proportions of these residents seek care from urban communities (mostly Winnipeg), they are "replaced" by patients drawn from more distant (adjoining) areas.

For the 10 low-availability areas, except P2 (the PSA with the lowest physician-availability), the remaining nine areas (E5, C5, C3, C10, E1, I4, I8, C1, P3) is a grouping characterized by low physician-activity. Although little relationship between PSA-TYPE and physician-availability was detected, six of the 10 low-availability PSAs are high-usage areas (H), characterized by patterns of usage greater than the expected need for ambulatory visits. Of the six PSAs with the lowest physician-availability, five are high-usage areas. However, from where is ambulatory care obtained? The residents of E5, C3, E1, I4 and I8 obtain substantial amounts of care from urban communities (mostly Winnipeg); the inhabitants of C5, C10, I8 and P3 made many ambulatory visits to influential rural sites; while only C1 is characterized by high proportions of in-area care-seeking (see Table 4.1). This latter exception of high in-area utilization is likely explained by CM physicians operating a clinic in C1. Overall, however, out-of-area care-seeking compensates for low physician-availability.

For the 10 high-availability areas (PD, WN, CM, W1, PS, W3, W10, C2, W5, P5), eight are characterized by either low (3) or balanced (5) patterns of usage compared with expected need for ambulatory physician visits. High physician-availability is determined by physician-activity exceeding 100% FTE offsetting physician-contacts attributed to out-of-area patients. This set includes:

- influential communities, providing care to in-area residents and adjacent areas, that exhibit high physician-activity and significant proportions of patient-contacts from out-of-area patients (PD, WN, CM, PS);
- "self-contained" areas, mostly serving in-area residents, that exhibit lower physician-activity and few physician-contacts from out-of-area patients (W1, W10, C2, W5); and
- "hybrid" areas, rendering high amounts of ambulatory care mostly to in-area residents, that are characterized by high physician-activity and few physician-contacts from out-of-area patients (W3, P5).

It is not clear why the greater variation in physician-availability occurs within these areas.

Finally, for the 14 mid availability areas (E3, W4, E8, W18, P4, CP, ES, W9, I1, I2, I3, W19), seven are low-usage, three are balanced-usage, and four are high usage. As for the high availability areas, physician-availability arises from consistently greater physician-activity. Compared with the high availability grouping, however, lower physician-availability among these areas is explained by greater physician-activity generated by out-of-area patients.

Although it is discouraging to detect fourfold differences in physician-supply and physician-availability within rural Manitoba, finding that high need areas are not systematically disadvantaged is, however, encouraging. The interpretation of these findings, however, is limited by not considering the role of out-of-area care-seeking by rural residents. Residents facing low physician-availability may obtain needed (or otherwise) ambulatory medical care through contacts made with out-of-area physicians. As noted in Section 4.1, substantial out-of-area care-seeking occurs in certain PSAs -- mostly those adjacent to rural/urban influential areas, especially those adjoining Winnipeg. An alternative measure, "core" physician-supply -- the ratio of the "core" physician-supply to the proportion of the "core" population seeking from in-area physicians -- estimates higher levels of physician-availability and lower variation across PSAs. These findings suggest that measures of physician-availability provide only partial insight into the ability of residents to obtain ambulatory medical care. Clearly, out-of-area care-seeking provides the missing component underlying patterns of population care-seeking. Therefore, a broader measure of a population's ability to obtain ambulatory medical care -- physician-accessibility -- is considered.

4.2.3 PHYSICIAN-ACCESSIBILITY

Access to primary medical care is determined by the local (in-area) availability of general practitioners and residents' willingness to obtain care from out-of-area sources as required -- on an *ad hoc* or a continuing basis -- because of poor physician-availability or expressed preferences for alternative sources of care. Three measures of rural populations' access to medical care in rural settings are employed:

- the population contact rate, the proportion of the population making at least one physician visit;
- the average number of visits per residents made to all (in-area and beyond) physicians

TABLE 4.6: PHYSICIAN-ACCESSIBILITY (CONTACTS, UTILIZATION, EFFECTIVE PHYSICIAN-SUPPLY), GROUPED BY REGION

PSA	PHYSICIAN-VISITS				MD-CONTACT	USE OF ALL CARE		EFFECTIVE MD-SUPPLY	
	NEEDED	ACTUAL	PSA-TYPE	SOURCE OF CARE	% RESIDENTS > = 1 VISIT	VISITS PER CAPITA	VISITS PER PATIENT	PER CAPITA MD-SUPPLY	PER PATIENT MD-SUPPLY
	EAV	AV	L,B,H;*	%INAREA	%AP/R	AV/R	AV/AP	EFTE/000	EFTE/000AP
C1	3.94	3.22	L	75.11%	77.17%	3.22	4.12	0.92	1.19
C2	3.98	4.03	B	72.81%	80.22%	4.03	4.75	1.19	1.49
C3	3.71	4.21	H	56.10%	81.88%	4.21	5.14	1.08	1.32
C5	4.17	4.97	H	42.84%	84.62%	4.97	5.92	1.10	1.30
C6	3.89	4.47	H	67.41%	82.60%	4.47	5.12	1.17	1.42
C10	4.00	4.29	H	52.46%	80.35%	4.29	5.24	1.11	1.38
CM	3.88	3.36	L*	93.12%	76.65%	3.36	4.33	0.98	1.27
CP	4.47	4.74	H*	88.42%	82.57%	4.74	5.68	1.00	1.21
E1	3.28	4.58	H	67.69%	83.02%	4.58	5.56	1.15	1.38
E3	5.97	4.47	L	57.44%	77.80%	4.47	6.09	1.19	1.53
E5	3.37	3.79	H	41.32%	82.07%	3.79	4.97	1.03	1.26
E8	6.87	4.85	L	69.38%	79.93%	4.85	5.40	1.27	1.59
ES	3.81	4.09	H*	75.28%	79.26%	4.09	4.72	1.03	1.30
I1	6.44	4.76	L	67.42%	83.11%	4.76	5.80	1.18	1.42
I2	5.26	5.55	B	70.34%	83.91%	5.55	6.08	1.29	1.53
I3	6.79	5.34	L	63.46%	77.80%	5.34	6.09	1.43	1.84
I4	6.41	4.51	L	66.25%	81.11%	4.51	5.66	0.94	1.15
I8	3.81	3.65	B	67.33%	80.86%	3.65	5.18	1.11	1.37
IS	4.01	4.31	H*	50.74%	83.23%	4.31	5.19	1.16	1.39
P2	6.45	4.72	L	26.85%	82.98%	4.72	5.84	1.19	1.43
P3	5.25	4.76	L	60.97%	79.60%	4.76	5.30	1.26	1.58
P4	5.96	4.58	L	78.94%	79.42%	4.58	5.43	1.00	1.26
P5	5.43	4.65	L	59.46%	81.87%	4.65	5.59	1.29	1.58
PD	4.89	4.44	L*	92.26%	81.66%	4.44	5.03	1.34	1.64
PS	4.88	4.68	B*	90.38%	81.04%	4.68	5.39	1.07	1.32
W1	3.99	4.43	H	76.74%	79.44%	4.43	5.17	1.25	1.58
W3	4.48	5.22	H	83.08%	84.40%	5.22	5.90	1.27	1.50
W4	4.64	4.46	B	77.80%	79.47%	4.46	5.20	1.25	1.57
W5	4.62	4.72	B	83.76%	80.93%	4.72	5.38	1.28	1.59
W9	7.19	5.72	L	62.14%	84.60%	5.72	6.67	1.39	1.64
W10	4.18	4.16	B	87.25%	77.84%	4.16	4.74	1.20	1.54
W18	3.85	4.55	H	69.80%	82.27%	4.55	5.21	1.18	1.43
W19	5.08	3.76	L	77.26%	75.19%	3.76	4.67	0.94	1.25
WN	4.62	4.86	B*	91.51%	81.91%	4.86	5.42	1.21	1.48

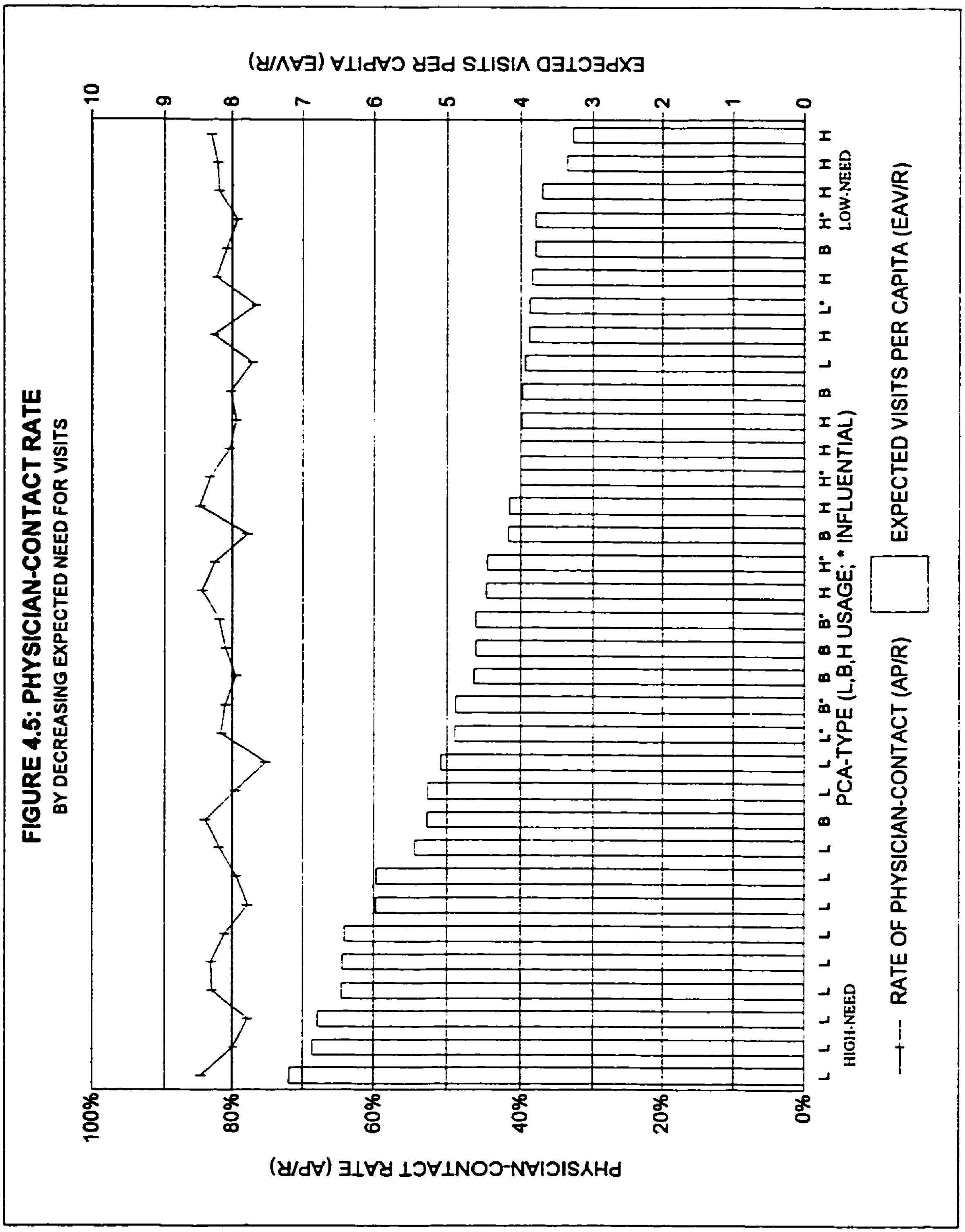
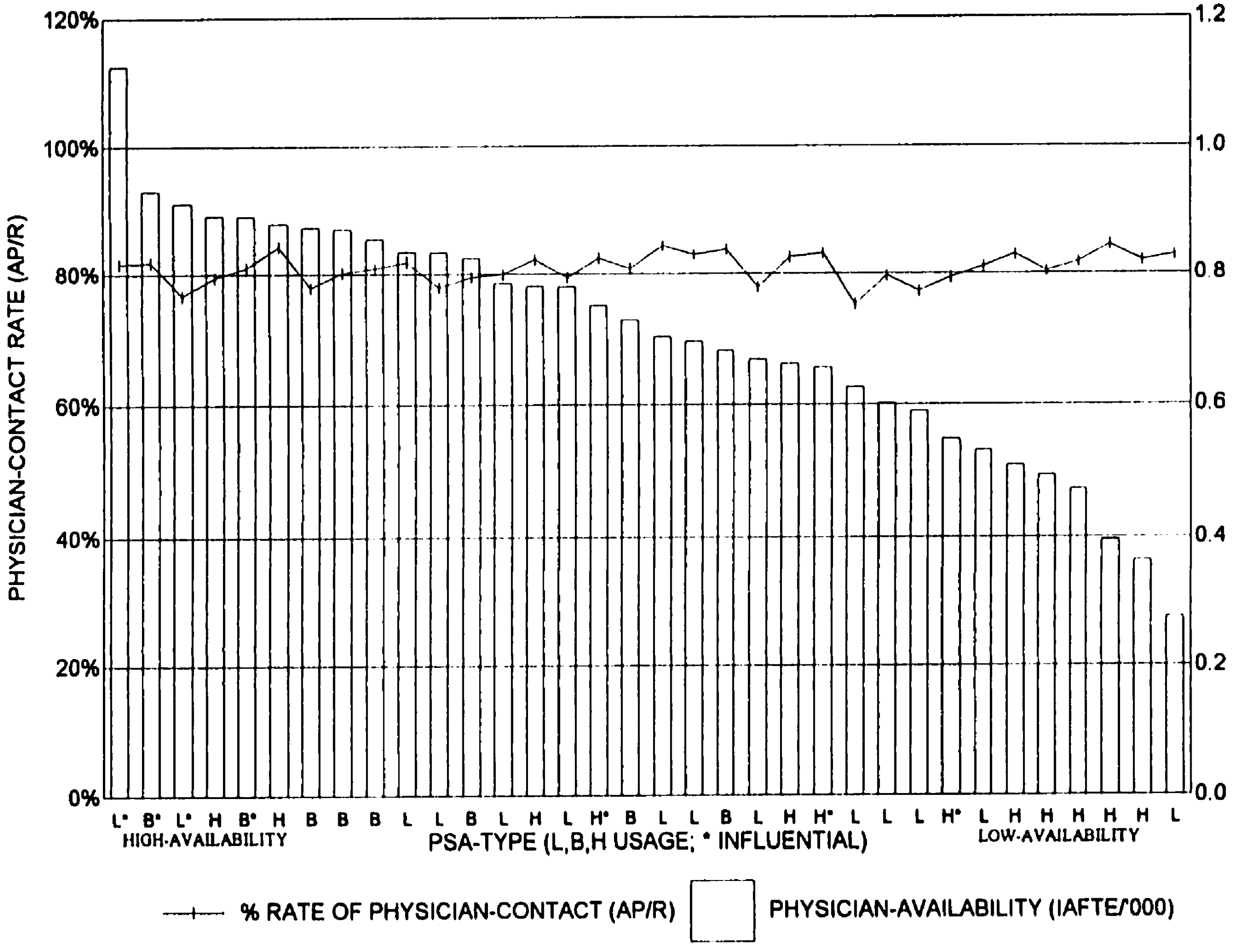


FIGURE 4.5: PHYSICIAN-CONTACT RATE
BY DECREASING EXPECTED NEED FOR VISITS

FIGURE 4.6: PHYSICIAN-CONTACT RATE

BY DECREASING PHYSICIAN-AVAILABILITY



contacted by the population; and

- the "effective" availability of full-time-equivalent physicians to the population.

Table 4.6 displays these values by PSA, grouped by Region. Expected (needed) visits and actual utilization are also displayed, along with PAS-TYPE (High, Balanced and Low usage relative to expected rates of visits). Because of concern about satisfying residents' need (demand) for primary medical care using in-area physicians, the proportion of care-seeking to in-area physicians is also reported.

Population rate of physician-contact -- the percentage of residents making at least one visit to a generalist practitioner, regardless of practice location -- is a key measure of residents' ability to obtain needed (and beyond) primary medical care. In Table 4.6, the physician contact-rate is consistently high across PSAs, regardless of region, ranging from a low of 74% (W19, an isolated, needy area) to a high of 85% (C5, adjacent to WN and CP). Physician contact-rate also exhibits little relationship with estimated population need for ambulatory medical care ($r = 0.021$, $p = 0.91$; see Figure 4.5), or with physician-availability (see Figure 4.6; $r = -0.24$, $p = 0.18$).

Interpreting findings of consistently high levels of physician-contact is problematic. On one hand, equally high access for all residents, no matter place of residence, is an important accomplishment. On the other hand, however, access to physicians is clearly not based on comparative need for primary medical care. While rates of physician-contact exceeding 80% are appropriate for high need areas, do healthier populations really benefit from this high level of annual contact? For disadvantaged populations, their greater need for medical care may explain the high rates of physician-contact, even in the face of distance and other barrier. For healthier residents, however, ease of access to physicians (in-area and beyond) may explain these residents' (and/or physicians') preferences for high rates of physician-contact.

Physician-accessibility, estimated as the average number of visits per resident (*per capita*) to all generalist physicians (AV/R), reflects:

- the proportion of residents making at least one physician contact annually (i.e., the ratio of patients to residents; AP/R), and
- the average number of physician visits made annually by these patients (AV/AP).

The relationship between accessibility and its components is denoted by the identity,

$$AV/R = AP/R \times AV/AP.$$

While variation in the *per capita* utilization of physician visits is an important, widely used measure of population access to medical care, this variable reflects both demand and supply behaviours. Variation in the proportion of residents making at least one physician contact (AP/R) reflects differences in populations' attitudes towards medical care and the effects of distance and other barriers limiting usage (see above). For residents contacting physicians, however, the resulting patient utilization (or physician visit-intensity) (AV/AP) is determined by complex factors bearing upon the patient--physician (inter)relationship. Distinguishing between these effects is important -- that is, for comparable physician-accessibility, populations exhibiting lower rates of physician-contact and higher patient visit-utilization present different policy issues than areas displaying greater contact, but lower usage.

Figure 4.7 graphically displays physician-accessibility estimated as visit-usage,

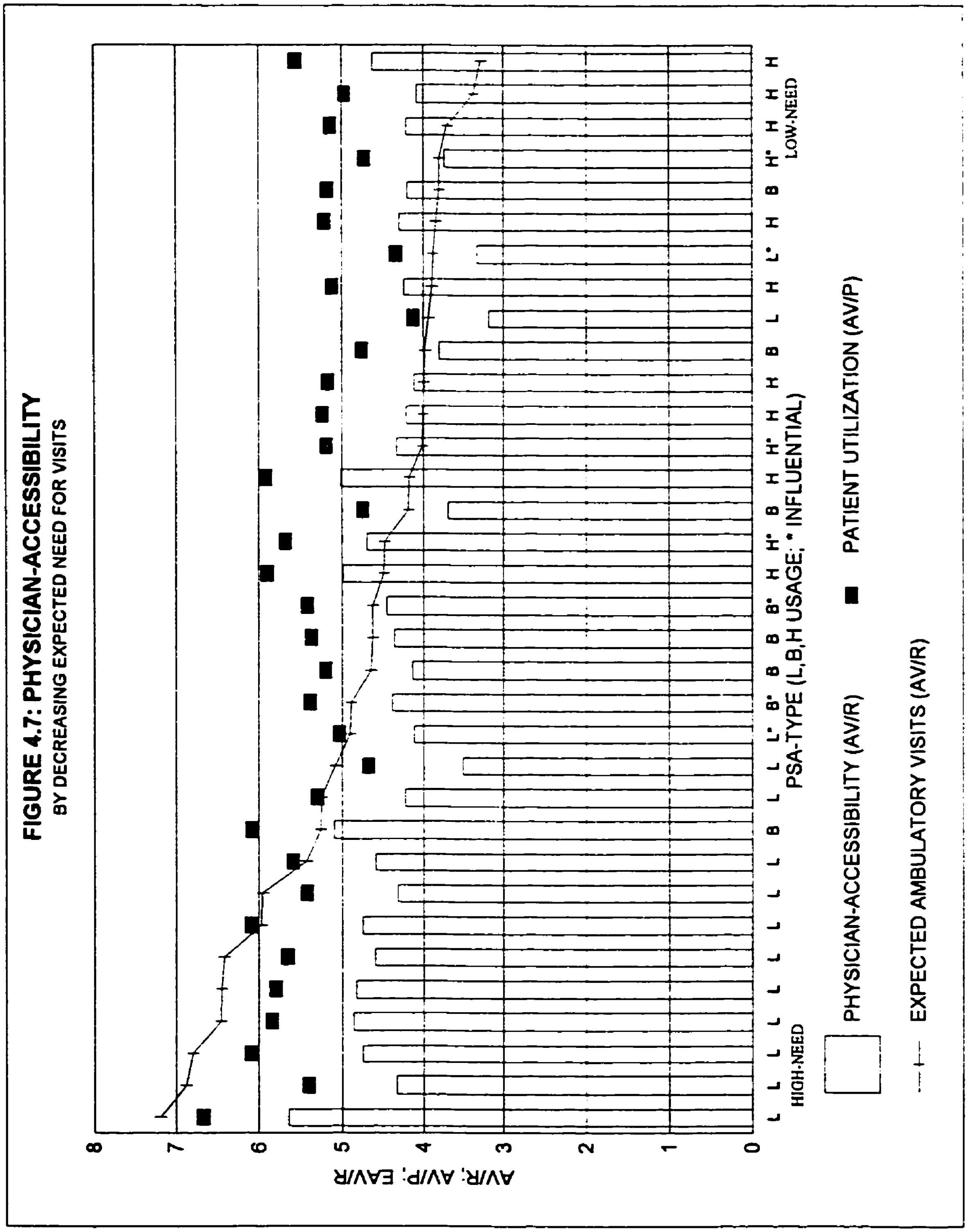
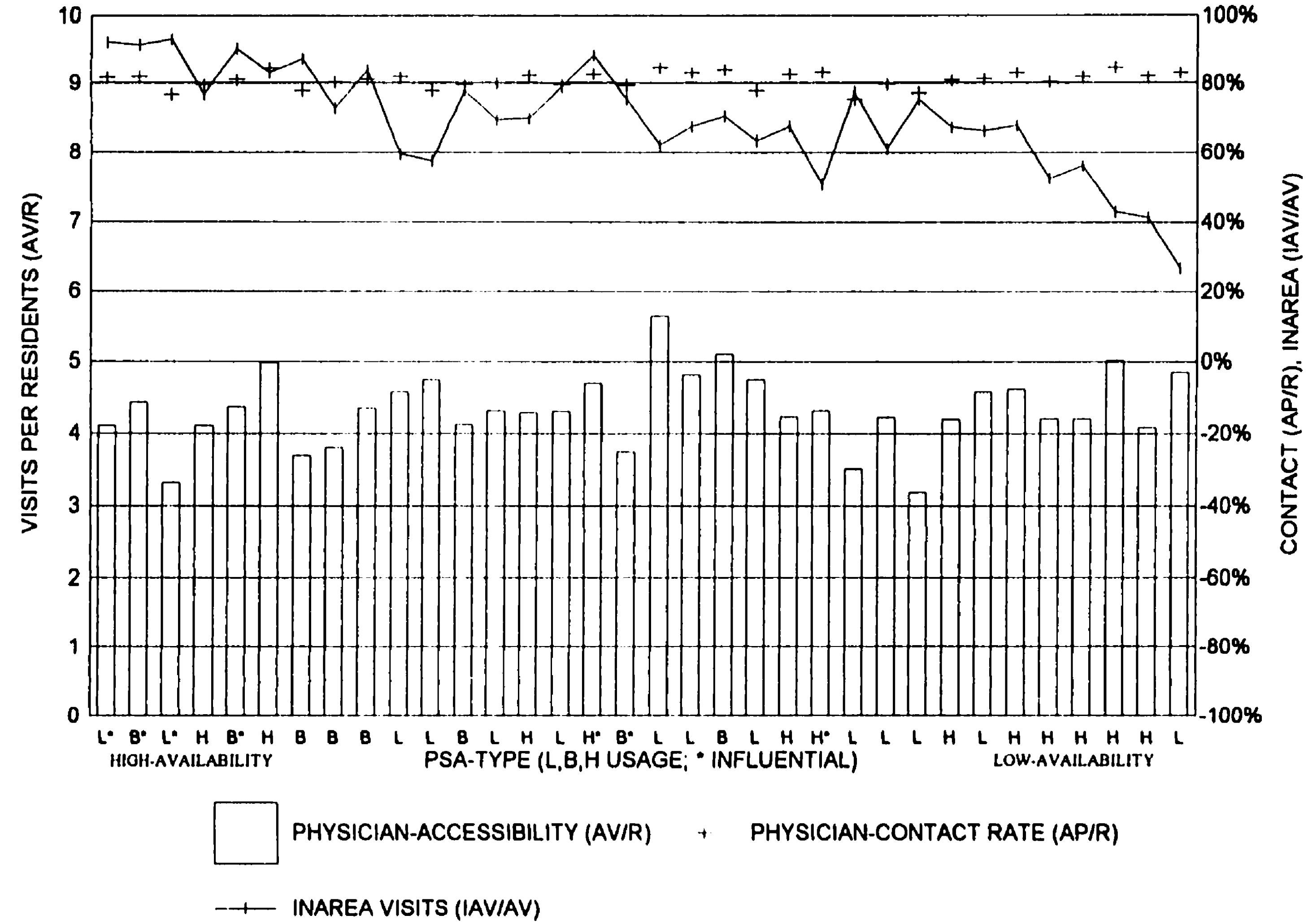


FIGURE 4.7: PHYSICIAN-ACCESSIBILITY
BY DECREASING EXPECTED NEED FOR VISITS
AV/R; AV/P; EAV/R
0
1
2
3
4
5
6
7
8
L L L L L L L L L L B L L L L' B' B B B' H H' B H H' H H B L H L' H B H' H H H
HIGH-NEED
LOW-NEED
PSA-TYPE (L,B,H USAGE; * INFLUENTIAL)
PHYSICIAN-ACCESSIBILITY (AV/R)
PATIENT UTILIZATION (AV/P)
EXPECTED AMBULATORY VISITS (AV/R)

ranked in order of decreasing need for ambulatory physician visits. To simplify analysis, expected need for ambulatory medical care is displayed and the PSAs are denoted by PSA-TYPE (low, balanced, and high patterns of usage relative to expected levels). As population rate of physician-contact is invariant with respect to expected need, this component of physician-accessibility is excluded in order to simplify the graph. Physician-accessibility estimated as average visits per resident exhibits a very weak relationship with expected need for ambulatory medical care, with levels of patient utilization increasing marginally for mid and high need areas. As first displayed on Figure 4.2 and replicated here, however, expected and used visits *per capita* exhibits some agreement for PSAs classified as low to mid need, utilization is too low within the high need areas. In contrast, comparing populations on the basis of expected visits per resident to patient utilization (i.e., average visits per *patient*) detects patterns of excess visit-utilization across low to mid need areas, with the high need PSAs exhibiting agreement between expected and consumed rates of visits.

The issue faced by policy-makers becomes what does (should) the average expected number of visits per resident measure? As currently constructed, this indicator reflects population patterns of utilization adjusted for demographic, health, and socioeconomic factors. However, this measure does not distinguish between residents' initial contact with physicians and their resulting utilization of ambulatory visits. This analysis suggests that for comparable rates of contact found in rural Manitoba, patients in the mid to (especially) low need areas make excessive numbers of visits. In Figure 4.8, physician-accessibility across PSAs exhibits little association with physician-

FIGURE 4.8: PHYSICIAN-ACCESSIBILITY
BY DECREASING PHYSICIAN-AVAILABILITY



availability ($r = 0.060$, $p = 0.73$).

Finally, a third measure of accessibility -- the effective full-time equivalent physician-supply per thousand residents (EFTE/000) accessed by area residents -- is estimated as all medical care (specialists and generalists; ambulatory and beyond) obtained from all physicians no matter where contact occurred. Again, the underlying components include:

- the proportion of residents making at least one physician visit annually (i.e., the ratio of patients to residents; AP/R); and
- the effective full-time-equivalent physician-supply contacted by these patients (EFTE/000AP).

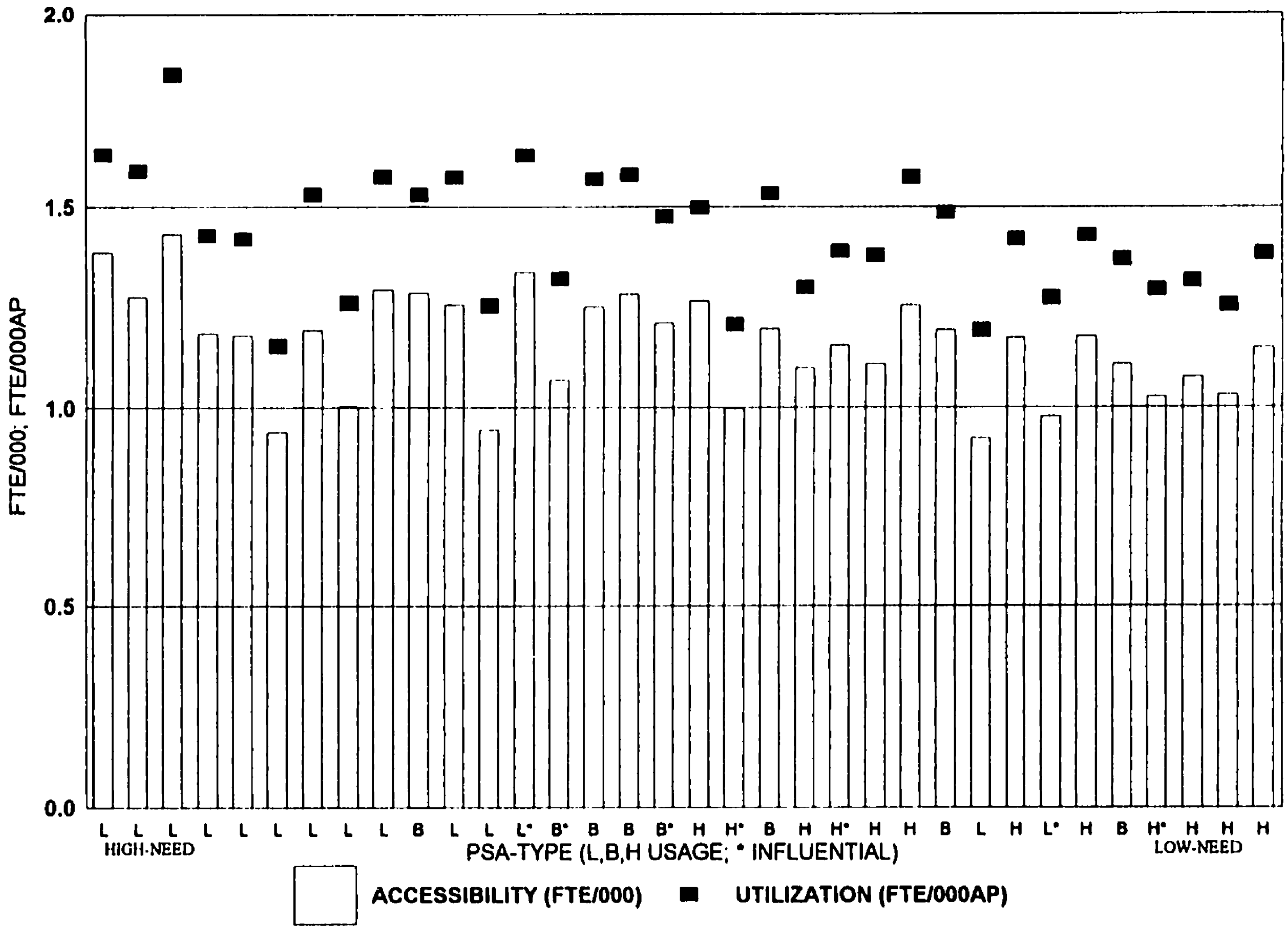
The relationship between these factors is denoted by the identity,

$$EFTE/000 = AP/R \times EFTE/000AP.$$

The effective physician-supply accounts for the full spectrum of medical care used by these populations. In encompassing all patients and all sources of care, this ratio is not distorted by the misclassification of residents and physicians. As above, the two effects of contact and resulting utilization are distinguished, but the physician contact-rate is not displayed to simplify the graphical analysis.

In Figure 4.9, physician-accessibility, estimated as the effective physician-supply available to PSAs, exhibits a moderate strength association of increasing accessibility with greater need for physician visits ($r = 0.45$, $p = 0.007$). Indeed, the greatest effective physician-supply of 1.84 full-time equivalent physicians per thousand residents was estimated for I3 -- an isolated area ranked third highest by need for physician visits.

FIGURE 4.9: PHYSICIAN-ACCESSIBILITY
BY DECREASING EXPECTED NEED FOR VISITS



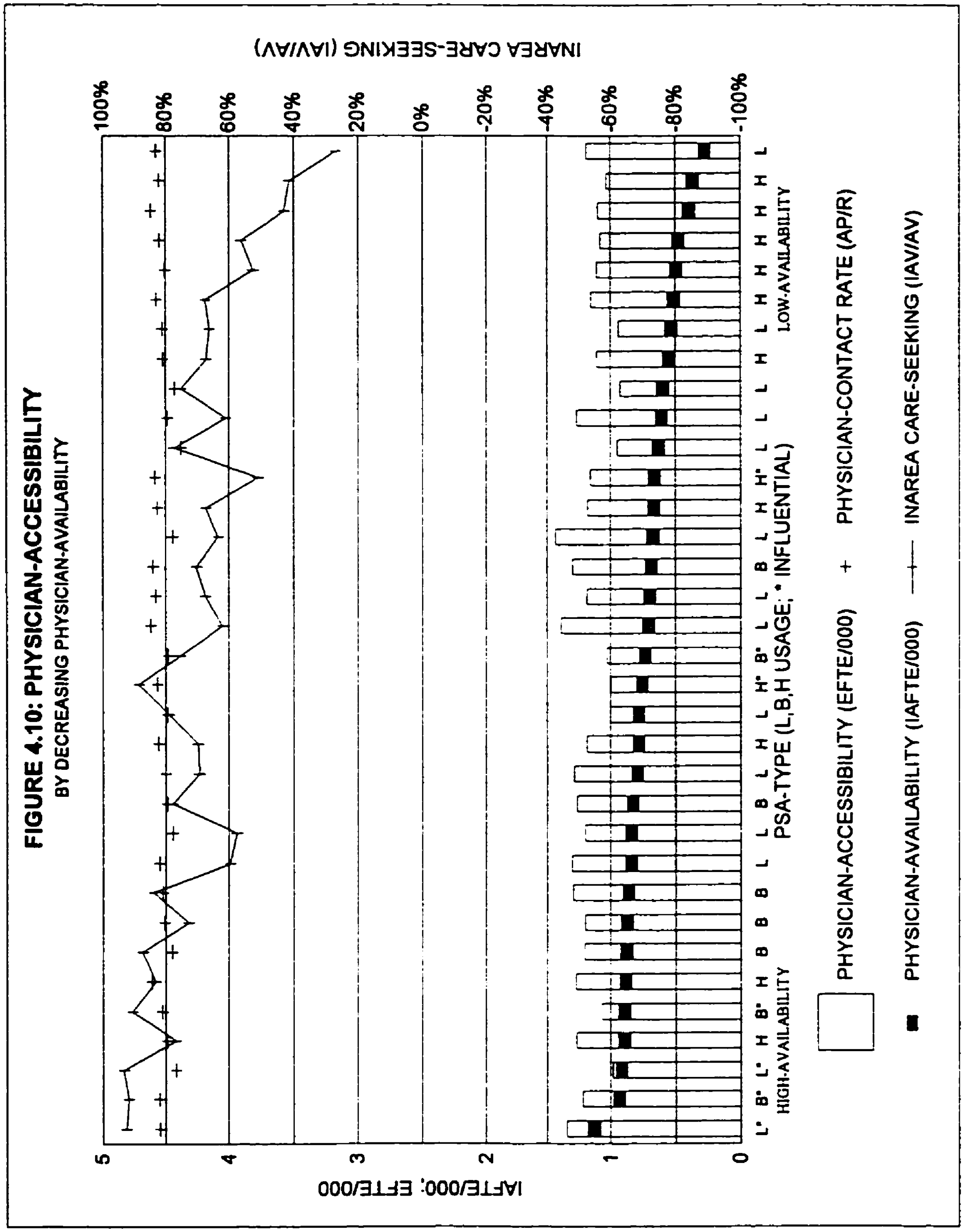


FIGURE 4.10: PHYSICIAN-ACCESSIBILITY
BY DECREASING PHYSICIAN-AVAILABILITY

However, the area with the lowest effective-supply of 1.15 full-time-equivalent physicians per thousand residents is I4, an isolated area adjacent to I3, ranked sixth highest by need for physician visits. With its greater distance to Winnipeg, the residents of I4 rely slightly more on the in-area physician-supply than that of I3. In contrast, the I3 population makes greater contact with Winnipeg physicians. Indeed, in spite of its greater distance, I3 out-of-area care-seeking to Winnipeg compares favourably to high users directly adjacent to this influential source of physicians (see Table 4.1).

Although the role of physician-availability is thought to influence patterns of primary medical care utilization, extensive out-of-area care-seeking may offset (cause) poor availability. Figure 4.10 displays physician-accessibility, estimated as the effective physician-supply and sorted in order of decreasing physician-availability. The rate of physician-contact is also displayed to detect any trends between contact and physician-availability. Percentage population in-area care-seeking is included to aid interpretation.

The percentage of in-area care-seeking strongly decreases with physician-availability ($r = 0.78$, $p < 0.0001$), this effect is especially notable for the eight PSAs exhibiting the lowest physician-availability. No evidence was found of a relationship between effective physician-supply (either on a resident or a patient basis) and physician-availability. In the face of a threefold range in physician-availability (from 0.28 to 1.13 IAFTE/000), how do rural areas maintain comparable level of physician-accessibility? Areas with high physician-availability are key influential communities (PD, WN, CM, PS) and other rural areas characterized by high rates of in-area care-seeking. In contrast, areas with poor physician-availability exhibit low rates of in-area care-seeking. For these areas, poor local availability is compensated for (or caused by) care-seeking to adjoining influential areas, usually, Winnipeg. For example, P2, the PSA with the lowest physician-availability, exhibits the lowest amount of in-area care-seeking (26.85%), but the highest proportion of out-of-area care-seeking to an influential community (52.84% to PS), with the net result of comparable physician-accessibility. It is not clear, however, if increased physician-availability would overcome patterns of low (L) usage compared with expected visits. For all areas, physician-accessibility is enhanced by even small amounts of out-of-area care-seeking.

For both influential and non influential PSAs, physician-accessibility estimated as physician-contact exhibits very little relationship with expected need for medical care ($r = 0.021$, $p = 0.91$) and only a weak relationship with physician-availability ($r = -0.24$, $p = 0.18$). These relationships are more pronounced for the comparison of the EFTE/000 estimate of physician-accessibility with need (moderate strength; $r = 0.45$, $p = 0.007$) and with availability (weak strength; $r = 0.37$, $p = 0.03$). These stronger associations may reflect the wider range of care/services included in the FTE measure and differences between in-area and out-of-area care-seekers in their usage of primary medical care.

As little variation in population rate of physician-contact occurs across PSAs, differences in physician-accessibility are determined by patterns of visit-utilization following contact -- that is, the complex behavioural interactions between patients and physicians during episodes of illness. Among patients, visit-utilization is strongly correlated with need for ambulatory visits ($r = 0.63$, $r < 0.0001$), but exhibits little association with physician-availability ($r = -0.099$, $p = 0.57$) and only a weak

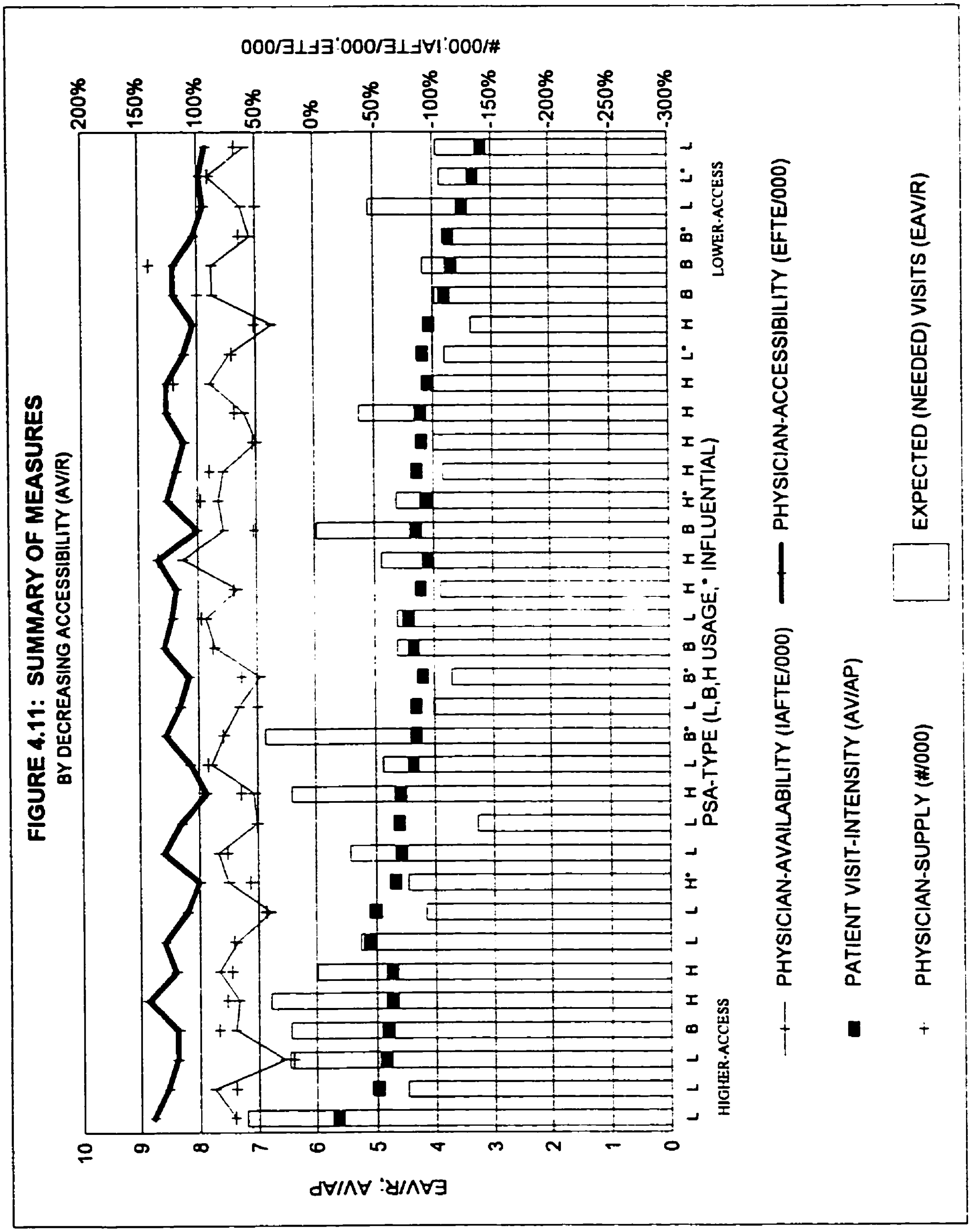


FIGURE 4.11: SUMMARY OF MEASURES
BY DECREASING ACCESSIBILITY (AV/R)

relationship to physician competition (r = 0.22, p = 0.20). These findings are very encouraging as they suggest that variation in rural primary medical care utilization is more related to differences in need than with the respective responses of residents and/or physicians to prevailing levels of physician-availability and physician-competition.

The mechanisms responsible for comparable physician-accessibility across rural Manitoba differ by PSA-TYPE -- that is, the residents of more isolated areas characterized by low out-of-area utilization achieve high accessibility through the greater use of in-area physician while areas adjoining the U/IRs enhance accessibility through out-of-area utilization. While physician-availability (IAFTE/000) varies widely across PSAs, physician-accessibility (AV/AP and EFTE/000) exhibits a moderate positive correlation with expected need for ambulatory medical care. Imbalances in physician-availability might be redressed by out-of-area care seeking to influential areas; however, for more distant PSAs, within-area care-seeking assumes greater importance in determining physician-accessibility.

Figure 4.11 summarizes relationships between ambulatory medical care utilization (AV/R) and

- population expected need for ambulatory physician visits (EAV/R),
- physician-supply (#/000),
- physician-availability (IAFTE/000), and
- physician-accessibility (patient visit-intensity, AV/AP, and effective physician-supply, EFTE/000).

Population rates of physician-contact are not displayed since this measure of population access to medical care is invariant with respect to physician-supply, physician-availability, and physician-accessibility (about 80% across rural PSAs; see above). Values are displayed by decreasing physician-accessibility estimated as average patient visit-intensity.

Although physician-accessibility (EFTE/000) varies moderately across rural Manitoba, differences occur in the levels of patient visit-intensity ($r = 0.42$, $p = 0.014$), not in the rates of physician-contact ($r = 0.24$, $p = 0.18$).

Overall, while equity has been achieved in population visits to general practitioners, access to *all* medical services rendered by generalists and specialists is greater in areas characterized by higher patient visit-intensity (AV/AP). This trend likely reflects distance and other barriers limiting access to urban-based specialists. As noted above, many PSAs exhibiting high visit-intensity are adjacent to Brandon and, especially, Winnipeg. Finally, imbalances in physician-supply, which exhibits the greatest degree of variation, is mitigated by the countervailing actions of physician-activity, population out-of-area care-seeking, and the range of medical care incorporated in the above measures.

4.3 DETERMINANTS OF PATTERNS OF PHYSICIAN-SUPPLY CARE-GIVING

The perspectives of physician-supply and population in explaining patterns of utilization across small areas are complementary notions in the ledger accounting for patterns of primary medical care utilization. This section is concerned with the relationship between physician-activity (workload) and physician-competition -- specifically, variation in the patient-load managed and in the intensity of visits rendered to these patients.

4.3.1 PHYSICIAN-COMPETITION

Although physician-competition is typically estimated as physician-supply -- the ratio of in-area physician head count to in-area population (#/000) -- this measure can be misleading due to numerator and denominator effects. First, while most physicians achieve full-time equivalent status, their average activity (FTE/#) varies more widely: from a few areas where physicians provide only limited amounts of care to those where the average activity is "equivalent" to 1.5 (or more) physicians. Therefore, unless head count closely approximates full-time-equivalent status, physician-supply is an inaccurate (possibly biased) measure of physician-competition.

Second, the consumers contacting these physicians may not correspond to the in-area population due to PSA residents seeking care from out-of-area sources as well as outside patients obtaining care from area physicians. Moreover, for certain PSAs, physicians from elsewhere periodically practice in-area, thereby augmenting (or providing) the local supply. The multiplier factor (000/E000) relating PSA population (000) to the effective number of residents actually served by in-area physicians (E000), both in thousands, estimates the imbalance between population and practice. For influential PSAs, this ratio should be less than 1.00 (or less than 100%) while, for areas adjacent to Winnipeg (and other influential communities), the ratio should be much larger than one. The following identity highlights the relationship between physician-competition and its components,

$$FTE/E000 = \#/000 \times FTE/\# \times 000/E000.$$

In rural Manitoba physician-completion is moderate, generally exceeding 1.0 FTE

TABLE 4.7: PHYSICIAN-COMPETITION AND COMPONENTS, GROUPED BY REGION

PSA	AMBULATORY PHYSICIAN VISITS			PHYSICIAN COMPETITION AND COMPONENTS			
	NEEDED	USED	PSA-TYPE	COMPETITION	SUPPLY	ACTIVITY	PRACTICE
	EAV	AV	L,B,H;*	FTE/E000	#/000	FTE/#	000/E000
C1	3.94	3.22	L	0.79	0.68	0.99	116.53%
C2	3.98	4.03	B	1.20	1.00	0.97	123.49%
C3	3.71	4.21	H	0.84	0.63	0.86	154.96%
C5	4.17	4.97	H	0.92	0.43	1.12	189.34%
C8	3.89	4.47	H	0.96	0.69	1.10	128.61%
C10	4.00	4.29	H	0.94	0.53	0.97	184.77%
CM	3.88	3.36	L*	0.98	0.90	1.21	89.81%
CP	4.47	4.74	H*	0.85	0.56	1.77	84.74%
E1	3.28	4.58	H	0.75	0.50	1.09	137.84%
E3	5.97	4.47	L	1.45	0.72	1.25	160.41%
E5	3.37	3.79	H	0.88	0.51	0.95	179.50%
E8	6.87	4.85	L	1.13	0.79	1.29	110.63%
ES	3.81	4.09	B*	0.96	0.70	1.38	99.56%
I1	6.44	4.76	L	1.03	0.84	0.96	127.68%
I2	5.26	5.55	B	0.97	0.70	1.23	111.83%
I3	6.79	5.34	L	1.05	0.77	1.08	126.33%
I4	6.41	4.51	L	0.80	0.64	0.91	138.14%
I8	3.81	3.65	H	0.81	0.64	0.98	129.85%
IS	4.01	4.31	H*	1.29	0.50	1.43	180.71%
P2	6.45	4.72	L	1.03	0.20	2.04	257.47%
P3	5.25	4.76	L	0.99	0.68	0.96	150.22%
P4	5.96	4.58	L	0.99	0.52	1.62	116.01%
P5	5.43	4.65	L	1.40	0.76	1.15	160.68%
PD	4.89	4.44	L*	1.22	1.33	1.42	64.63%
PS	4.88	4.68	B*	0.98	0.92	1.38	77.70%
W1	3.99	4.43	H	1.16	1.20	0.81	119.80%
W3	4.48	5.22	H	1.06	0.69	1.38	111.13%
W4	4.64	4.48	B	1.06	0.97	0.39	121.90%
W5	4.62	4.72	B	1.02	0.87	1.12	104.44%
W9	7.19	5.72	L	1.13	0.70	1.23	130.47%
W10	4.18	4.16	B	1.00	1.41	0.67	105.45%
W18	3.85	4.55	H	1.12	0.90	1.05	119.07%
W19	5.06	3.76	L	0.81	0.50	1.36	120.05%
WN	4.62	4.86	B*	1.02	0.97	1.32	79.20%

physicians per 1000 residents in 22 PSAs, but marginally lower than 1.0 for nine areas, and between 0.81 and 0.75 for the remaining five sites (see Table 4.7). As expected, physician-supply underestimates physician-competition in most areas.
Indeed, through interactions between the effective population severed and physician-activity, physician-supply less than 1.0 physician per thousand population are augmented.

Physician-competition varies both between and within Regions. Western Region, and, to a lesser extent, Parkland exhibits uniformly high competition (all at least 1.0, with the exceptions of W19 and P5). Central, Eastman and Interlake Regions exhibit greater variation. Higher physician-competition (e.g., P5) arises from the combined effects of a greater in-area physician-supply and a smaller effective population served while, in contrast, lower competition (e.g., C1) exhibits the effects of a small physician-supply serving a large effective population.

Consistent with their role as influential sites serving patients from adjacent (and beyond) areas, the influential communities (with the notable exception of IS) exhibit a net-gain in the effective population managed. Physicians in E5, IS and P2 manage lower effective populations due to the net-loss of patients to out-of-area practitioners. However, does physician-competition vary systematically with factors of concern to physicians, residents, and/or policy-makers?

First, consider the relationship between population need for primary medical care and the distribution of physicians across PSAs. In Figure 4.12, physician-competition and its components -- physician-supply, average physician-activity and the population-to-practice ratio -- are displayed in descending order by population expected need for

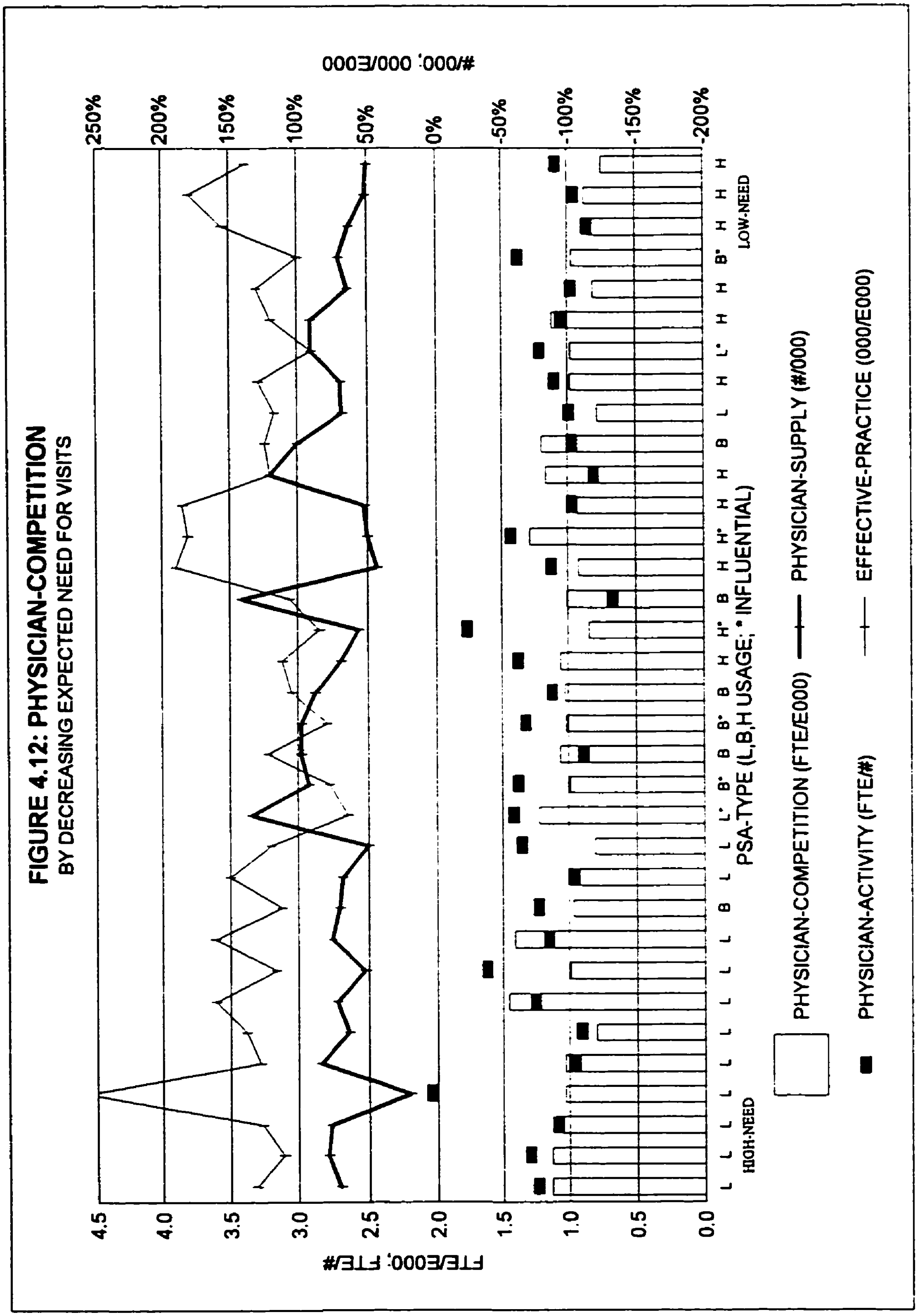
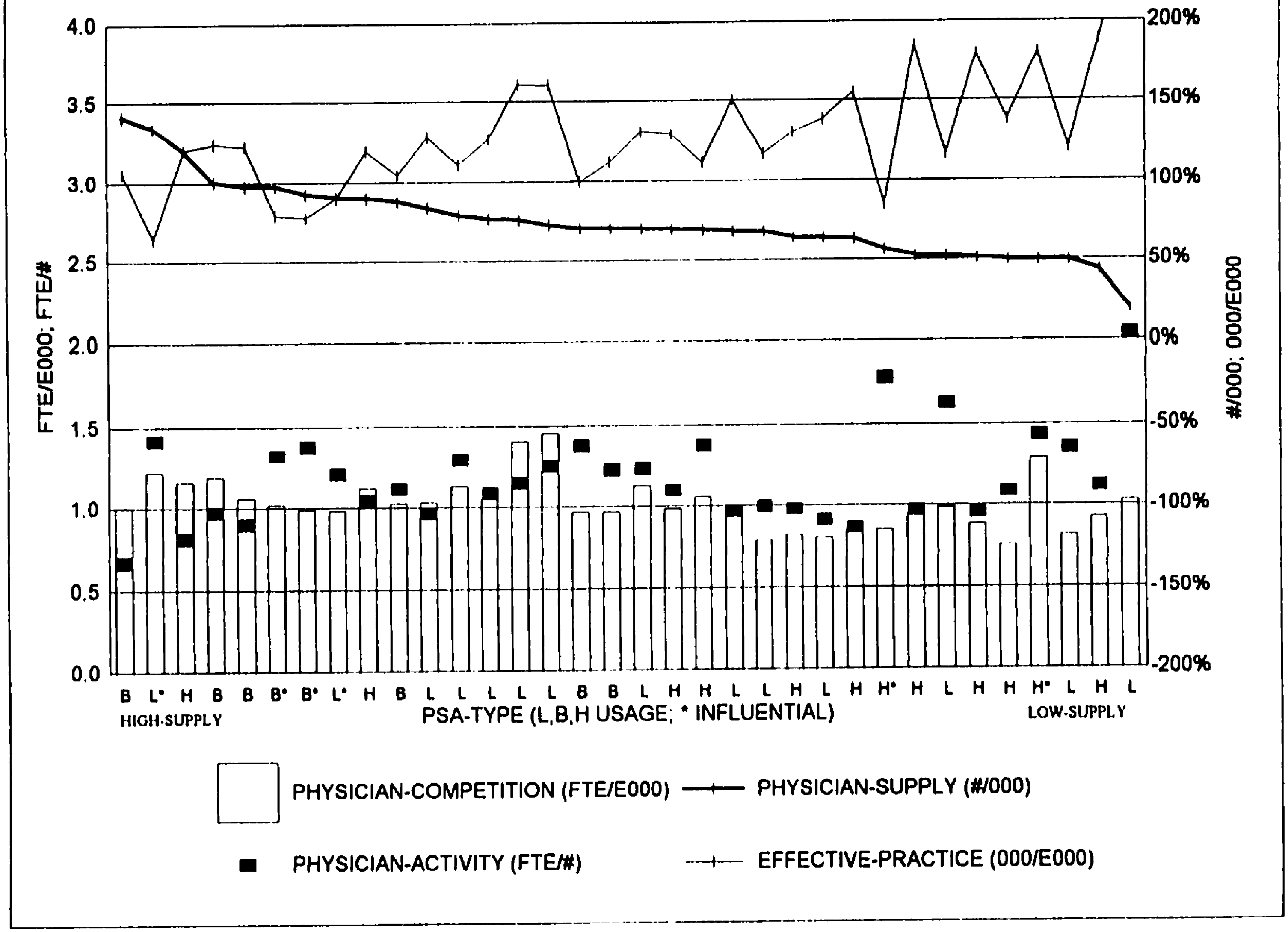


FIGURE 4.12: PHYSICIAN-COMPETITION
BY DECREASING EXPECTED NEED FOR VISITS
FTE/E000; FTE/#
#/000; 000/E000
PSA-TYPE (L,B,H USAGE; * INFLUENTIAL)
HIGH-NEED
LOW-NEED
PHYSICIAN-COMPETITION (FTE/E000)
PHYSICIAN-SUPPLY (#/000)
PHYSICIAN-ACTIVITY (FTE/#)
EFFECTIVE-PRACTICE (000/E000)

FIGURE 4.13: PHYSICIAN-COMPETITION
BY DECREASING PHYSICIAN-SUPPLY



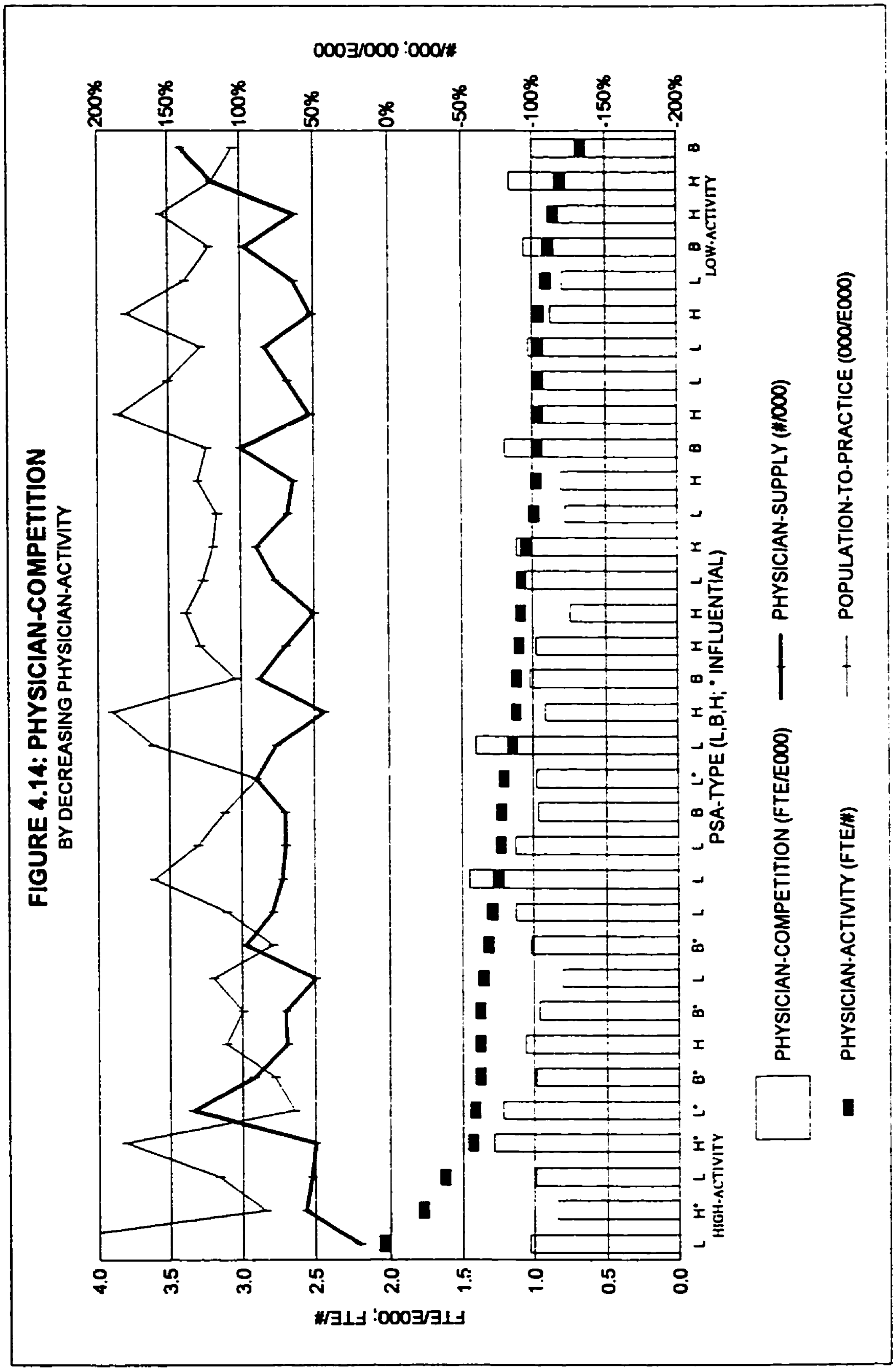
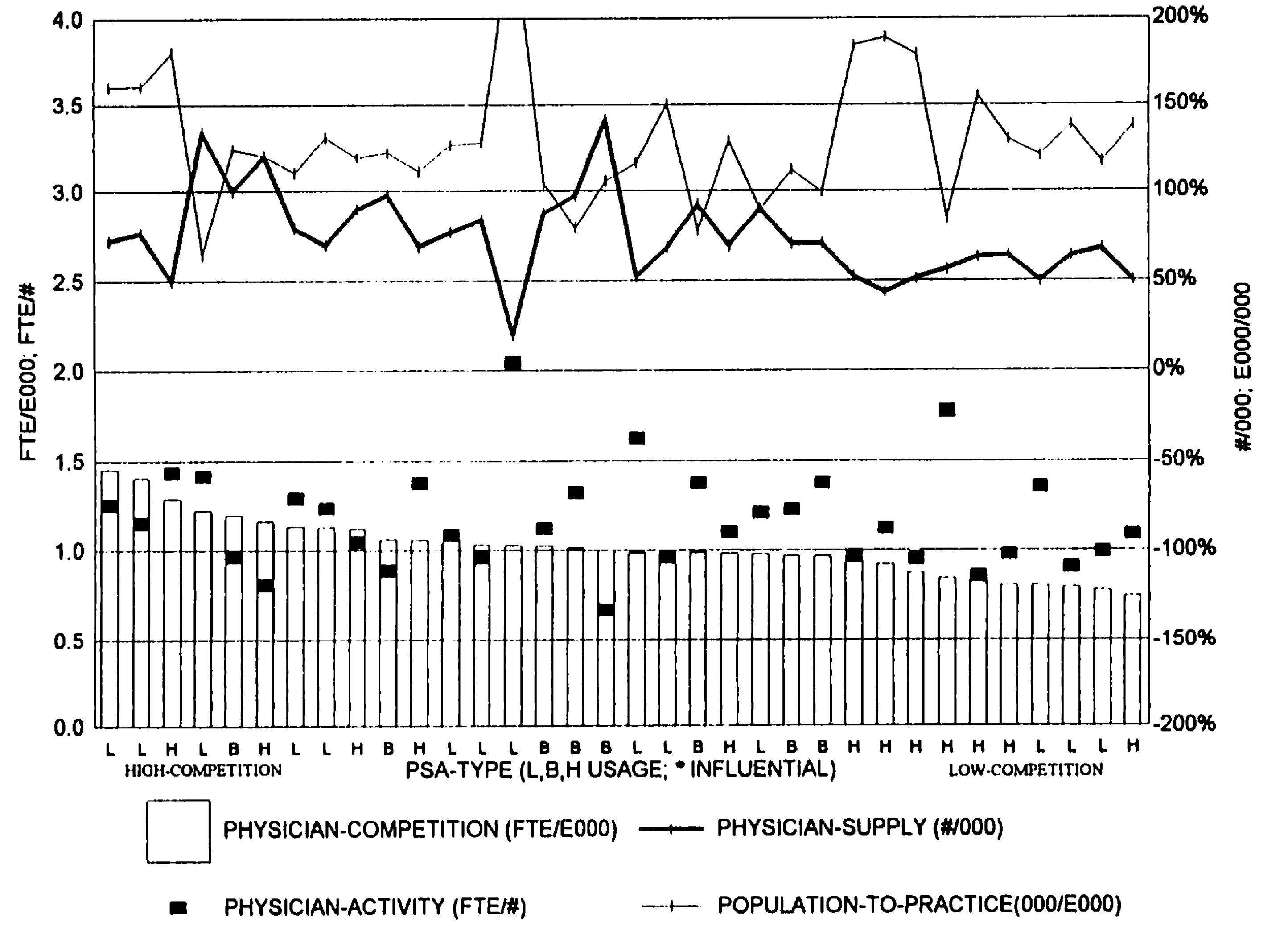


FIGURE 4.14: PHYSICIAN-COMPETITION
BY DECREASING PHYSICIAN-ACTIVITY

FIGURE 4.15: PHYSICIAN-COMPETITION

BY DECREASING PHYSICIAN-COMPETITION



ambulatory physician visits. Although no systematic associations among the determinants of competition are obvious, physicians serving population with higher need for ambulatory medical care generally face moderately greater competition, while the reverse relationship is found for physicians practicing in areas characterized by lower need ($r = 0.42$, $p = 0.013$). This finding arises from the strong relationship between physician-supply and the effective practice served (i.e., the reciprocal of population-to-practice ratio) by these physicians ($r = -0.61$, $p < 0.0001$).

Figure 4.13 emphasizes the influence of physician-supply on physician-competition. When ranked in order of descending physician-supply, a moderate strength association is observed across rural areas ($r = 0.53$, $p = 0.0012$). In contrast, no consistent pattern is detected for physician-competition versus physician-activity (see Figure 4.14; $r = 0.18$, $p = 0.32$). As expected, physicians in the influential areas (except IS) manage larger practices than their in-area populations would predict; physicians within PSAs near Winnipeg manage smaller practices than their populations would predict. Contrary to expectations, however, influential PSAs are not exclusively found among the high competition areas, but, rather, are distributed across the full spectrum of physician-competition. Finally, analysis examining the determinants of the twofold difference between high and low competition finds that subtle difference in all three components interact to explain this difference (see Figure 4.15).

Compensating interactions among physician-activity, physician-supply, and effective-practice produce marked uniformity in physician-completion in rural Manitoba. Of these interactions, however, only the relationship between physician-supply and effective-practice achieved statistical significance ($r = -0.61$, $p < 0.0001$). While forces have ensured comparable levels of physician-competition across rural Manitoba, what is the meaning of this development for physicians in terms of their workload?

Physician-activity (workload) is critical concern to physicians. As expected, physicians in influential communities are characterized by higher average workload (see Table 4.7). In the face of comparable competition, this feat is achieved by physicians seeing larger effective-practices than these populations would predict. Except for IS, physicians draw patients from adjacent (and beyond) rural areas while providing care to in-area residents. For IS, however, workload is maintained in the face of a large population-to-practice ratio (i.e., a small effective-practice) through a lower physician-supply. The average workload in most PSAs is near or greater than 100% FTE -- only in 5 (out of 34) area does it fall much below 100% FTE. Among these areas, four contain high proportions of salaried physicians who generally manage fewer patients (and overall workloads; see Wall *et al.* 1994) than their fee-for-service counterparts. The finding of in-area supply greater than competition is consistent with this observation. Moreover, because they do not face financial incentives, salaried physicians are less motivated to attract patients in from adjoining areas to offset the poor local supply of patients. In contrast, fee-for-service physicians achieve 100% FTE status, with practitioners in certain areas (including all influential communities) achieving higher levels.

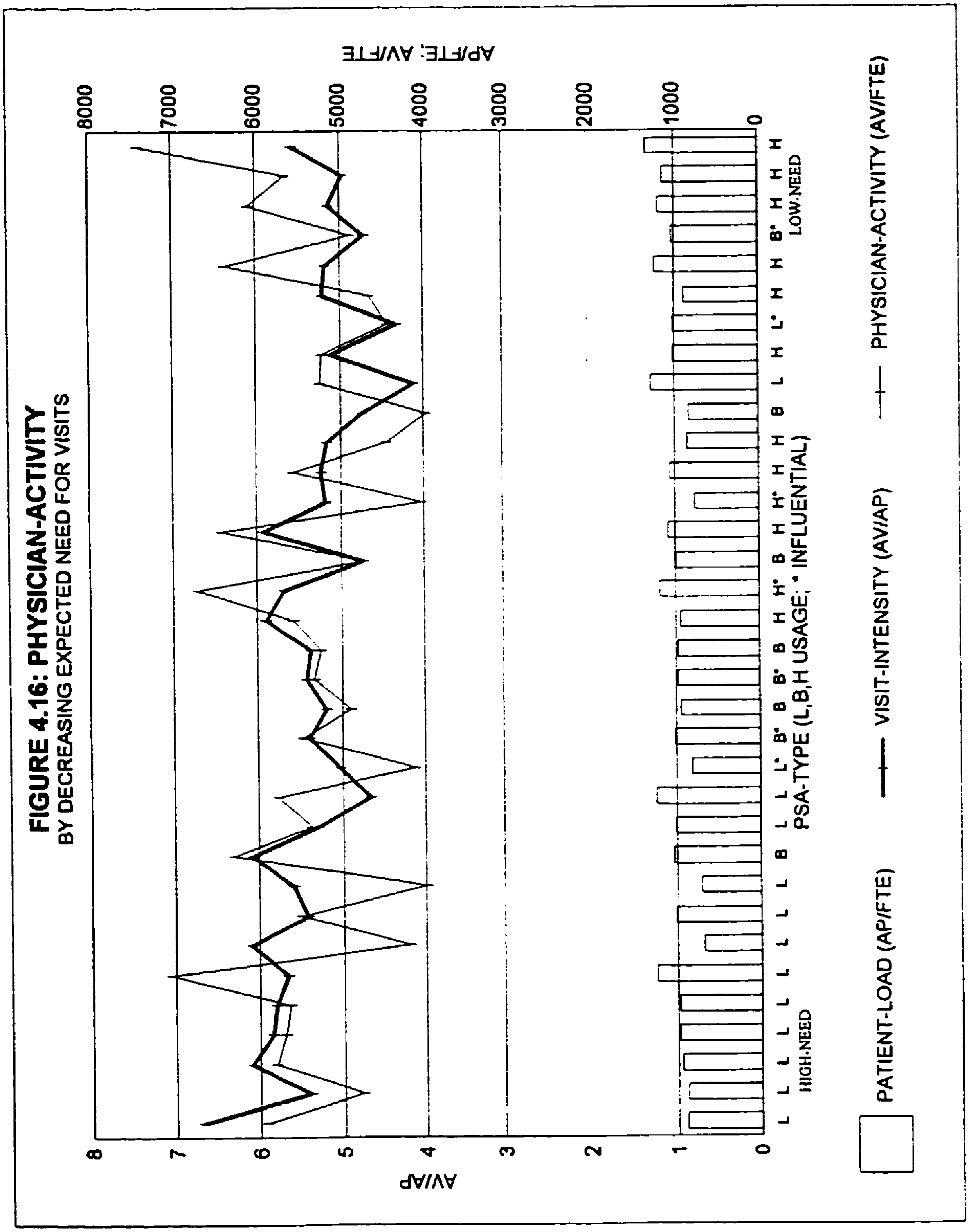


FIGURE 4.16: PHYSICIAN-ACTIVITY
BY DECREASING EXPECTED NEED FOR VISITS

4.3.2 PHYSICIAN-ACTIVITY

Ambulatory visit physician-activity (workload) -- estimated as the number of quarterly ambulatory visits per full-time-equivalent physician (AV/FTE) -- should be influenced by population need for visits and it may be affected by the prevailing level of physician-competition over patients. Physician-workload consists of two components, patient-load (AP/FTE) and visit-intensity (AV/AP), linked through the identity,

$$AV/FTE = AP/FTE \times AV/AP.$$

Visit-intensity is expected to increase with greater population expected need for ambulatory visits. While average patient-load should decrease with increasing competition, individual physicians may partially offset the loss of patient-load by "sharing patients" (physician-commonality) and by increasing the intensity of care rendered (visit-intensity).

Figure 4.16 displays average physician-activity and its components in order of descending population expected need for visits. Physician-activity exhibits little correlation with increasing expected need for medical care ($r = 0.059$, $p = 0.74$). While patient-load appears to decrease with increasing need (i.e., physicians manage fewer, but sicker patients; $r = -0.42$, $p = 0.013$), visit-intensity exhibits a strong association with increasing need ($r = 0.63$, $p < 0.0001$). While these findings are encouraging, variation in physician-workload suggests that other factors also influence physician-activity.

Although physician visit-workload is moderately correlated with visit-intensity ($r = 0.44$, $p = 0.0098$), patient-load is key to explaining variation in physician-activity across rural PSAs ($r = 0.79$, $p < 0.0001$). Through amplifying the effect of visit-

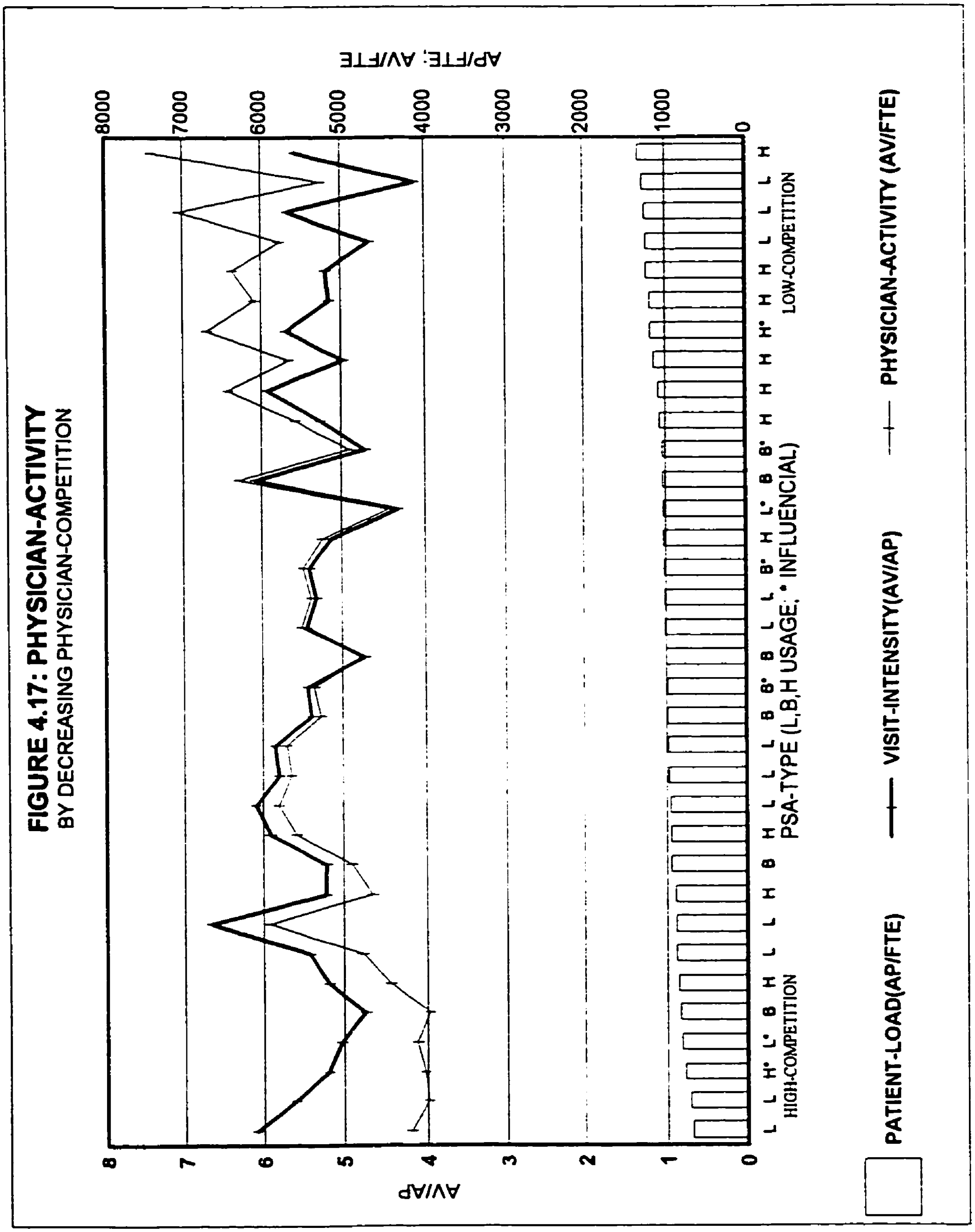


FIGURE 4.17: PHYSICIAN-ACTIVITY
BY DECREASING PHYSICIAN-COMPETITION
AV/AP
8
7
6
5
4
3
2
1
0
AP/FTE; AV/FTE
8000
7000
6000
5000
4000
3000
2000
1000
0
L L H* L* B H L L H B H L L L L B B* B L L B* H L* B B* H H H H* H H L L L L H
HIGH-COMPETITION
PSA-TYPE (L,B,H USAGE; * INFLUENCIAL)
LOW-COMPETITION
PATIENT-LOAD(AP/FTE)
VISIT-INTENSITY(AV/AP)
PHYSICIAN-ACTIVITY (AV/FTE)

intensity, each additional patient generates several visits, with this effect being greater for aggressive physicians (or those managing sicker patients) rendering higher intensity care.

Figure 4.17 displays physician visit-activity and its components in descending order by physician-competition. As anticipated, visit-activity strongly increases with decreasing competition ($r = -0.78$, $p < 0.0001$), but with substantial noise being observed. Also, as expected, average physician patient-load exhibits (near) perfect correlation with decreasing competition ($r = 1.00$, $p < 0.0001$). As expected visit-intensity is correlated with increasing competition ($r = 0.25$, $p = 0.15$) and with decreasing average patient-load ($r = -0.26$, $p = 0.14$), but the strength and significance of these associations is much lower than predicted.

The interaction between patient-load and visit-intensity in explaining physician-workload can be viewed in terms of three phases of competition. First, for higher levels of competition, visit-intensity acts to buffer decreases in patient-load for levels less than 1,000 patients per FTE physician. It is not clear if this effect reflects population expected need for ambulatory visits and/or supplier-induced demand. However, as nine out of 13 areas either exhibited low (7) or balanced (2) patterns of visits compared with expected need, the increase in visit-intensity is, at least partially, explained by population expected need. While the increase in visit-intensity with decreasing patient-load supports the hypothesis that physicians render excess visits to preserve income, the overall balance between usage--need suggests that other factors are important. While supplier-induced demand may explain some variation in physician-workload in the face of increasing competition and the corresponding decrease in average patient-load, based on the strength and statistical significance of correlation coefficients (see above), however, population need for medical care appears to be a more important determinant of average (physician-supply) visit-activity.

For mid levels of competition, average patient-load is flat (at 1,000 patients per FTE physician) and variation in physician-activity is fully determined by differences in visit-intensity. While variation in physician-workload may reflect differences in physician practice-style, as 10 out of 11 areas are in balance (6) or exhibit low (4) patterns of usage, population characteristics may be more important determinants of physician-activity.

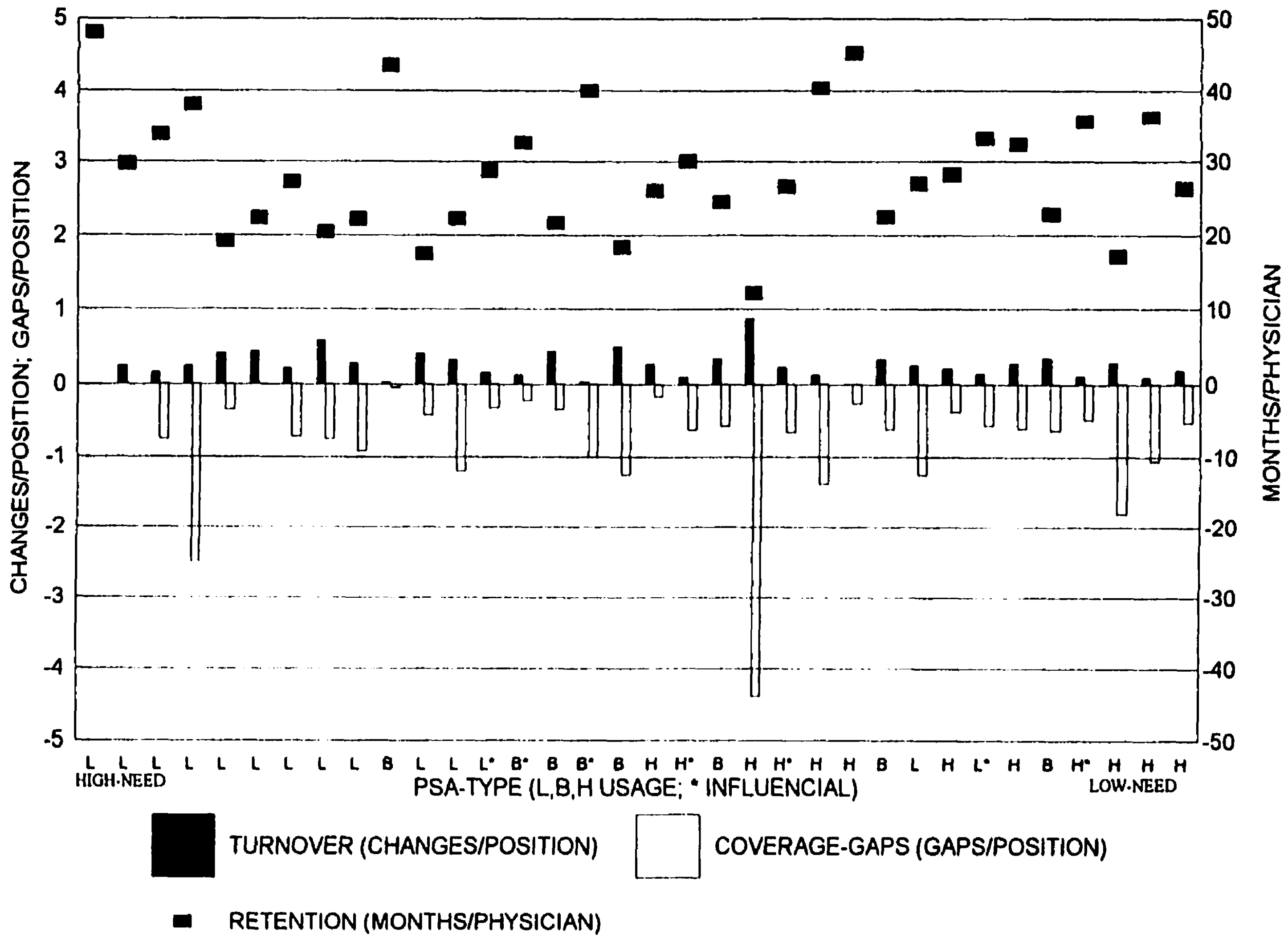
Finally, for lower levels of competition (less than 1.0 FTE physician per 1000 patients), average patient-load plays a key role in explaining patterns of physician-activity. The widening divergence between increasing patient-load and decreasing visit-intensity reflects the importance of the interaction between these components of physician-workload (see above). In spite of managing the largest patient-load and rendering lower levels of visit-intensity, seven out of 10 areas exhibit patterns of excess usage compared with expected need. It is not clear if these patterns reflect population demand behaviour and/or physician-supply behaviour.

Overall, in the face of twofold difference in physician-competition (0.75 to 1.5 FTE/000) levels of physician-activity exhibit remarkable comparability. This situation is explained by tradeoffs between physician-supply and practice-size -- that is, in areas characterized by lower physician-supply, physicians may compensate by managing more patients. Additional variation reflects differences in population expected need for visits

TABLE 4.8: PHYSICIAN PRACTICE-STABILITY AND DIMENSIONS, GROUPED BY REGION

PSA	ALL PHYSICIANS			PHYSICIANS PRACTICING > ONE QUARTER		
	TURNOVER	COVERAGE	RETENTION	TURNOVER	COVERAGE	RETENTION
	CGNs/POS	GAPS/POS	MTHS/MD	CGNs/POS	GAPS/POS	MTHS/MD
C1	0.25	-1.00	13.35	0.25	-1.25	27.00
C2	0.41	-0.44	16.51	0.33	-0.60	22.52
C3	0.64	-0.39	11.35	0.29	-1.81	17.12
C5	1.17	-2.08	6.35	0.88	-4.38	12.22
C6	0.44	-0.17	14.10	0.21	-0.38	28.20
C10	0.63	0.00	15.21	0.13	-1.38	40.40
CM	0.19	-0.50	25.13	0.14	-0.56	33.17
CP	0.40	-0.35	16.31	0.10	-0.61	30.00
E1	0.51	-0.60	10.59	0.19	-0.52	26.33
E3	0.56	-1.17	10.54	0.22	-0.72	27.29
E5	0.78	-0.75	13.24	0.09	-1.06	36.20
E8	0.42	-1.83	17.43	0.25	0.00	29.75
ES	0.63	-0.66	14.80	0.12	-0.48	35.59
I1	0.44	-0.34	8.89	0.42	-0.34	19.30
I2	0.67	-0.79	6.34	0.03	-0.05	43.50
I3	0.58	-0.67	15.67	0.17	-0.75	33.75
I4	1.00	-2.33	8.20	0.44	0.00	22.40
I8	0.52	-0.98	12.10	0.35	-0.63	22.81
IS	0.52	-0.20	11.08	0.22	-0.65	26.61
P2	1.69	-1.63	7.08	0.25	-2.50	38.00
P3	0.71	-0.25	8.39	0.42	-0.42	17.50
P4	1.00	-0.67	11.54	0.58	-0.75	20.43
P5	0.31	-0.63	13.24	0.29	-0.92	22.25
PD	0.31	-0.32	22.75	0.17	-0.32	28.80
PS	0.58	-0.25	18.27	0.13	-0.22	32.58
W1	0.28	-0.25	25.00	0.00	-0.25	45.25
W3	0.29	-0.08	18.50	0.27	-0.17	26.09
W4	0.37	-0.23	16.45	0.44	-0.34	21.74
W5	1.00	-1.00	12.00	0.50	-1.25	18.40
W9	0.00	0.00	24.50	0.00	0.00	48.00
W10	0.57	-0.54	16.76	0.34	-0.57	24.50
W18	1.08	-0.45	15.06	0.28	-0.60	32.38
W19	0.53	-1.15	18.75	0.33	-1.20	22.30
WN	0.21	-0.89	27.08	0.04	-1.00	40.00

FIGURE 4.18: PRACTICE-STABILITY
(BY DECREASING NEED FOR VISITS)



and possible supplier-induced demand in select areas.

4.4 PHYSICIAN PRACTICE-STABILITY

Three dimensions are employed to estimate physician practice-stability: physician-turnover, gaps in practice-coverage and the duration of physician-retention. The process of incumbent physicians stopping practice and their replacements being installed is one complete cycle of physician-turnover (the average number of changes per position per fiscal year). If the replacement physician is not readily available, then gaps occur in the coverage provided to the practice (the average months per practice per fiscal year). Finally, length of physician practice over the study period (average months per physician) complements the information provided by turnover. Table 4.8 displays PSA physician practice-stability and its dimensions, grouped by Region. Figure 4.18 graphically displays these values, but sorted by population expected need for primary medical care.

Although rural residents voice strong, continuing concerns over perceived high levels of physician turnover, excessive gaps in practice are also problematic. From the perspective of residents, both dimensions suggest possible problems in obtaining needed (or otherwise) ambulatory medical care from local sources. Moreover, excessive turnover, through disrupting the continuity of the patient--physician relationship, impairs the quality of care (and possibly, the outcomes achieved). To physicians, excessive turnover disrupts formal/informal professional relationships while extended gaps in practice-coverage may (at least temporary) redistribute the aggregate workload among the remaining practitioners. Increasing the duration of physician practice is a goal of those concerned with enhancing the stability and continuity of rural medical care. High physician-retention identifies communities that have achieved this goal.

These measures of physician practice-stability exhibit high variation. As expected, practice-stability is generally higher in influential communities (see Table 4.9). Moreover, variation is greater when all physicians (i.e., including those practicing for less than one quarter). Patterns of practice-stability, estimated for physicians present for at least three continuous months, when sorted by population expected need for ambulatory medical care, physician-competition, and physician-workload also show little systematic differences (see the correlation matrix in the Appendix). Comparison of practice-stability versus decreasing expected need for physician visits finds that rural populations are not systematically disadvantaged by poor physician practice-stability (all correlations are very weak and do not achieve the conventional level of statistical significance). However, the unexpected finding of weak, nonsignificant correlations with physician-competition may reflect the effect of the limited variation found across rural Manitoba (see above) on macro-level events. As expected physician turnover and retention are strongly correlated ($r = -0.90$, $p < 0.0001$).

4.5 SUMMARY

Although variation across rural Manitoba was detected, a key finding of this analysis is the highly *comparable* pattern of population ambulatory visits (i.e., realized physician-accessibility) and levels of physician-competition. As physician-supply -- the traditional measure of physician-availability -- fails to account for important differences in physician-activity and patterns of population care-seeking, physician-availability and, particularly, physician-accessibility provide more policy-relevant information. Population access to out-of-area sources of primary ambulatory medical care and physician-competition over patients are important factors. Another important finding is that patterns of utilization exhibit only a limited relationship to population expected need for physician visits. It is not clear if greater physician-availability would redress these imbalances. Finally, variation in average physician-workload is complex and not explained by need or supplier-induced demand alone. Variation in physician-workload will be examined in greater detail in Chapter 5.

5.0 PRACTICE-MODALITY AND PHYSICIAN PERFORMANCE

Imbalances in physician distribution are a concern of rural residents, physicians, and policy-makers. To residents, physician-supply *is equated* with the local availability of medical care; to physicians, physician-supply *is seen* as the prevailing competition for patients; while, to policy-makers, imbalances in physician-supply *are associated* with the unequal access to primary medical care. Although imbalances exist in the distribution of general practitioners in rural Manitoba, complex interactions among the flows of patients, physician-activity and other determinants create comparable levels of physician-accessibility, physician-competition and physician visit-utilization. Physician performance (visit-workload, appropriateness of utilization, practice-stability) is critical to determining patterns of rural ambulatory visit utilization, but what factors determine physician behaviour? This chapter examines the role of practice-modality (i.e., payment-modality and practice-organization) and selected physician, practice, patient-profile, population and PSA factors in determining the performance of general practitioners in rural Manitoba.

Theory and analysis find that practice-modality influences physician visit-workload (see Chapter 2). Fee-for-service reimbursement provides financial incentives motivating physicians to see greater numbers of patient-contacts per quarter and to render more visits per contact (episode), compared with salaried practitioners with comparable annual net professional earnings. Although fee-for-service physicians in both solo and group practice exhibit comparable levels of ambulatory visit-workload, these groupings differ in the size of discrete patient-load managed and the frequency of patient-contact. Financial incentives available through fee-for-service payment combined with greater opportunities for specialization within the context of organized practice may encourage/enable fee-for-service physicians in group practice to render greater amounts of consultative care. Income considerations delay patient referrals to specialists among fee-for-service physicians, particularly among general practitioners with small practices; however, active physicians may refer patients with complex conditions to specialists to free-up time to manage their large patient-loads. Finally, whereas payment-modalities alternative to fee-for-service (mostly capitation) can reduce the frequency/duration of hospitalization, recent research finds no evidence of differences for capitated practice in Ontario. Differences in the health care system financing and operation may explain historic and international differences.

Upon entering into practice, physicians typically do not specify payment-modality and practice-organization independently, but consider the full package. Therefore, in this study physicians are classified as three alternative comprehensive practice-modalities. Within these groupings, payment-modality and practice-organization each effect different aspects of physician behaviour. For example, variation in physician visit-workload in rural Manitoba likely reflects differences in

- the number of patients (episodes) seen per quarter (all-contact patient-load) and/or
- the volume of visits per episode (visit-intensity).

Furthermore, variation in all-contact visit-load, itself, arises from differences in

- the number of patients managed (discrete patient-load) and
- the number of episodes-of care (contact-frequency) seen over the year (see Wall *et al.*

1994).

These distinctions inform policy-making about physician resource management if patient-load is driven by payment-modality, if contact-frequency is determined by practice-organization and if visit-intensity is sensitive to payment-modality. Policy-makers need to consider tradeoffs among the components of physician visit-workload when contemplating alternative practice-modalities.

Alternative practice-modalities available to physicians practicing in rural Manitoba during the 1990-91 to 1994-95 fiscal years are

- fee-for-service reimbursement and solo practice,
- fee-for-service reimbursement and group practice,
- salaried payment and solo practice, and
- salaried payment and community health centre (group) practice (see Table 5.1).

TABLE 5.1: PHYSICIAN DISTRIBUTION BY PRACTICE-MODALITY, 1991-94 FISCAL YEARS

PRACTICE-MODALITY (PAYMENT; ORGANIZATION)	SOLO ORGANIZATION	GROUP ORGANIZATION
FEE-FOR-SERVICE PAYMENT	FEE-FOR-SERVICE SOLO (FFSS) PRACTICE 2093 physician-quarters; 323 physicians	FEE-FOR-SERVICE GROUP (FFSG) PRACTICE 1094 physician-quarters; 130 physicians
SALARIED PAYMENT	SALARIED PAYMENT SOLO (SS) PRACTICE (EXCLUDED)	SALARIED COMMUNITY HEALTH CENTRE (SCHC) PRACTICE 505 physician-quarters; 77 physicians

Fee-for-service solo (FFSS) practice is the dominant practice-modality, with the fee-for-service group (FFSG) and, to a much lesser extent, the salaried community health centre (SCHC) practice-modalities providing important sources of primary medical care in rural Manitoba. As the small number of salaried physicians in solo practice (SS) mostly provide emergency room coverage in the larger rural hospitals, these practitioners are excluded from further analysis.

How physicians are distributed across rural Manitoba is not random (see Chapter 2). Physicians' preferences, income considerations and efforts to recruit/retain physicians to "under serviced" areas affect the geographical distribution of rural doctors. Although these forces have varied across space and over time, physician-supply is comparable across rural Manitoba (see Rock et al. 1985), between planning regions (see Tataryn et al. 1995), and across PSAs (see Roos et al. 1997). Traditional fee-for-service payment and solo practice dominates rural practice, but alternative arrangements are also found.

Solo fee-for-service practices are found in more sparsely settled, isolated settings. Considering the high and varied demands made upon these practitioners (often the only local physician) and the constraints placed on personal lifestyles, it is not surprising that these areas experience greater difficulties in recruiting and retaining physicians. The Manitoba Health Standing Committee on Medical Manpower helps these communities -- often recruiting international medical graduates to these sites for specified periods.

FFSG practices are found in influential communities and other larger rural settings less distant from Winnigeg/Brandon. These sites are generally staffed by Manitoba medical graduates and experience few problems in recruiting/retaining physicians.

Finally, community health centres (CHC) were established under the District Health Centres Act 1972, that enabled interested sponsors to set up a variation of the CHC model best suiting local conditions (see Tulchinsky 1975; for more recent commentary, also see Carrothers et al. 1991 and Crichton et al. 1997). At that time four urban and three rural CHCs were established: Hamiota Village in W4, Gladstone Town in C5, and Lac Du Bonnet in E3. A total of eight CHCs -- in C2 (2), C3, E3, I1, W4 (2) and W10 -- were operating throughout the study period. A key point of the Act is that these CHCs were established by the choice of the community; they do not exist primarily as a mechanism for Manitoba Health to staff under serviced areas. In fact, compared with FFSS and FFSG practices, physicians staffing CHCs are less likely to practice in isolated settings (respectively 10%, 11% and 6%; see Table 5.3). The Manitoba Health Standing Committee on Medical Manpower also helps these communities to deal with physician recruitment and retention concerns -- often recruiting international medical graduates to these sites for specified periods.

Based on findings from the literature review reported in Chapter 2, the expected ordering of study practice-modalities by mean physician total visit-workload is,

FFSS = FFSG >> SCHC.

Significant differences are also anticipated in the expected ordering of study practice-modalities by the set of visits included in total visit-workload,

FFSS = FFSG >> SCHC, for ambulatory visits,

FFSS << FFSG > SCHC, for consultative visits,

FFSS = FFSG >> SCHC, for inpatient visits, and

FFSS > FFSG < SCHC, for referral visits.

As a general guide for interpreting the above rankings, the expected ordering of the components of total, ambulatory, consultative and referral visit-workloads, is

FFSS < FFSG >> SCHC, for patient-load,

FFSS > FFSG > SCHC, for billing-intensity,

FFSS > FFSG > SCHC, for visit-intensity,

FFSS > FFSG > SCHC, for contact-frequency, and

FFSS = FFSG > SCHC, for the proportion of active-physicians.

Finally, the expected ordering of practice-modality for the three dimensions of practice-stability is

FFSS > FFSG < SCHC, for physician-turnover,

FFSS > FFSG > SCHC, for practice coverage-gaps, and

FFSS < FFSG = SCHC, for physician-retention.

Unless otherwise indicated, the unit-of-time is the quarter (i.e., three full months), with the unit-of-analysis being the physician-quarter (i.e., a physician being in a specific practice-modality and a site for the full three continuous months). Physician-quarters not satisfying these conditions were excluded from analysis to enhance the fairness of comparison.

As the effects of practice-modality are expected to be expressed as differences in the central tendency expressed by data and its dispersion, both the mean and coefficient of relative variation are reported. Because the study data are continuous and approximately normally distributed, the mean is an appropriate measure of central tendency. The coefficient of relative variation adjusts for the tendency of groups with higher scores (and means) also to exhibit greater dispersion (Bohrnstedt and Knoke 1982). As this statistic is calculated as the ratio of the standard deviation to the mean, smaller values exhibit lower variation; as a rule, values less than one suggest very low within-group variation. Statistics were estimated by aggregating quarterly data across the 1991-94 study period, categorized by the three physician-modalities. In essence, these statistics estimate between-modality (cross-sectional) differences that typify the overall study period, but do not necessarily generalize to specific quarters or years.

5.1 SELECTED DIMENSIONS OF PHYSICIAN PERFORMANCE

Dimensions of physician performance include visit-activity, the appropriateness of patterns of usage, and practice-stability. Table 5.2 reports statistics (mean, coefficient of variation) estimated for physician visit-activity and practice-stability and their components, grouped by practice-modality. Visits are distinguished by setting -- ambulatory or inpatient -- and the source of contact -- patient visits or consultation. Referrals of patients made by rural practitioners to "specialists" (both general practitioners and certified specialists) are also reported. The "core" of rural physician practice is the ambulatory visit. Acting, in part, as "specialists," however, some general practitioners also, upon request (referral), render consultations to the patients of other physicians. As physicians choose between ambulatory and inpatient settings for patient management, including both types of visits is important. Ambulatory, inpatient, and consultations are identified by tariffs claimed by physicians. Finally, patient referrals are directed to both certain general practitioners and certificated specialists, mostly based in Winnipeg and Brandon. Because medical claims filed by these consultants note the referring general practitioner, these visits are assigned to study physicians.

The components of physician visit-workload -- proportion of active physicians, billing-intensity, visit-intensity, contact-frequency -- relating tariffs paid, visits reported, patient-loads managed and other factors are also reported. Also, the dimensions of practice-stability -- physician-turnover, practice coverage-gaps, physician-retention -- are displayed. Table 5.2 also reports the influence of the alternative practice-modalities on physician visit-workload and practice-stability compared with traditional FFSS arrangements. Comparing the FFSG and the FFSS practice-modalities provides insights into the effect of group organization on physician performance (see column GRP). Similarly, comparing the SCHC and FFSG groupings provide some understanding of the influence of payment-modality (see column PYMT). Finally, contrasting the SCHC and the FFSS practice-modalities provides insights into the simultaneous effects of group organization and salaried payment (see column GRP, PYMT).

5.1.1 TOTAL VISIT-WORKLOAD

The physician quarterly total visit-workload includes all direct and indirect contacts made by patients with their physicians. Direct patient-contacts include all medical care rendered by general practitioners in ambulatory/inpatient settings. Indirect patients' contacts consist of visits made to specialists initiated by referrals from primary care physicians. This broader definition of visit-workload incorporates important differences in physicians use of ambulatory, inpatient and referral sources of care for managing patients.

First, in the face of clinical uncertainty and other factors bearing upon patterns of utilization, physicians exercise discretion in electing where to manage their patients. Analysis focusing solely on ambulatory visits will underestimate the workloads of

TABLE 5.2: PHYSICIAN PERFORMANCE AND COMPONENTS BY PRACTICE-MODALITY

PHYSICIAN PERFORMANCE	GROUP MEANS				GROUP VARIATION (CRV)				RELATIVE EFFECTS		
AND COMPONENTS	FFSS	FFSG	SCHC	ALL	FFSS	FFSG	SCHC	ALL	GRP	GRP,PYMT	PYMT
TOTAL VISIT-WORKLOAD:											
ALL VISITS & REFERRALS (TV)	1547	1326	735	1364	2.14	2.41	2.19	1.97	-14%	-53%	-45%
% AMBULATORY (AV)	92.74%	91.37%	94.74%	92.63%	12.45	11.30	28.60	12.69	-1%	2%	4%
% CONSULTATIONS (CV)	0.16%	0.37%	0.01%	0.20%	0.31	0.17	0.14	0.16	131%	-94%	-98%
% INPATIENT (IV)	4.28%	5.25%	4.78%	4.63%	1.27	1.61	1.74	1.41	23%	12%	-9%
% REFERRALS (RV)	2.82%	3.01%	0.47%	2.54%	0.43	0.59	0.28	0.44	7%	-83%	-84%
PATIENT-CONTACTS:											
ALL-CONTACT PATIENT-LOAD (AP)	909.34	893.70	475.39	841.22	0.50	0.38	0.39	0.50	-2%	-48%	-47%
DISCRETE PATIENT-LOAD (DP)	565.92	592.85	321.89	537.9	1.83	2.72	2.28	1.91	5%	-43%	-46%
CONTACT-FREQUENCY (AP/DP)	1.66	1.51	1.51	1.60	0.17	0.13	0.15	0.17	-9%	-9%	-0%
VISIT-INTENSITY:											
VISIT-INTENSITY (TV/AP)	1.76	1.48	1.52	1.64	0.21	0.18	0.16	0.22	-16%	-14%	3%
AMBULATORY VISITS:											
BILLINGS ($AV)	25417	22145	12170	22529	0.47	0.42	0.45	0.51	-13%	-52%	-45%
VISIT COUNT (AV)	1433.30	1218.70	693.80	1262.50	0.48	0.44	0.46	0.52	-15%	-52%	-43%
BILLING-INTENSITY ($AV/AV)	17.95	18.33	17.58	17.99	0.14	0.08	0.08	0.12	2%	-2%	-4%
PATIENT-CONTACTS (AP)	909.34	893.70	475.39	841.22	0.50	0.38	0.39	0.50	-2%	-48%	-47%
VISIT-INTENSITY (AV/AP)	1.64	1.36	1.44	1.53	0.23	0.20	0.16	0.23	-17%	-12%	6%
EXCESS-VISITS ((EAV-AV)/AP)	0.30	0.03	0.03	0.18	1.29	9.39	11.62	2.11	-89%	-90%	-9%
CONSULTATIONS:											
BILLINGS ($CV)	92	182	20	106	2.66	5.31	0.04	5.26	97%	-78%	-89%
% ACTIVE PHYSICIANS	42%	58%	3%	42%	1.17	0.84	5.72	1.18	38%	-93%	-95%
ACTIVE BILLINGS ($CV)	218.20	311.70	83.90	254.90	1.56	4.01	0.47	3.31	43%	-62%	-73%
VISIT COUNT (CV)	5.32	7.67	2.00	6.24	1.56	4.05	0.50	3.36	44%	-62%	-74%
BILLING-INTENSITY ($CV/CV)	41.00	41.07	41.47	41.03	0.02	0.02	0.95	0.02	0%	1%	1%
PATIENT-CONTACTS (AP)	1068.20	950.40	423.30	1010.10	0.41	0.29	0.47	0.38	-11%	-60%	-55%
VISIT-INTENSITY (CV/00AP)	0.63	1.07	0.49	0.81	1.91	5.30	0.34	4.62	69%	-22%	-54%
INPATIENT VISITS:											
BILLINGS ($IV)	3374	3525	1986	3215	0.75	0.67	0.73	0.75	4%	-41%	-44%
% ACTIVE PHYSICIANS	91%	95%	92%	92%	0.31	0.22	0.30	0.29	4%	0%	-4%
ACTIVE BILLINGS ($IV)	3695	3697	2166	3488.20	0.66	0.62	0.64	0.67	0%	-41%	-41%
VISIT COUNT (IV)	74.13	72.61	40.66	69.15	0.72	0.60	0.58	0.71	-2%	-45%	-44%
BILLING-INTENSITY ($IV/IV)	51.75	52.22	53.39	52.09	0.32	0.27	0.48	0.33	1%	3%	2%
PATIENT-CONTACTS (AP)	955.40	917.74	497.10	880.97	0.45	0.35	0.35	0.46	-4%	-48%	-46%
VISIT-INTENSITY (RV/00AP)	8.26	8.06	8.14	8.20	0.75	0.56	0.49	0.67	-2%	-1%	1%
REFERRALS:											
REFERRALS (RV)	46.04	37.60	3.41	37.48	2.49	1.69	4.01	2.51	-18%	-93%	-91%
% ACTIVE PHYSICIANS	76%	91%	39%	75%	0.56	0.31	1.26	0.66	20%	-49%	-58%
ACTIVE REFERRAL COUNT (RV)	60.60	41.30	8.84	49.90	2.12	1.59	2.37	2.12	-32%	-85%	-79%
PATIENT-CONTACTS (AP)	976.50	915.34	474.30	917.60	0.46	0.33	0.37	0.44	-6%	-51%	-48%
VISIT-INTENSITY (RV/00AP)	6.36	4.67	1.86	5.43	2.20	1.98	1.94	2.22	-27%	-71%	-60%
RATIO GP/ALL REFERRALS	0.68	0.60	0.71	0.66	0.53	0.53	0.55	0.53	-12%	5%	19%
PRACTICE-STABILITY (ANNUAL):											
PHYSICIAN-TURNOVER (CGNS/POSITION)	0.30	0.16	0.36	0.26	1.35	1.03	1.60	1.44	-48%	20%	131%
PRACTICE COVERAGE-GAPS (MTHS/CGN)	-1.73	-0.94	-0.54	-0.78	-0.77	-0.80	-1.03	-0.95	-46%	-69%	-43%
PHYSICIAN-RETENTION (MTHS)	25.89	33.61	26.26	28.60	2.44	3.15	2.09	3.30	30%	1%	-22%

Dollar values attributed to ambulatory visits provided by CHCs have been imputed from FFS schedule tariffs. They are provided for comparative purposes only and do not reflect actual visit costs of CHC services, which are likely higher than the FFS values.

physicians whose patients are managed in hospital settings or referrals to specialists. Second, as alternative payment-modalities are associated with lower rates of hospital admissions/shorter length-of-stays, evidence from rural Manitoba that one practice-modality was associated with fewer inpatient visits has obvious implications for physician resource management.

Consultations are distinguished from other types of patient visits because,

- not all physicians engage in speciality care,
- these contacts arise from decisions made by other (referring) generalists, and
- follow-up care is usually not provided by consultants.

For equal workloads, consultants see more patients, but provide fewer visits per patient and rarely see referrals again. Physicians providing speciality care includes certified (urban-based) specialists and rural generalists with (presumably) advanced training/experience.

Patient referrals are also included to estimate the total visit-workload (direct and indirect) generated by study physicians. In the face of clinical uncertainly inherent in patient--physician interactions, physicians exercise great discretion in referring patients to specialists. Referrals generate additional visits, which either

- complement ongoing care rendered by generalist physicians,
- substitute for care that would otherwise have been provided by generalist physicians, or
- transfer the management of specific aspects of patients' medical conditions to the care of specialists.

In all three cases, part of the generalist's ambulatory visit-workload is transferred to a specialist. While appropriate rates of complementary, substitute, and transfer care are unknown, variation across the alternative payment-modalities may provide important insights into the role of financial and organizational incentives. Given policy-makers' concern about the cost of specialist care, evidence of the association of payment-modality and rates of referrals may have implications for physician resource management.

Table 5.2 displays statistics on physician total visit-workload and the constituent percentages of ambulatory, consultative, inpatient and referral contacts, by practice-modality. As expected, fee-for-service physicians have much greater contact with their patients (all visits) than their salaried counterparts. Among fee-for-service practitioners, however, solo practice is associated with marginally greater total visit-workload, but this difference did not achieve statistical significance ($p = 0.27$). Compared with FFSS practice, the relative effect of alternative practice-modalities on total visit-workload is respectively 14% and 53% fewer visits between FFSG and SCHC practitioners.

Non consultative ambulatory visits dominate the activity of physicians in all three practice-modalities (more than 90%). At 95% of total visit-workload, SCHC physicians derive the highest proportion of their activity from ambulatory contacts, followed closely by members of the FFSS practice-modality (93%). In contrast, however, FFSG practitioners derive 91% of their workload from non consultative care. Physician-workload generated from consultative care varies widely, with FFSG practitioners providing the greatest percentage (0.37%), members of the SCHC practice-modality the least (0.009%), and FFSS physicians taking an intermediate position (0.16%). While no significant differences were detected in the percentage of physician-workload generated by inpatient care, the proportion for FFSS practitioners is 1% lower than levels associated with FFSG and SCHC practitioners. Finally, while the 3% proportion of total visit-workload directed to other physicians is equal among fee-for-service physicians, SCHC practitioners make substantially fewer referrals (0.5%). Although these findings are interesting, they offer little explanation of between-modality differences in physician total visit-workload. The moderate variation estimated around the point (mean) estimates of total visit-workload is mostly explained by very high data dispersion in proportions of ambulatory visit-workload (and to a lesser extent, inpatient visit-workload). Contrary to expectations, however, fee-for-service payment was not associated with greater variation around these means.

Whereas important between-modality differences were detected in overall levels of physician-activity, these findings from aggregate data provide little guidance to policy-makers concerned with the specific effects of payment-modality on physician behaviour. For example, does greater fee-for-service physician-activity arise from the management of larger numbers of discrete patients or from providing unnecessary visits? Policy-making is better informed when these effects are distinguished. The following sections examine the role of practice-modality in determining the number of patient contacts and the intensity of visits rendered during these episodes.

5.1.2 PATIENT-CONTACTS

"All-contact patient-load" is the number of patients who contact a physician at least once during a quarter in either an office, clinic or other ambulatory setting. All-contact patient-load -- the total set of patient-contacts -- is the most important determinant of physician total visit-workload and, so, should be a key consideration of policy-making choosing among alternative practice-modalities. Patients initiate episodes of care by contacting their physicians. Thus, each patient generates at least one contact during the quarter. Over the year, patients initiate subsequent contact with their physicians for additional episodes of illness (either acute or chronic). Following contact, subsequent patient visits may occur in ambulatory, inpatient or referral settings throughout the episode (quarter). Therefore, the all-contact patient-load in any quarter consists of a mix of patients making their first ever contact and those initiating subsequent episodes of care. Therefore, this research distinguishes between the all-contact patient-load and the discrete patient-load seen during the quarter. The annual count of discrete patients divided by four (quarters) measures the average discrete physician patient-load. Quarterly *total* patient-load varies with the size of the annual *discrete* patient-load and the proportion of these patients seen in two or more quarters per year.

The discrete patient-load is the set of distinct patients generating all within-episode (quarter) visits and all contacts made across the quarters (episodes) throughout the year. Summed over the four quarters, the discrete patient-load corresponds to the count of distinct patients seen annually. Patient contact-frequency is estimated as the mean number of quarters in which patients contact the same physician over the year. Contact arises from patients demanding single episodes of (acute) care or periodically reestablishing contact with changes in their chronic conditions, and

- physicians recalling patients for preventive care or for the ongoing management of chronic conditions.

Both patients and physicians exercise at least some discretion over the demand for, and the supply of, contacts. Discrete patient-load is a subset of the larger (unknown) practice-load consisting of both patients making contact during the year and current nonusers. Although practice size is unknown, the consistently high annual contract-rate estimated for physician service areas (greater than 80%) suggests that residents' care-seeking (demand) behaviour is likely comparable across the physicians practicing within these areas. Therefore, discrete patient-load represents the underlying practice-profile from which these patients were drawn.

On average, FFSS physicians manage 565 discrete patients and see 909 patient-contacts (episodes) per quarter. In contrast, FFSG practitioners manage 593 patients and experience 894 contacts while SCHC physicians only oversee 322 patients and respond to 475 contacts. Compared with the FFSS grouping, FFSG practitioners manage 5% more discrete patients and experience 2% fewer patient-contacts while SCHC physicians oversee 43% fewer patients and 48% fewer contacts. As anticipated, physicians in group and community health centre practices exhibit *equal* frequency of patient-contact (i.e., 1.51 contacts per year), an amount 9.0% lower than the FFSS practitioners. However, SCHC physicians manage only 322 discrete patients compared with 593 and 566 respectively seen by FFSG and FFSS practitioners. As group practice acts to increase the number of discrete patients seen, the fairest estimate of the effect of payment-modality on all-contact patient-load is thought to be derived from comparing SCHC and FFSG practitioners. This comparison finds that salaried physicians see 46%

fewer patients. Even comparison to the FFSS-modality finds salaried physicians see 43% fewer patients. Although frequency of contact is an important determinant, the discrete patient-load managed provides the key explanation of the mean levels of patient-contacts seen by rural physicians. Estimated coefficient of relative variation values show only little dispersion about the point (mean) estimates for all-contact patient-load and moderate variation for patient contact-frequency. Overall, the interaction of patient-load and contact-frequency generates low dispersion. Estimated with-group variation is similar across the three modalities.

These findings are consistent with previous research also concluding that fee-for-service payment motivates physicians to secure sufficient numbers of patients to meet their income needs. Compared to solo practitioners, physicians in group and community health centre (group) practice see patients less frequently -- possibly due to the effects of practice-arrangements. It is not clear, however, if systematic differences in practice-style, patient-sharing, or other known/unknown confounding factors explain at least some of these highly significant differences in all-contact patient-load and its components, discrete patient-load, and patient contact-frequency. Multivariate analysis may provide further insight.

5.1.3 VISIT-INTENSITY

Visit-intensity, the number of ambulatory contacts made by a patient to a physician over an episode of care, is estimated here as the ratio of the number of patient-visits occurring within a quarter to the all-contact patient-load seen during this period -- that is, the average number of visits utilized by patients following their initial physician contact.

Variation in visit-intensity is thought to reflect discretionary clinical decision making by physicians as modified by patient access to, and compliance with, prescribed care.

Visit-intensity was highest for FFSS practitioners (1.76 visits per contact), with FFSG and SCHC practitioners respectively reporting 16% and 14% lower use (1.48 and 1.52 visits per contact; see Table 5b). Although FFSS physicians had been expected to generate the highest visit-intensity, it was surprising to find that SCHC and FFSG practitioners rendered similar levels (within 5%). Compared with FFSS practice, group practice-organization appears to reduce visit-intensity, even in the face of fee-for-service financial incentives. For FFSG practice, the combination of large patient-loads and group organization may reduce opportunities for practitioners to render higher intensity care. For SCHC practice, however, marginally higher visit-intensity may be explained by salaried physicians managing fewer patients and having greater opportunity (time) for more within-episode (contact) patient visits. Perhaps FFSG and SCHC physicians differ in the factors motivating/constraining behaviour: financial incentives are constrained by time versus opportunity constrained by practice-style.

5.1.4 AMBULATORY VISITS

As noted above, the bulk of rural physician total visit-workload is composed of ambulatory visits (i.e., 91% or greater). This grouping includes all patient-contacts occurring in office, emergency room, and other ambulatory settings. Ambulatory visit-workload can be estimated as either the count of visits or the billings for these contacts paid by Manitoba. Insights into between-modality differences in physician visit-workload are gained from the following identities:

Billings = fee/visit x visits/physician, and

Billings = fee/visit x visits/patient x patients/physician.

The first identity relates billings for ambulatory contacts to visit-workload (visits/physician) and to the fees paid by Manitoba Health. From the second identity, ambulatory visit-workload is, itself, a function of the size of the all-contact patient-load (patients/physician) and the number of visits made by these patients during the quarter (visits/patient). The estimated values of these components, are reported by physician practice-modality in Table 5.2.

As expected, fee-for-service physicians report much larger ambulatory visit-workloads -- estimated both as the count of visits (1,433) and the billings for these contacts ($25,417) -- than their salaried counterparts. Compared with FFSS physicians, SCHC practitioners report much lower visit-workloads (52% fewer visits, 53% lower billings). Contrary to expectations of comparable visit-workload among fee-for-service physicians, however, FFSG practitioners report 15% fewer visits and make 13% lower billings than their FFSS colleagues. Low within-group variation suggests that these practice-modalities acts to modify physicians' care-giving behaviours, or else attracts physicians sharing a similar practice-style (i.e., self-selection). Yet what factors explain these between-modality differences in visit-workload? As noted above, attention should be paid to all-contact patient-load (patient-contacts), visit-intensity and billing-intensity.

First, consider the substantial difference between salaried and fee-for-service physicians in the billings made for ambulatory visits (i.e., billings-workload). As noted above, billings are determined by billing-intensity (fee per patient) and visit-workload (visits per physician). Different tariffs are assigned to the various ambulatory visits and consultations comprising physicians' visit-workloads. The small between-modality variation in the mean fee billed per visit, which failed to achieve statistical significance, explains little variation in billings-workload. The marginally higher mean fee claimed by fee-for-service practitioners (especially the FFSG-modality) likely reflects differences in the volume of higher tariff consultations rendered (see below). Although consistent with *a priori* expectations, this finding offers little explanation of between-modality differences in billings-workload. However, the 52% lower patient utilization (visit count) associated with SCHC physicians is consistent with this observation.

As noted above, physician visit-workload is, itself, mathematically determined by size of the all-contact patient-load (patients per physician) and visit-intensity (visits rendered per patient). While the 7% lower visit-intensity of salaried physicians explains some variation, the 48% difference in patient-load is key to explaining between payment-modality differences in visit-workload. Although visit-intensity is, as expected, less for SCHC practitioners, group practice-organization rather than the salaried payment may determine physician behaviour. Physicians in organized practice, whatever payment-modality, render fewer visits per patient than do solo practitioners. While these findings confirm *a priori* expectations about the overall effect of practice-organization on visit-workload, SCHC practitioners had been expected to render fewer visits per patient than their FFSG counterparts. Patient-profile expected need for ambulatory visits and other factors may explain the 6% greater level of visit-intensity rendered by SCHC physicians compared with their FFSG counterparts.

Physician billing-intensity and visit-intensity arise from the interaction of practice-styles with attitudes toward income, as influenced by applicable financial incentives and constraints imposed by practice-organization, as well as other factors. Compared with FFSS physicians, the practice-styles of FFSG practitioners are influenced by group-practice, which may reduce within-modality disagreement about patient-load, visit-intensity and/or billing-intensity. Because the behaviour of SCHC practitioners is constrained by group-practice and the lack of fee-for-service financial incentives, within-modality disagreement is expected to be the lowest among this group. As a measure of the within-modality disagreement over mean billing-intensity and mean visit-intensity, the coefficient of relative variation values *a priori* were thought to be higher among FFSS physicians, with FFSG and then SCHC practitioners exhibiting greater agreement. Contrary to these expectations, however, little variation was found for billings-workload and its components. Moreover, only small differences were detected in the strength of disagreement across the three practice-modalities. FFSG/SCHC practitioners also exhibit greater within-modality agreement over the size of discrete patient-load than the solo practitioners. While the estimated effect of practice-modality on physician billings-workload and its components is in the expected direction, stronger differences had been anticipated. Overall, practice-modality has little effect on with-modality disagreement about levels of ambulatory billings-workload and its components: discrete patient-load, visit-intensity and billing-intensity.

Excess ambulatory visits measure the balance obtained between expected (needed) and supplied amounts of ambulatory visits rendered by physicians to their patient-profiles each quarter. Patient-profile expected (comparative) need for ambulatory medical care is estimated from demographic (age, sex) structure, socioeconomic status (the socioeconomic risk index) and health status (rate of premature mortality) (see Chapter 3). While physicians in organized practice appear to strike a balance between patient-profile need and usage, solo practitioners render excess numbers of visits (see Table 5.2). How physicians in organized practice achieve this balance is not clear. If all patient-contacts occur with single physicians, then these estimates of excess usage are not distorted. If, however, patients see several physicians within care-episodes because of practice-coverage and other organizational effects, then usage may be underestimated by physician-commonality. Interestingly, FFSS physicians exhibit greater agreement (smaller coefficient of relative variation) about providing excess visits than their FFSG and, especially, SCHC colleagues. Perhaps when financial incentives are not mitigated by group-practice, physicians possessing aggressive practice-styles are motivated, and have the opportunity to, render excess numbers of visits.

The number of patient-contacts within the quarter (all-contact patient-load), the frequency of patient-contacts across quarters (episodes) (contact-frequency), and the number of patient visits within the quarter (episode) (visit-intensity) exhibit interesting relationships. Fee-for-service physicians in solo practice manage smaller discrete patient-loads, but see patients more frequently across episodes (quarters). Compared with FFSS physicians, FFSG practitioners manage marginally larger discrete patient-loads, but do not see patients as often across episodes (quarters). Also compared with FFSS physicians, SCHC practitioners manage much smaller discrete patient-loads, but see these patients more frequently. Comparing FFSG and SCHC practitioners finds equal levels of patient contact-frequency. These findings offer support for the hypothesis that physicians make tradeoffs between patient-load and patient contact-frequency in determining ambulatory visit-workload. Moreover, as this effect is not commonly reported in the literature, analysis comparing alternative payment-modalities will be biased if imbalances exist in the distribution of physicians by practice-organization. However, the key factor explaining between-modality differences in physician visit-workload is the much greater number of patient-contacts (and discrete patients) seen by fee-for-service physicians.

5.1.5 CONSULTATIVE VISITS

Consultative patient contacts are distinguished from office and other ambulatory visits to recognize their specialized nature -- that is, while all general practitioners render ambulatory care, not all rural physicians provide consultations to the patients of other (referring) general practitioners. As noted above, consultations are a very small proportion of physician total ambulatory visit-workload; the FFSG-modality total visit-workload contains the highest percentage of consultative visits (0.37%; see Table 5.2). Even within the subset of FFSG practitioners actively engaged in consultative care, these visits comprise only 1.08% of the total visit-workload. The percentages of mean FFSS-modality and SCHC-modality visit-workloads derived from consultations is less.

Variation across practice-modalities in patterns of billings for consultative visits is related to the size of patient-load managed by active physicians, the number of consultations rendered to these patients and the fees paid. When comparing groupings of practitioners, however, differences in the proportion of physicians actively providing consultative care should be considered. Insight into sources of between-modality variation in consultative workloads is gained from the following identity,

$CV/all-MDs = $CV/CV x CV/00AP x 00AP/active-MD x active-MDs/all-MDs.

Mean quarterly billings for consultative care are estimated from quarterly claims made by all physicians within the practice-modality ($CV/all-MDs). As these groupings include both active and non-active practitioners, a key source of between-modality variation is the proportion of physicians providing consultative care. This proportion is measured by the ratio of active-physicians rendering any consultative care to all practitioners belonging to the practice-modality (i.e., active-MDs/all-MDs). For active-physicians, patient-load is an important factor explaining differences in billings. While each individual seeking consultative care is counted as a patient, he or she will typically generate one visit. Physicians rendering higher proportions of consultative care will exhibit larger patient-loads and lower numbers of visits per patient. The all-contact patient-load of active physicians is expressed as the count, in hundreds, of ambulatory patients seen per quarter (00AP/active-MD). The contribution of consultative visits to physician visit-workload is measured by visit-intensity -- that is, the count of consultative visits per hundred patients (CV/00AP). Finally, the billing-intensity of the fees received for these consultations is calculated as the billings per visit ($CV/CV). For each of the three practice-modalities, patient-load, visit-intensity and billing-intensity are measured as the mean of the values reported by active-physicians present for the full quarter in an exclusive practice-modality and a single practice site.

The substantial between-modality variation in billings is partially explained by differences in the proportions of physicians providing consultations. Whereas 58% of FFSG physicians are active in providing speciality care, 42% of FFSS and only 3% of the SCHC practitioners report consultations (see Table 5.2). The higher tariffs paid for consultative care may motivate fee-for-service physicians to engage in speciality care and/or accurately to report these visits to Manitoba Health. Therefore, it is not surprising that more fee-for-service physicians claim consultations. Moreover, in providing a supporting infrastructure, group practice may encourage some degree of specialization among member physicians. Therefore, incentives combined with opportunity may explain FFSG physicians providing at least some speciality care.

Variation around these mean estimates differed substantially by practice-modality, with the greatest level of disagreement over billing for consultations found for the FFSG-modality and the lowest (almost total agreement) detected for the SCHC-modality. Finding high disagreement within the FFSG-modality is consistent with group practice allowing for some specialization by (designated) practice members. Although also practicing under community health centre arrangements, SCHC physicians face no financial incentives to provide (or report) consultations. Finally, FFSS physicians exhibit less within-modality variation in patterns of billings received for consultations. In contrast to FFSG practitioners, most FFSS physicians render consultative care, but it is a much smaller proportion of total visit-workload.

5.1.6 INPATIENT-VISITS

Inpatient visits comprise only 5% of total ambulatory visit-workload, despite physician practice-modality (see Table 5.2). Analysis finding very similar patterns of hospital visits to manage rural patients suggests that practice-profile need for inpatient care rather than physician practice-style and practice-modality determine observed patterns of hospitalizations. The moderate amount of variation found about the point estimates, however, suggests some within-modality disagreement occur over the use of inpatient settings for managing patients.

Variation in patterns of billings for inpatient visits is determined by the all-contact patient-load managed by these physicians (patient-contacts), the number of visits rendered to these patients (visit-intensity), and the fees received for these visits (billing-intensity). When comparing groupings of practitioners, however, differences in the proportions of physicians rendering inpatient care are important considerations. Insight into sources of between-modality variation in inpatient visit-workload is gained from considering the identity,

$IV/all-MDs = $IV/IV x IV/00AP x 00AP/active-MD x active-MDs/all-MDs.

Mean quarterly billings are estimated from claims made by all physicians ($IV/all-MDs). The proportion of physicians within each practice-modality actively using hospital inpatient beds to manage their patients are estimated as the ratio of the active physicians reporting inpatient visits to all practitioners belonging to the practice-modality (i.e., active-MDs/all-MDs). The high proportion of rural general practitioners reporting inpatient visits (greater than 91%) testify to the role of hospital bed-availability (see below) in broadly determining rural medical care usage.

For active physicians, all-contact patient-load is the key factor explaining variation in billings. The contribution of inpatient visits to physician total visit-workload is measured as mean visit-intensity (IV/00AP) -- that is, the count of inpatient visits per hundred ambulatory patient-contacts (00AP). Finally, the billing-intensity of the fees received for inpatient care is calculated as mean billings per visit ($IV/IV). For each of the three practice-modalities, patient-load, visit-intensity, and billing-intensity are estimated as means values using the claims of active physicians present for the full quarter in one site and remaining in the same practice-modality.

Whereas fee-for-service physicians report comparable levels of inpatient visit-workload, the much lower volume reported by salaried physicians is explained by a large difference in the number of patient-contacts. Compared with FFSS practitioners, FFSG and SCHC physicians reporting inpatient visits respectively manage 4% and 48% fewer patients. The subsets of FFSS, FFSG and SCHC physicians providing inpatient care see more patient-contacts (respectively 1068, 950 and 497 contacts) than do all members of these groupings (respectively 909, 894 and 475 contacts).

As the fee schedule tariffs paid for inpatient visits change only with the duration of hospitalization, the lower mean fee per visit estimated for FFSS practitioners suggests that the patients of these physicians experience longer lengths-of-stay. It is not clear if this finding reflects incentives/constraints bearing upon FFSS practice, greater patient-profile expected need for hospital care, or distance and other barriers limiting opportunities for community-based care. Overall, no evidence of between-modality differences in hospital visits was found after adjusting for the number of patient-contacts (all-contact patient-load). Apart from the effect of all-contact patient-load, between-modality differences are small and fail to achieve statistical significance. Moreover, the low variation around these mean estimates with little differences across the practice-modalities suggests that inpatient-visits are not affected by physicians practice-styles nor practice-modality effects.

5.1.7 REFERRAL VISITS

Referral visits comprise, at most, 3% of physician total ambulatory visit-workload (see Table 5.2). Among fee-for-service physicians, practice-organization has little effect on rates of referrals.

Variation in patterns of referrals across physicians is determined by the number of patient-contacts seen and factors influencing the number of referrals made for these patients. Differences in the proportions of active physicians making referrals may yield information of the effects of practice-modality on this dimension of total ambulatory visit-workload. Insight into sources of between-modality variation in referral-visits can be gained from the following identity,

RV/all-MD = RV/00AP x 00AP/active-MD x active-MDs/all-MDs.

Quarterly counts of referral visits were estimated from the medical claims filed by "specialists" (both general practitioners presumably with advanced training and certified specialists) are attributed to the general practitioner identified as the referring physicians. For study physicians practicing within a single practice-modality and in one site throughout the full three months, the quarterly count of average referrals per physician was estimated (RV/all-MDs) for the three payment-modalities. As this ratio includes both active and non-active physicians, however, the proportion of active-physicians to all practice-modality members (active-MDs/all-MDs) is also estimated. For active-physicians, all-contact patient-load, is an important factor explaining differences in patterns of referrals -- that is, physicians experiencing greater numbers of patient-contacts are more likely to encounter patients likely to benefit from consultative care. Patient-load is expressed as the count, in hundreds, of ambulatory patients per active-physician (00AP/active-MD). Finally, the contribution referral visits could have made to physician ambulatory visit-workload is measured by mean visit-intensity -- that is, the count of referral visits per hundred patients (RV/00AP). For each practice-modalities, patient-load, and visit-intensity are estimated as the means of the values reported by member physicians.

The referral visit-workload generated by rural physicians varies widely by payment-modality. FFSS practice is associated with the greatest number (46.04 referrals per physician), with FFSG and SCHC making respectively 18.3% and 92.6% fewer referrals (see Table 5.2). While some correspondence was detected between fee-for-service physicians in rates of referrals, salaried practitioners make significantly fewer referrals. Clearly, the relationships between referral-visits and its components are complex.

First, whereas essentially all (91%) FFSG practitioners make referrals, only 76% of FFSS and 39% of SCHC physicians do so. Even after adjusting for the proportion of active physicians, however, important differences in rates of referrals remain. Among the active physicians, FFSS practitioners manage the largest quarterly all-contact patient-load (955 patients), with FFSG and SCHC physicians seeing respectively 3.9% and 48.0% fewer contacts. Active physicians also differ in the rate of referrals per hundred patients. FFSS practitioners exhibit the highest rate (6.4 referrals per hundred patients), with FFSG and SCHC physicians making respectively 26.6% and 70.8% fewer referrals per hundred patients.

The distribution of referrals made to general practitioners and certified specialists is also displayed in Table 5.2. FFSS and SCHC practitioners exhibit comparably high rates of referrals to general practitioners (about 70%) while FFSG physicians display a lower level (60%). Findings of high proportions of referrals made to general practitioners by rural Manitoba physicians are also found by other researcher (see Michael Lloyd & Associates 1992, Tataryn *et al.* 1995). These patterns of referrals lend support to concerns that rural residents face significant barriers to accessing (mostly) urban-based specialists.

The above gradient in patterns of referrals across the study practice-modalities is difficult to explain. While FFSS practitioners face financial incentives to continue treating patients, physicians managing larger patient-loads may not have sufficient time or competencies to treat complex conditions. Therefore, referrals may act as a mechanism aiding FFSS physicians to cope with heavy workloads while referring patients to more appropriate caregivers. In contrast, FFSG physicians may make fewer referrals because they manage marginally smaller patient-loads and are supported through the membership in group practices. These physicians are better positioned to manage patients suffering with complex conditions. While comparison of fee-for-service and salaried practitioners' rates of referrals finds a 400% difference, because referral-visits comprise a very small proportion of overall physician-activity, this variation offers little explanation of the substantial between-modality differences in total visit-workload.

5.1.8 PRACTICE-STABILITY

Physician-practice means a physician staffing a defined practice for a full quarter. While physicians come and go, rural positions endure over time. Rural communities are highly proactive in recruiting physicians and in voicing concerns about medical care availability. Rural practice stability is an issue,

- to patients concerned about the continuity of the physician--patient relationship,
- to populations concerned about physician-availability
- to the remaining physicians who must provide coverage during turnover and then develop new professional relationships, and
- to physician-supplies facing declining pools of patients because residents are seeking medical care from stable out-of-area sources.

Important dimensions of practice-stability are physician-turnover, coverage-gaps, and physician-retention. One complete cycle of physician-turnover consists of the combined activities of practice termination by the incumbent practitioner followed by the initiation of practice by the replacement physician. However, the delay between termination and initiation -- the practice coverage-gap -- is also an important dimension of practice-stability. While some rural residents cope with endemic turnover, excessive gaps in coverage may be a concern, especially in the more isolated areas. Finally, the average duration of physician-retention provides information about long-term practice-stability. As both patient--physician relationships and physician integration into professional networks develop (slowly) over time, areas able to retain physicians may benefit for greater quality of generalist care and enhanced access to specialist services. Estimates of practice-turnover and practice coverage-gaps are standardized to the fiscal year while physician retention is reported fo· the full study period (i.e., four fiscal years, or 48 months).

The expectation of lower physician-turnover among group-practices was only partially realized. As expected, physician-turnover is much lower among FFSG physicians. Contrary to expectations, however, SCHC practitioners exhibit 20% higher turnover than FFSS (solo) physicians. Community health centre organization had been expected to offset the stress of rural practice and, so, reduce turnover among members. Compared with the mean 0.30 changes per position among FFSS practitioners, FFSGs and SCHC practitioners are respectively characterized by 47% lower and 20% greater turnover.

Also, as anticipated, organized practice is associated with shorter duration coverage-gaps. Compared with the mean 1.73 months per FFSS position per year, FFSGs are characterized by 46% fewer gaps in coverage while SCHCs experienced an even lower 69% amount. The shorter mean gap in practice-coverage among SCHC practices likely reflects ongoing recruitment efforts by these communities supported by the Manitoba Health Standing Committee on Medical Manpower (SCOMM; see Postl *et al.* 1994). Beyond the practice-coverage burdens imposed by solo practice on rural physicians, and difficulties in recruiting physicians for FFSS, settings may reflect greater professional and personal isolation in these communities. Moreover, in contrast to SCHC practice, however, these communities are less likely to collaborate with SCOMM to attract replacement physicians. Gaps in FFSG practice-coverage likely reflect selection considerations within these practices -- that is, because group members interact professionally and financially, group collectivity is preserved only by recruiting new members who share this culture. Therefore, the recruitment of replacement physicians may be delayed until appropriate candidates are found.

Finally, also as anticipated, organized practice is associated with the greater retention of physicians in rural practice. Compared with FFSS practice, FFSGs are characterized by 30% greater retention of physicians while SCHCs experience lower, but comparable (1%) levels. With a mean physician retention of 33.61 months (out of four years), FFSGs are particularly appealing sites. The income potential afforded by fee-for-service payment combined with the infrastructure of group practice may provide an attractive environment for rural practice. Moreover, as 57% of FFSG practices are found in influential settings and 67% manage low to medium need practice-profiles (see below), these sites are more consistent with physicians' personal\professional lifestyle needs. In contrast, mean physician retention of 26 months in SCHC and FFSS practices is much shorter than that of FFSG sites. Possible explanations of this difference are higher proportions of International medical graduates who, overall, are less committed to rural (or Manitoba) practice and/or fewer placements in influential communities and/or dealing with more demanding patient-profiles. Although fee-for-service incentives also available through FFSS practice had been expected to enhance physician-retention, these findings suggest that group-practice and location may be more important than financial incentives for motivating physicians to remain in rural Manitoba settings.

5.2 SELECTED EXPLANATORY FACTORS

Although payment-modality, practice-organization, and their interaction are clearly associated with important differences in physician total visit-workload and practice-stability, other factors may also explain between-modality differences. Practice-modality may be a confounding factor rather than an explanation of observed patterns of utilization. For example, physicians select among practices (defined by modality, location) based on income potential, fit with personal/professional requirements and the Manitoba Health initiatives designed to recruit practitioners into less desirable settings. Therefore, the distribution of physicians across alterative practice-modalities is not random. Table 5.3 displays selected physician, practice, patient-profile, population, and physician service area (area) characteristics by practice-modality.

Table 5.3 reports statistics (mean, coefficient of relative variation) estimated for selected explanatory variables describing physician, practice, practice-profile, population, physician service area (area) characteristics. These variables describe important micro-level, meso-level and macro-level relationships bearing upon physician performance. As for Table 5b, relative percentage differences between physician grouping by payment-modality (see column PYMT), practice-organization (see column GRP) and both, simultaneously, (see column GRP, PYMT) are reported.

TABLE 5.3: SELECTED PHYSICIAN, PRACTICE, PATIENT-PROFILE, POPULATION AND AREA CHARACTERISTICS BY PRACTICE-MODALITY

SELECTED CHARACTERISTICS	GROUP MEANS				GROUP VARIATION (CRV)				RELATIVE EFFECTS		
	FFSS	FFSG	SCHC	ALL	FFSS	FFSG	SCHC	ALL	GRP	GRP,PYMT	PYMT
PHYSICIAN CHARACTERISTICS:											
% FEMALE	11%	13%	15%	12%	2.88	2.56	2.38	2.71	23%	42%	15%
MEAN AGE (YEARS)	45.51	42.89	38.53	43.84	0.30	0.28	0.32	0.30	-6%	-15%	-10%
% MANITOBA GRADUATES	36%	61%	33%	43%	1.34	0.80	1.43	1.15	71%	-7%	-46%
% CANADIAN GRADUATES	4%	10%	6%	6%	4.75	2.95	3.85	3.85	143%	49%	-39%
% INTERNATIONAL GRADUATES	60%	29%	61%	51%	0.81	1.58	0.81	0.99	-52%	1%	112%
PRACTICE CHARACTERISTICS:											
QUARTERS IN RURAL PRACTICE	45.49	40.71	14.85	39.84	0.97	0.97	1.37	1.04	-10%	-67%	-64%
QUARTERS IN CURRENT PRACTICE	39.69	36.19	12.90	34.97	1.12	1.09	1.45	1.18	-9%	-68%	-64%
PHYSICIAN-ACTIVITY (FTE STATUS)	1.10	1.09	0.66	1.03	0.35	0.29	0.39	0.37	-0%	-40%	-39%
% PART-TIME PRACTICE	7%	5%	18%	8%	3.65	4.35	2.12	3.32	-28%	161%	262%
% ACTIVITY LESS THAN 1 FTE	23%	18%	90%	31%	1.81	2.11	0.34	1.48	-21%	284%	388%
% ACTIVITY EQUAL 1 FTE	17%	26%	8%	19%	2.19	1.70	3.32	2.09	49%	-52%	-68%
% ACTIVITY GREATER THAN 1 FTE	59%	56%	2%	50%	0.83	0.89	7.04	1.00	-6%	-97%	-96%
PATIENT-PROFILE CHARACTERISTICS:											
EXPECTED (NEEDED) VISITS (EAV)	1.34	1.32	1.40	1.34	0.20	0.17	0.17	0.19	-1%	5%	6%
POPULATION CHARACTERISTICS:											
% PHYSICIAN CON TACT-RATE (AP/R)	81%	80%	80%	81%	38.78	35.04	43.94	35.85	-2%	-2%	1%
% IN-AREA UTILIZATION	70%	78%	73%	73%	4.85	4.95	7.60	4.94	11%	4%	-6%
AMBULATORY VISITS PER CAPITA (AV/R)	4.36	3.99	4.16	4.22	10.20	8.10	10.23	8.92	-9%	-5%	4%
ALL MD MEDICAL EXPENDITURES ($AV/R)	95.30	88.05	90.74	92.55	10.14	8.63	9.95	9.15	-8%	-5%	3%
AREA CHARACTERISTICS:											
PHYSICIAN-SUPPLY (MDs/000)	0.90	0.93	1.01	0.93	0.18	0.17	0.13	0.17	3%	12%	8%
INPATIENT BED-SUPPLY (BEDS/MD)	6.81	6.42	6.52	6.65	0.32	0.25	0.30	0.30	-6%	-4%	2%
% RECRUITMENT PROBLEMS	20%	16%	69%	25%	0.50	0.44	1.49	0.58	-19%	244%	324%
% ISOLATED PRACTICE	10%	11%	6%	10%	0.34	0.35	0.26	0.33	9%	-39%	-44%
% INFLUENTIAL COMMUNITY	30%	57%	0%	35%	0.66	1.16	NA	0.73	90%	-100%	-100%
% LOW-USE–LOW-NEED	3%	23%	0%	9%	0.18	0.55	0.04	0.31	617%	-94%	-99%
% MEDIUM-USE–LOW-NEED	9%	15%	0%	10%	0.31	0.43	NA	0.33	75%	-100%	-100%
% HIGH-USE–LOW-NEED	13%	12%	25%	14%	0.39	0.36	0.57	0.41	-15%	82%	113%
% BALANCED USE–NEED	21%	27%	57%	28%	0.51	0.60	1.16	0.62	30%	180%	115%
% LOW-USE–HIGH-NEED	27%	11%	8%	20%	0.61	0.35	0.29	0.49	-61%	-72%	-28%
% MEDIUM-USE–HIGH-NEED	27%	13%	10%	20%	0.60	0.38	0.33	0.50	-53%	-62%	-20%

Dollar values attributed to ambulatory visits provided by CHCs have been imputed from FFS schedule tariffs. They are provided for comparative purposes only and do not reflect actual visit costs of CHC services, which are likely higher than the FFS values.

5.2.1 PHYSICIAN CHARACTERISTICS

Physician characteristics -- for example, gender, age, place-of-graduation -- are measures correlated with latent behaviours underlying observed performance. Compared with male physicians, the smaller visit-workload managed by female practitioners is derived from seeing fewer patients and rendering fewer services per patient. Other explanations include less time devoted to overall practice and more time used per patient visit. Physicians grouped by age-cohorts share similar attitudes toward practice -- possibly due to common training/career experience. The relationship between physician age and activity is typically nonlinear, with both younger and older physicians experiencing smaller workloads. Graduates of International medical school manage greater workloads. Finally, the relationship between gender, age and place-of-graduation, and practice-stability is complex. Overall, older male graduates of the University of Manitoba have remained the longest in rural Manitoba practice.

In terms of absolute numbers of physicians-quarters (measuring stock and practice-duration over the four year study period), female physicians are respectively more likely to be found in FFSS (n=230), FFSG (n=142) and, finally, SCHC (n=76) practice (see Table 5.3). Proportionally, however, female physicians are more likely found in SCHC practice (15%), followed by the FFSG (13%) and FFSS (11%) modalities. Compared with FFSS practice, the percentage of females found in group practice (FFSG and SCHC) is respectively 23% and 42% higher. The greater proportion of female physicians practicing in group settings, particularly in salaried practice, is consistent with the findings of other research in Manitoba, Quebec, and Ontario. While female practitioners electing SCHC practice may explain some between-modality difference in physician visit-workload and practice-stability, this effect is limited by small numbers of female physicians -- overall, rural Manitoba practices are predominately (almost exclusively) staffed by male physicians.

FFSS physicians (mean age = 45.5 years) are respectively 6% and 15% older than their FFSG (42.9 years) and SCHC (38.5 years) counterparts (see Table 5.3). As physician output is typically not sensitive to age for the range of mean values estimated here, between-modality variation in visit-workload is likely not related to differences in mean group age. Physician length-of-practice may be the more relevant determinant of visit-workload (see below). The lower mean age of SCHC-modality physicians may arise from combined effects of the recruitment of younger physicians and their greater turnover -- that is, as SCHC physicians typically do not remain in rural practice beyond the contracted time and their replacements are generally also younger physicians, the mean age of SCHC practitioners does not advance. Within-modality variation (estimated as the coefficient of relative variation) around these mean ages is very low for all practice-modalities.

Finally, the proportions of the practitioners drawn from Manitoba, other Canadian and International medical schools exhibit interesting patterns. The mix of physicians in FFSS practice is respectively 36%, 4%, 60% drawn from Manitoba, other Canadian and International medical schools. Similarly, the structure of the SCHC practice-modality is respectively 33%, 6%, 61% drawn from Manitoba, other Canadian, and International schools. In contrast, however, the mix of physicians in FFSG practice is respectively 61%, 10%, 29% drawn from Manitoba, other Canadian, and International schools. These findings have implications for physician total visit-workload and practice-stability. Whereas the FFSS and SCHC practice-modalities are similar in terms of the proportions of Manitoba, Canadian, and International graduates, the substantial difference in mean visit-workload argues against place-of-graduation explaining between-modality variation. FFSS and FFSG practitioners exhibiting similar levels of visit-workload in spite of contrasting mixes of graduates also argue against place-of-graduation explaining between-modality variation. The high proportion of International medical school graduates recruited into the FFSS and SCHC practices may be a factor explaining high turnover if these physicians view these sites as entry points into the Manitoba Health-care System (and beyond) or temporary placements used to experience foreign medical practice/lifestyle before returning home.

5.2.2 PRACTICE CHARACTERISTICS

Acting through meso-level linkages, practice characteristics influence physician care-giving behaviour and their propensity to remain in the current setting. While practice-modality is a key determinant of physician behaviour, other practice characteristics also predict levels of visit-workload. For example, the visit-workloads of practitioners more experienced in rural medicine and practicing longer in their current settings may systematically differ from those less experienced and practicing for shorter periods. Overall, greater physician total-activity (proportion part-time, full-time-equivalent status) is associated with larger visit-workloads. Practice-stability may also be affected by excessively high/low levels of physician visit-workload.

From data reporting on physician initiation and termination of practice since starting in Manitoba, physician-retention, both in current practice and for rural sites, were estimated. The reordering of physician practice-modalities based on career experience was the FFSS-modality (45.5 quarters in all rural sites, 39.7 quarters in current practice), the FFSG (40.7, 36.2 quarters), and the SCHC (14.9, 12.9 quarters) modalities (see Table 5.3). Fee-for-service practice, in general, and in combination with solo practice, in particular, exhibit the greatest physician-retention in rural Manitoba. In contrast, SCHC physicians remain in rural practice for shorter periods. The difference in the ordering of study practice-modalities reflects the effect of the larger number of older FFSS physicians in FFSS practice who have made a career of rural medicine; study period data, however, provide more timely information on current patterns of physician-retention.

Although this study is concerned with physician visit-workload, estimates of total patient care activity provide important insights. Full-time versus part-time status is a widely used approach accounting for differences in physician-activity. Few (i.e., 6%) fee-for-service physicians are in part-time practice while 18% of the salaried practitioners are classified as such. More recently, Canadian physicians are being compared based on full-time equivalent (FTE) activity. In as much as fee-for-service physicians exhibit highly similar full-time-equivalent status (about 1.10 FTE whatever practice-organization), SCHC practitioners achieve only 40% of this value (0.66 FTE). Within the FFSS and FFSG practice-modalities, some 60% of the physicians are classified as greater than one FTE. In contrast, 90% of the SCHC physicians are classified as less than one FTE. Compared with salaried practitioners, the larger visit-workload associated with fee-for-service payment is consistent with these physicians' greater overall level of activity.

5.2.3 PRACTICE-PROFILE CHARACTERISTICS

Practice-profiles' characteristics used to investigate patterns of rural primary medical care usage include:

- the comparative patient-profile expected need for ambulatory physician visits; and
- the physician contact-rate measuring the patient demand for episodes of health care.

Physicians managing patient-profiles including greater numbers of patients with greater needs of ambulatory physician visits should generate patterns of medical care utilization that differ from practitioners seeing lower need patients. Similarly, patterns of visit utilization may vary across patient-profiles based on rates of physician contact.

Patient-profile expected need for ambulatory physicians visits was estimated using patients' demographic, health, and socioeconomic characteristics (see Section 3.1.4). Although these data estimate patient-profile need, do they generalize to the underlying (and unknown) practice-profile? Consistently high rates of patient-contact across rural Manitoba (i.e., 80% within one year, 95% within two years; see Michael Loyd & Associates 1993) suggest that these estimates generalize to the practice-profile (users and nonusers). Both FFSS and FFSG physicians face comparable patient-profile expected need (1.34 and 1.32 visits/patient), with SCHC practitioners seeing patient-profiles exhibiting 4.5% greater need (see Table 5.3). Overall, between-modality differences of 5%, or less, in mean patient-profile expected need for ambulatory medical care, are unlikely to explain substantial variation in physician visit-workload.

Although rates of patient-contact were not estimated for individual physician practice-profiles, the annual rates estimated for the physician service area from which patients are drawn were used as proxy measures. At 81%, FFSS physicians experience the highest rate of contact, with FFSG and SCHC practitioners also facing a comparably high rate of 80%. High (but comparable) levels of within-modality variation around these means, however, reflect differences in populations' (and, so, practice-profiles') demand for ambulatory primary medical care.

5.2.4 POPULATION CHARACTERISTICS

Population access to medical care is a key influence on the demand for contacts with physicians. Other measures of rural population-access to medical care include:

- the proportion of residents' using in-area primary care physicians;
- the number of visits made to all generalist physicians (no matter site of practice); and
- the total expenditures on medical care (generalist and specialist).

FFSS physicians draw their patients from populations with the lowest proportions of in-area utilization (70%) while FFSG and SCHC practitioners are found in areas characterized by higher rates of in-area care-seeking (respectively 78% and 73%) (see Table 5.3). These findings suggest that group practice-organization is associated with greater in-area access to medical care. In particular, the combination of fee-for-service payment and group practice appears to increase both physician-availability and practice-stability -- factors thought to enhance the continuity of the patient--physician relationship and, so, the use of in-area physicians. However, as 57%

of FFSG practices are within influential communities -- sites with greater overall availability of physicians and other health care resources -- this may also influence patterns of population (and patient-profile) care-seeking (see below). In contrast, lower levels of in-area utilization between FFSS and SCHC physicians may reflect higher physician-turnover and poorer health care resource availability (see above).

The populations cared for by FFSS practitioners are characterized by the greatest utilization of all ambulatory visits, as measured by the crude visit-intensity of medical care obtained from all generalists physicians (4.36 visits/resident). Populations receiving care from FFSG practitioners express the lowest overall use of ambulatory care (3.99 visits/resident), with SCHC sites experiencing levels similar to the FFSG group (4.16 visits/resident). Compared with FFSS physicians, FFSG and SCHC practitioners draw patients from populations characterized by 9% and 5% lower access to ambulatory medical care. As the FFSS and SCHC sites exhibit similar levels of access (i.e., within 5%) and FFSG physicians are associated with the lowest level, factors other than practice-modality explain these findings. Perhaps lower proportions of in-area care-seeking leads to greater overall levels of visit utilization when care is obtained from Winnipeg practitioners and/or if duplicated care is obtained from seeing more than one physician.

Expenditures on all medical care follow patterns similar to that of visit-intensity (see above). Whereas populations served by FFSS practitioners generate the greatest levels of expenditures ($95.30/'000 capita), those receiving care from SCHC ($90.74/'000 capita) and, especially, FFSG ($88.05/'000 capita) practices consume much less medical care. Compared with FFSS physicians, FFSG and SCHC practitioners draw patients from populations characterized by 8% and 5% less access to generalist/specialist medical care (all sources). Again, since FFSS and SCHC sites exhibit similar levels of expenditures (within 5%) and FFSG physicians are associated with the lowest level, clearly, factors other than practice-modality explain these findings -- for example, differences in practice-profile expected need for medical care and/or physician place-of-graduation.

In spite of differences in the financial and organizational incentives that may bear upon physician behaviour, in aggregate, rural Manitobans experience comparable levels of access to medical care, no matter physician practice-modality; however, utilization varies substantially within these modalities. The proportion of rural Manitobans making at least one contact with a physician annually is consistently high regardless of physician practice-modality. When all generalist visits and all expenditures on generalist/specialist care are considered, however, the populations served by FFSG practitioners generally use less ambulatory medical care. In contrast, SCHC and, especially, FFSS physicians are found in physician service areas characterized by overall higher usage of ambulatory medical care. Compared with FFSG practitioners, the higher utilization of all physician visits by populations served by FFSS and SCHC practitioners (respectively 10% and 4%) is related, in accounting sense, to these groupings' greater visit-intensity (respectively 15% and 5%).

5.2.5 PHYSICIAN SERVICE AREA CHARACTERISTICS

Physician service area characteristics influencing physicians' performance (total visit-workload and practice-stability) include:

- high competition among physicians for patients and inpatient beds;
- having problems recruiting physicians;
- containing isolated practices;
- influential versus other sites; and
- the relationship between population usage of, and the expected need for, ambulatory visits.

Competition for patients directly determines total physician visit-workload by partitioning available patients (residents) among in-area practitioners and, indirectly, through the inverse relationship between physician patient-load and visit-intensity (i.e., supplier-induced demand behaviour). In the face of greater physician-competition, financial incentives available through fee-for-service payment may motivate physicians to maintain their workloads (incomes) by increasing visit-intensity. Physician-competition, traditionally measured as physician-supply, is estimated as the ratio of the number of in-area physicians to the corresponding population severed, in thousands (#/'000).

FFSS physicians face the lowest within-areas competition (0.90 physicians per thousand residents), followed by FFSG (0.93 physicians/000) and SCHC (1.01 physicians/000) practitioners (see Table 5.3). As expected, differences in the competition faced by fee-for-service and salaried physicians mirror the number of patients managed. Compared with fee-for-service physicians, salaried practitioners face

12% greater competition, but treat 43% fewer patients. Clearly, competition alone cannot explain this difference. Policy-makers should carefully consider current physician-supply and average physician-workload when placing physicians in *under serviced* sites. This is especially true for areas characterized by dispersed populations and/or staffed by salaried physicians whose incomes are not determined by the numbers of discrete patients managed. Finally, as expected, the 3% difference in physician-competition for patients between FFSS and FFSG closely corresponds to the 2% difference in discrete patient-loads managed.

Among rural physicians, physician-competition is a major determinant of larger discrete patient-loads, not physicians' personal preferences, prevailing customs, or other considerations determining lower levels of discrete patient-load Since FFSS and FFSG physicians generally face less competition, they have higher patient-loads. However, in the face of comparable levels of competition, fee-for-service physicians generally manage larger patient-loads (also see Wall *et al.* 1994).

Whereas the supply of hospital inpatient beds varies widely, their availability to physicians is remarkably uniform across rural Manitoba. FFSS physicians face the greatest bed-availability, followed by SCHC and FFSG practitioners (respectively 6.81, 6.52 and 6.42 beds per physician). Physician usage of inpatient beds (inpatient visits per hundred patients) corresponds well to bed-availability. Ranked in order of descending inpatient bed usage/availability relationship, inpatient-visits, as a measure of bed usage, are higher with greater bed-availability. It is not clear if this pattern is determined by bed-availability, itself, or other factors associated with practice-modality.

Physician service areas reporting recruitment problems and/or identified as containing isolated practices may explain differences in physician performance. During periods of physician-turnover, gaps in practice-coverage may require that the remaining practitioners shoulder this workload. Also, isolated practice is typically not the preferred choice of Canadian graduates considering rural practice. On one hand, the finding that fee-for-service practitioners are more likely to practice in isolated settings (10%, 11% versus 6%, respectively, for FFSS, FFSG and SCHC physicians) is important for physician resource planning. On one hand, the combination of active recruitment of International medical graduates by Manitoba Health and the incentives of fee-for-service payment may motivate physicians to locate in isolated settings (at least for short periods). On the other hand, separation of financial consideration and reimbursement for patient care enables physicians to practice in areas not otherwise generating sufficient income. That 69% of salaried physicians locate in physician service areas with recruitment problems is consistent with poorer practice-stability among SCHC sites (see above). Perhaps entering physicians consider SCHC practice (and these sites) as temporary settings. Policy-makers should carefully consider the placement and numbers of salaried physicians in rural Manitoba.

Influential communities, which are characterized by,

- concentrations of physicians, hospital beds, and other health care resources,
- large populations, and
- are better placed to satisfy the lifestyle needs of physicians and their families,

exhibit greater physician practice-stability. Besides possessing sufficient numbers of residents to support group-practice, the availability of health care resources, the social/recreational/economic infrastructure is attractive to physicians contemplating rural practice. Moreover, except Swan River (PS), influential communities are within a reasonable distance of Winnipeg and/or Brandon. Finding 57% of FFSG practitioners in influential communities are consistent with these sites possessing sufficient numbers of physicians (and residents) to support group-practices. In contrast, finding that only 23% of FFSG physicians practice in other rural sites may reflect problems in developing group-practice in sparsely populated areas containing few physicians. One important exception is finding that SCHC practices are solely in non influential areas. Aside from communities' preferences for the style of care provided in community health centres, the separation of activity from income enables these group-based practitioners to earn a reasonable professional income while managing smaller patient-loads than would support fee-for-service physicians.

Finally, the relationship between patterns of ambulatory medical care utilization and populations' expected needs for physician-visits provides important insights into the influence of practice-modality on physician behaviour. Physicians practicing in groups or community health centres are found in areas exhibiting patterns of visit usage in balance with, or lower than, expected (needed) levels. In contrast, solo practitioners mostly locate in sites characterized by visit usage in balance with, or greater than, that expected (needed). Although physicians belonging to all practice-modalities are found in areas characterized by balance in the usage--need relationship, the distribution of these practitioners varies by practice-modality. In descending order of the percentage of the physician-stock practicing in balanced usage--need areas, the SCHC-modality contains the greatest rate (57%), followed by FFSG and FFSS practitioners (respectively 27%, 21%).

Inappropriate patterns of ambulatory medical care utilization -- numbers of visits above/below that of expected levels -- are of increasing concern to policy-makers. For example, while SCHC-modality is associated with greater balance between average visits and patient-profile need for ambulatory care, are these physicians more likely to render too few visits due to the absence of financial incentives? On one hand, financial incentives may motivate fee-for-service physicians to provide excess visits. Among FFSS physicians, who have workloads only 45% of the fee-for-service level, 54% practice in areas classified as excess usage while only 24% of FFSG and 18% of SCHC practitioners are included in this grouping. Moreover, 27% of FFSS physicians locate in areas denoted as high-use--low-need while only 11% and 8% of FFSG and SCHC physicians respectively practice in areas of extreme excess visits. Fee-for-service payment, overall, and fee-for-service solo practice-arrangements, in particular, are associated with patterns of medical care usage exceeding the expected (needed) number of ambulatory visits.

On the other hand, policy-makers are also concerned that salaried practitioners may not be sufficiently motivated to provide needed levels of visit utilization. Among FFSG practitioners, 57% are found in areas classified as usage less than need, while only 25% of FFSS and SCHC physicians practice in sites characterized by insufficient usage of ambulatory physician visits. Moreover, 25% of SCHC physicians practice in areas denoted as low-use--high-need while only 13% and 12% of FFSS and FFSG practitioners do so. Although SCHC practice patterns are generally in balance with expected levels of visit utilization, finding all SCHC physicians with low workloads in areas classified as low-usage--high-need is a concern. Do these patterns arise from population, physician-supply, perverse financial incentives, or interactive behaviours?

To the extent that physician practice-style and financial incentives dominate the patient--physician interaction, observed patterns of ambulatory visit utilization reflect supply-side behaviours. Fee-for-service solo practice is associated with patterns of physician visits exceeding levels predicted by patient-profile expected-need for ambulatory medical care. Conversely, FFSG and SCHC practice patterns are generally not less than the levels predicted by the expected need. Overall, these findings emphasize the tension between visit usage and expected need that are consistent with theory (Woodward, Warren-Boulton 1984) verified by the only randomized controlled trial comparing fee-for-service and salaried physicians (Hickson *et al.* 1987).

5.3 TOWARD UNDERSTANDING THE EFFECTS OF PHYSICIAN PRACTICE-MODALITY ON PATTERNS OF PRIMARY MEDICAL CARE UTILIZATION: LESSONS FROM RURAL MANITOBA

Messages distilled from this preliminary descriptive research emphasize the role of physician practice-modality as a key determinant of ambulatory medical care utilization in rural Manitoba. Policy-makers concerned with managing physician resources, however, should understand the complex effects of payment-modality (fee-for-service, salary) and practice-organization (solo, group, community health centre [group]) on observed physician care-giving behaviour. To distinguish between the effects of practice-modality and other explanatory factors, Table 5.4 displays physician total visit-workload and its components along with selected physician, practice, patient-profile, population, and physician service area characteristics. Although other factors likely explain limited amounts of variation, our preliminary descriptive analysis strongly suggests that practice-modality, especially the fee-for-service payment-modality, is a critical determinant of physician performance. Group practice further modifies physician care-giving behaviour by reducing visit-intensity and physician turnover. These preliminary findings are derived from tabular and graphical analysis of physicians' quarterly workloads (and its components and determinants) by practice-modality.

First, whereas FFSS and FFSG practitioners exhibit different mixes of patient-contacts (all-contact patient-load) and numbers of visits rendered during these episodes (visit-intensity), they experience comparable levels of total visit-workload. Compared with fee-for-service physicians, however, salaried practitioners generate a much lower mean total visit-workload, mostly explained by materially smaller all-contact patient-loads. Therefore, while all three combinations of payment-modalities and practice-organizations influence patterns of primary medical care utilization, compared with salaried payment, fee-for-service financial incentives appear to motivate physicians to manage larger discrete patient-loads and to see greater numbers of patient-contacts.

Compared with FFSG practitioners, the 14% (statistically nonsignificant) greater FFSS mean total visit-workload reflects between-modality differences in visit-intensity (+16%) and all patient-contacts (+2%), which are believed to be determined by various factors identified in the literature review (see Chapter 2). Since both SCHC and FFSG physicians function within group-practices, comparison of these otherwise more similar modalities should provide insights into the relative effects of salaried payment upon physician performance.

Compared with FFSG practitioners, the 45% smaller SCHC mean total visit-workload is associated with substantially fewer mean number of all patient-contacts (-47%), with the marginally higher mean visit-intensity (+3%) offsetting some patient-contact effect. Higher SCHC-modality visit-intensity is, however, surprising since fee-for-service financial incentives had been expected to motivate FFSG physicians to render more visits per patient.

Compared with the FFSS practice-modality, FFSG and, especially, SCHC physicians report fewer total visits per quarter. Although the difference between FFSS and FFSG practitioners did not achieve statistical significance, group practice-organization may affect physician total visit-workload through higher visit-intensity among solo practitioners. The substantial divergence between fee-for-service and salaried physicians implies that payment-modality strongly influences total visit-workload, but the effects of other co-determinants are not accounted for.

Overall, this analysis finds that practice-modality (i.e., both practice-organization and payment-modality) effects physician performance by acting upon different dimensions of total visit-workload (ambulatory, inpatient, consultative, and referral visits). These findings are also observed when analysis is restricted to ambulatory visits -- the narrower, but better understood, definition of physician visit-workload (see Roos *et* *al.* 1996).

TABLE 5.4: PHYSICIAN VISIT-WORKLOAD AND SELECTED DETERMINANTS BY PRACTICE-MODALITY AND COMPONENTS

VARIABLE	UNIT	FFSS		FFSG		SCHC
TOTAL VISIT-WORKLOAD	**total-visits/physician**	**1547**	>	**1326**	>>	**735**
all-contacts patient-load	patients/physician	909		894		475
visit-intensity	visits/patient	1.70		1.48		1.55
AMBULATORY VISIT-WORKLOAD	**visits/physician**	**1433**	>	**1219**	>>	**694**
PATIENT-CONTACTS	**patients/physician**	**909**	>	**894**	>>	**475**
discrete patient-load	patients/physician	566		593		322
patient contact-frequency	episodes/patient-year	1.66		1.51		1.51
DISCRETE PATIENT-LOAD	**patients/physician**	**566**	>	**593**	>>	**322**
physician age	years	45.5		42.9		38.5
physician gender	proportion female	0.11		0.13		0.15
practice-duration	quarters	39.7		36.2		12.9
patient-profile expected need for visits	expected visits/patient	1.34		1.32		1.40
contact rate	proportion seeing MD	0.81		0.80		0.80
physician-competition	MD/'000 population	0.90		0.93		1.01
CONTACT-FREQUENCY	**episodes/patient-year**	**1.66**	<	**1.51**	=	**1.51**
physician age	years	45.5		42.9		38.5
physician gender	proportion female	0.11		0.13		0.15
practice-duration	quarters	39.7		36.2		12.9
patient-profile expected need for visits	expected visits/patient	1.34		1.32		1.40
percentage in areas of excess utilization	%	54		24		18
discrete patient-load	patient/physician	565		593		322
VISIT-INTENSITY	**visits/patient**	**1.76**	>	**1.48**	≤	**1.52**
physician age	**(contact)**	45.5		42.9		38.5
physician gender	years	0.11		0.13		0.15
percentage International medical graduates	proportion female	60		29		61
practice-duration	%	39.7		36.2		12.9
patient-profile expected need for visits	quarters	1.34		1.32		1.40
percentage in areas of excess utilization	expected visits/patient	54		24		18
all-contacts patient-load	%	909		894		475
	patients/physician					
BILLING-INTENSITY	**fee/visit**	**17.95**	≤	**18.33**	≥	**17.58**
physician age	years	45.5		42.9		38.5
physician gender	proportion female	0.11		0.13		0.15
percentage International medical graduates	%	60		29		61
practice-duration	quarters	39.7		36.2		12.9
patient-profile expected need for visits	expected visits/patient	1.34		1.32		1.40
percentage in areas of excess utilization	%	54		24		18
all-contacts patient-load	patients/physician	909		894		475
visit-intensity	visits/patient	1.70		1.48		1.55
proportion consultations	%	42		58		3

Dollar values attributed to ambulatory visits provided by CHCs have been imputed from FFS schedule tariffs. They are provided for comparative purposes only and do not reflect actual visit costs of CHC services, which are likely higher than the FFS values.

Clearly, the roles of payment-modality and practice-organization are intricate and subtle. Moreover, other factors may explain some between-modality variation, as discussed in the literature review. As a starting point for unravelling these complex interrelationships, consider sources of variation in all patient-contacts -- that is, the initial contact and all subsequent physician-visits made by all patients over the year.

Second, fee-for-service physicians in both solo and group practice see similar numbers of patient-contacts (all-contact patient-load), but differ in the mix of discrete patient-load (residents making their first contact) and patient contact-frequency (patients making subsequent contacts) employed. Compared with fee-for-service physicians, however, salaried practitioners experience substantially fewer patient-contacts per quarter -- mostly because these physicians manage much smaller discrete patient-loads.

The number of patient-contacts -- the actual number of patients contacting a physician during a quarter -- includes a mixture of residents making their first physician-contact (i.e., the discrete patient-load) and patients initiating subsequent episodes of care (contact-frequency). As fee-for-service physicians face common financial incentives, FFSS and FFSG modalities are compared to investigate the influence of alternative practice-organizations on all-contact patient-load (see Table 5.3). Overall, FFSS physicians manage smaller discrete patient-loads, but have more frequent contact with these patients over the year. This finding is consistent with expectations of solo practitioners managing smaller discrete patient-loads, but seeing these patients for most episodes of care arising over the year. In contrast, group-based practitioners manage larger discrete patient-loads, but they see their patients less frequently over the year. The negligible between-modality difference in contact-frequency may be explained by the

FFSS patient-profile greater expected need for ambulatory visits, among other factors. In the face of a common fee-for-service payment-modality, practice-organization may alter the mix of discrete patient-load and contact-frequency experienced by physicians, but does not affect the overall number of patient-contacts seen. Further investigation of the relative size practice-modality effects will employ multivariate methods to adjust for other co-determinants of physician performance simultaneously.

Because of their common exposure to the influence of group practice-organization, the SCHC and FFSG groups are compared to assess the effect of salaried compared with fee-for-service payment-modality on physician performance. Compared with their FFSG counterparts, SCHC physicians see 46% fewer initial patient-contacts, but experience similar levels of patient contact-frequency over the year. Compared with SCHC practice, the fee-for-service payment-modality motivates physicians to secure/manage greater numbers of patients while group practice-organization reduces the frequency of patient contact over the year. Although fee-for-service physicians share a similar level of all-contact patient-load (i.e., all patient-contacts), the fewer patient-contacts experienced by salaried practitioners reflect the much smaller discrete patient-loads managed by SCHC practitioners. In spite of differences in payment-modality, physicians in group-practice (FFSG, SCHC) experienced equal frequencies of patient-contact. This analysis suggests that practice-organization and payment-modality act independently in determining all-contact patient-load.

Besides the effect of practice-modality, the size of the discrete patient-load managed by physicians is thought to be influenced by differences in

- physician age, gender, practice-duration
- practice-profile expected need for ambulatory-medical care, and
- physician service area population contact-rate and physician-supply.

While the two-way analyses yielded few statistically significant differences, the much smaller discrete patient-load managed by salaried practitioners may reflect the younger age, higher proportion of females, shorter practice-duration, higher patient-profile expected need, and greater competition for patients (see Table 5.4).

Patient contact-frequency is also thought to be influenced by

- physician age, gender, and practice-duration,
- practice-profile expected need for ambulatory medical care,
- physician service area population realized-accessibility, and
- the size of the discrete patient-load managed.

Discrete patient-load is included here under the assumption that both fee-for-service and salaried physicians consider the number of patients managed when determining patient-contact frequency. Beyond differences in practice-style, however, fee-for-service physicians also are motivated by income (work/leisure) considerations and salaried practitioners are motivated by work/leisure tradeoffs that encompass the duration as well as the intensity of work (stress) of work. Finding that FFSG and SCHC exhibit *equal* levels of patient contact-frequency in spite of significant differences in the other explanatory variables (especially discrete patient-load) suggests the strong influence that group practice-organization has upon physician behaviour. Comparison of FFSS and FFSG physicians finds discrete patient-load to be the only variable differing materially between these modalities. This finding is consistent with the observation that FFSS and FFSG physicians employ different combinations of discrete patient-load and patient contact-frequency to achieve similar levels of all-contact patient-load.

Third, the effect of practice-modality on physician visit-intensity is complex. While fee-for-service payment-modality and solo practice-organization are key factors associated with higher levels of visit-intensity, physician practice-style, as measured by place of undergraduate medical training, may also explain at least some between-modality variation.

Visit-intensity is a key concern to policy-makers concerned with physician resource management. Although controversial, health economists, and other researchers generally agree that physicians exercise great influence over how much care is rendered within episodes -- that is, whereas patients initiate episodes of care, afterwards, physicians mostly determine the mix/volume of services rendered. Moreover, for income considerations, fee-for-service physicians may alter visit-intensity to compensate for changes in all-contact patient-load. Although theory suggests differences in visit-intensity, empirical findings rank physician practice-modalities in descending order of visit-intensity as FFSS > FFSG >> SCHC, this distribution is not observed here; however, while FFSG and SCHC practitioners exhibit similar visit-intensity -- surprisingly, the visit-intensity rendered by SCHC physicians exceeded that of FFSG practitioners. Multivariate analysis adjusting fro the effects of co-determinants may provide greater insight into these findings.

Although it is tempting to attribute differences in visit-intensity among fee-for-service physicians to group practice-organization mitigating the effects of unbridled financial incentives, some variation may be explained by the contrasting proportions of International medical graduates comprising these modalities. Compared with FFSG practitioners, both the FFSS and the SCHC modalities exhibit higher visit-intensity (respectively 19% and 3%), but these groupings have 50% more International medical graduates. Perhaps the higher visit-intensity associated with FFSS practice reflects the combined effects of practice-style derived from training/experience outside Canada, fee-for-service financial incentives, or systematic differences inherent within the PSAs in which these groupings are found.

Alternatively, the 3% greater SCHC-modality visit-intensity (compared with FFSS physicians) may be explained by the 5% greater practice-profile expected need for ambulatory medical care. Further evidence supporting the role of patient-profile expected need is provided by examining variation in the provision of ambulatory care exceeding expected visits. FFSG and SCHC practitioners locate in physician service areas characterized by a balance between the population usage of, and its need for, ambulatory medical care. In contrast, FFSS physicians locate in areas in which usage exceeds need. Comparing these macro-level and meso-level aggregations of net-visits (i.e., usage less expected-need) provides evidence that financial incentives increase visit-intensity to levels exceeding expected (needed) levels of ambulatory visits.

Fourth, physician billings for ambulatory visits exhibit little variation across the study practice-modalities. The marginally higher fee per visit paid to FFSG practitioners reflects the greater proportion of consultations rendered by these

physicians and possible behaviour compensating for lower all-contact patient-load and visit-intensity (i.e., total visit-workload).

Billing-intensity is also a potential negative side-effect of fee-for-service payment. In the face of clinical uncertainty, physicians may increase their incomes by claiming higher tariffs. Although theory and empirical findings rank physician practice-modalities in descending order of billing-intensity as FFSS = FFSG > SCHC, this distribution was not observed. These marginal differences in billing-intensity, which reflect higher proportions of consultations provided by FFSG practitioners, offer little explanation of physician visit-workload variation.

Fifth, ambulatory visits (excluding consultations) comprise the bulk of total visit-workload (more than 91%) for all three practice-modalities. Although interesting between-modality differences were detected, their impact on physician total visit-workload was negligible.

The percentage of physician total visit-workload consists of ambulatory visits (excluding consultations) are 91%, 93% and 95% respectively for the FFSG, FFSS, and SCHC modalities. These findings are consistent with fee-for-service payment motivating physicians to provide higher tariffs consultations and with group practice-organization supporting specialization. Overall, FFSG practice both motivates and enables its members to engage in consultative care.

Physicians' use of hospital inpatient beds is similar across the practice-modalities, after adjusting for differences in all-contact patient-load (patient-contacts).

The gradient observed in patient referrals to "specialists" across the study practice-modalities reflect differences in the numbers of patient-contacts, practice-modality incentives/constraints, and the practice-styles of the physicians attracted to these groupings. The high referral rate (6.36 visits per hundred patients) among the high proportion of active FFSS physicians (76%) may provide a mechanism for dealing with larger workloads and more needy patient-profiles. In contrast, the very high percentage of FFSG physicians making referrals (91%) may correspond to this groups' high rate of consultations. The availability of "specialists" within the practice eases the process of finding consultants and it reduces the potential loss of patients to "consultant" general practitioners. Alternatively, within-group exchanges of patients may be used as a mechanism by the participants to obtain the higher tariffs paid for consultations. A distributing observation is the high ratio of referrals made to other general practitioners by all rural physicians, but especially by FFSS and SCHC practitioners (respectively 0.68 and 0.71; see Table 5.3). The lower fraction exhibited by FFSG physicians (0.60) may reflect networking among graduates of the University of Manitoba and/or proximity to Winnipeg/Brandon specialists.

Sixth, practice-stability is affected by practice-modality. The lowest level of physician-turnover and the greatest physician-retention are both associated with FFSG practice. The shortest gaps in practice-coverage occur at SCHC sites, with FFSG practice places a close second. Whereas the FFSG practice-modality achieves high overall practice-stability, this finding may reflect (at least in part) physician graduation from the University of Manitoba and the desirability of rural influential communities.

Practice-stability -- a key concern to all stakeholders -- is considered as three related dimensions: physician-turnover, practice coverage-gaps, and physician-retention. Although the association of FFSG practice with the lowest rate of physician-turnover and longest physician-retention suggests the role of practice-modality on practice-stability, the staffing of these mostly influential communities by Manitoba graduates likely also explains this high degree of practice-stability. These attractive sites and practice-arrangements may be preferred by physicians interested in rural medicine. In contrast, comparably higher levels of turnover and shorter length of retention among FFSS and SCHC physicians likely reflect the much greater proportion of International medical graduates staffing these modalities. These physicians may view practice in rural Manitoba as a temporary phase of their careers -- either as an entry point into Canada or an opportunity to practice in a foreign country. Further multivariate analysis will provide greater insights into the relationship between practice-modality and practice-stability.

The shorter practice coverage-gaps among SCHC sites likely reflect the combined efforts of Manitoba Health (particularly, the Standing Committee on Medical Manpower), communities and the willingness of International medical graduates to move to rural Manitoba (see Postl *et al.* 1994). In contrast, the longer coverage-gaps estimated for FFSG practice may reflect the efforts of practice members to recruit physicians compatible with the requirements of rural practice, overall, and of the group culture, in particular. Considering the long-term associations implicit in FFSG practice, ensuring compatibility among group members may lengthen the recruitment process. Finally, the overall poor ranking of the FFSS-modality in all three dimensions of practice-stability suggests that solo practice in isolated areas is not an attractive option to physicians. The longest gaps in practice-coverage in sites staffed by FFSS physicians suggest difficulties in recruiting replacement fee-for-service physicians. Such locations may be candidates for publicly funded community health centres.

Although FFSG practice is associated with the highest overall practice-stability, clearly not all rural communities possess sufficient populations to support group practices. There are continuing efforts to staff solo practice sites in smaller communities; however, policy-makers should consider improving rural accessibility to fewer, but larger sites, staffed by physicians practicing in fee-for-service (and possibly capitated) group arrangements.

Finally, the generally low levels of within-modality variation (i.e., high agreement) estimated for total visit-workload, its components, and selected explanatory variables suggest that practice-modality self-selects like members. High within-group conformity among modality members may be achieved directly, by affecting physician behaviour, or indirectly, from physicians self-selecting practice-modalities. Contrary to expectation, levels of within-group variation are low and (generally) comparable across the alternative practice-modalities.

Dispersion within the data around estimates of central tendencies is thought to be influenced by physician practice-modality. While physician practice-style is correlated with many factors, practice-modality is one key to understanding physician behaviour. Variation in physicians' responses to alternative combinations of financial and organizational effects depends upon differences in their attitudes toward income and the strength of these influences. Within-modality variation derived from practice-modality effects was

- greater among FFSS practitioners facing solely financial incentives,
- less among FFSG physicians, due to the mitigating effects of group practice, and
- lowest among SCHC physicians in organized-practice and not facing fee-for-service financial incentives.

Lower within-group variation (CRV < 1.0) suggests stronger conformity among member physicians. Similarly low CRV levels estimated for the explanatory variables for the three study practice-modalities suggests that factors within each practice-modality act to achieve comparable levels of conformity. Although these alternative practice-modality influences mean levels of physician performance, they appear to exert little effect on within-group conformity; however, the complexity of the underlying behaviours invites further (more sophisticated) analysis.

5.4 DISCUSSION

The presence of three physician practice-modalities in rural Manitoba enables researchers to estimate the effects of alternative payment-modalities and practice-organizations on physician care-giving behaviour. Table 5.5 summarizes study findings providing insights into the role of practice-modality in explaining variations in physician total visit-workload and practice-stability. Based on two-way analyses, these findings should be regarded as preliminary and subject to verification by further analysis using multivariate methods. Total visit-workload differs by practice-modality, with lower levels associated with SCHC practice. Sources of variation arise from differences in the all-contact patient-load and the visit-intensity components of total visit-workload.

TABLE 5.5: THE EFFECT OF PRACTICE-MODALITY ON PHYSICIAN PERFORMANCE

DIMENSION OF PERFORMANCE	FFSS	FFSG	SCHC	fee-for-service payment-modality	group practice-organization
TOTAL VISIT-WORKLOAD	+		---	?	?
ALL-CONTACT PATIENT-LOAD:			---	?	?
DISCRETE PATIENT-LOAD	-	+	---	+++	
CONTACT-FREQUENCY	+	-	-		-
VISIT-INTENSITY	+			-	-
BILLING-INTENSITY		+		? (-)	? (+)
PRACTICE-STABILITY:		++	+	?	?
PHYSICIAN TURNOVER		--		?	?
PRACTICE COVERAGE-GAPS	+		-	?	?
PHYSICIAN-RETENTION		+		?	?

Compared with fee-for-service practitioners, all-contact patient-load is much lower among salaried physicians. Further analysis finds that both group practice and fee-for-service payment acts to generate similar levels of all-contact patient-load among fee-for-service physicians. For SCHC practice, however, the small effect of group practice on reducing contact-frequency is further supported by salaried payment failing to motivate practitioners to manage correspondingly larger discrete patient-loads. ***Group practice is characterized by lower frequency of patient contacts compared with solo practice, while fee-for-service practitioners typically manage many more discrete patients than salaried physicians. Combining these components into the alternative practice-modalities creates complex effects. Group practice, acting through contact-frequency, independently reduces patterns of all-contact patient-load. Among fee-for-service physicians, however, interaction between these components generates similar levels of all-contact patient-load. For SCHC-modality, however, salaried payment and group practice interact to yield substantially fewer patient contacts.***

Overall, payment-modality acting through discrete patient-load is the key determinant of all-contact patient-load and, ultimately, of total visit-work-load.

Variation in visit-intensity arises from complex interactions between payment-modality, practice-organization, physician practice-style, and the number of patient-contacts. FFSS practice is associated with the highest level of visit-intensity and surprisingly, FFSG practitioners exhibit the lowest level; however, FFSG and SCHC practitioners exhibit similar levels of visit-intensity (within 5%). ***Comparison of FFSS and SCHC practice -- an alternative modality sharing a similar profile of physician practice-style, but differing in practice-modality -- strongly suggests that the physician practice-modality matters. Payment and practice offset each other's effects in determining the size of visit-intensity. While fee-for-service payment motivates physicians to render excess visits per episode (contact), group practice offsets the effect of this financial incentive.***

The small variation in billing-intensity is another example of the interactive effects of payment-modality and practice-organization on physician behaviour. Fee-for-service payment provides financial motivation while group practice affords an infrastructure supporting the activities of physicians engaging in speciality care (and, so, claiming higher tariffs). ***Although these data cannot distinguish between these effects, both payment and practice likely explain higher levels of FFSG billing-intensity. Physician self-selection into these practice-modalities may play some role, however, with International medical graduates being less qualified or motivated to develop the referral network needed for specialization.***

Finally, FFSG practice-modality is associated with overall superior practice-stability. Physician-turnover is much lower and the length of physician retention is greater among SCHC practitioners. While greater gaps in practice-coverage occur, the structure of FFSG practice may both cope with this concern. Given the importance of relationships among group practitioners, FFSG physicians may be more selective in recruiting replacement physicians. However, as they are concerned about retaining patients, the membership may provide additional coverage throughout the recruitment process. ***Although these data do not distinguish between payment and organizational effects, both likely interact to explain the superior FFSG practice-stability.***

Overall, FFSG practice appears to retain the positive aspects of fee-for-service payment -- managing larger number of discrete patients -- while escaping the negative implications of solo practice -- rendering excess visits per patient and greater turnover.

The difficulty in interpreting these findings -- particularly differences in discrete patient-load -- arises from incomplete understanding of the determinants of physician and patient behaviour in rural settings. Do fee-for-service physicians respond to financial incentives? If so, are they motivated to maximize income or do they seek to achieve some target amount consistent with expectations (however determined)? Do salaried physicians seek to minimize their workloads or do they return "value for money"? Finally, do residents, particularly the patients of FFSG physicians, see several physicians?

The amount of physician remuneration likely influences the size of discrete practice-load managed. While fee-for-service physicians exercise some control over their income (and, so, underlying visit-workload), they also must cover overhead costs.

In contrast, salaried physicians are paid the average of rural fee-for-service billings less 35% estimated as the cost of practice overhead. Although facing comparable net incomes, salaried physicians receive much lower gross reimbursement. If physician behaviour is more influenced by gross rather than net incomes, this financial disincentive on SCHC practitioners may motivate them to reduce their workloads correspondingly. Therefore, salaried physicians may adjust their perceptions of full-time activity to the level signalled by the actual amount paid -- with corresponding implications for overall medical care activity and the patient-load managed. Finding that the difference in all-contact patient-load managed between the FFSG and SCHC modalities corresponds closely to the mean difference in gross reimbursement.

A key issue in interpreting variation in physician visit-workload is distinguishing between time and productivity effects. The time devoted by physicians to direct patient care is an important factor influencing the patient-load managed and subsequent level of care rendered to these patients. Extended office hours plus greater emergency room and on-call coverage increase opportunities for patient contact. Shared arrangement available through group/community health centre practice-organization enhances patient accessibility without unduly burdening member physicians. Therefore, the members collectively manage more patients but do not see them as often. Whereas group practice-organization affects physician visit-workload and its components, the advantage gained in physician productivity is not clear. After adjusting for patient sharing, do FFSG members care for greater numbers of residents than their FFSS colleagues?

Analysis of the 1990 Canadian Medical Association survey data found no statistically significant differences between rural Manitoba fee-for-service and salaried physicians in the time used for direct patient care (see Wall *et al.* 1994); however, analysis of a national survey finds salaried physicians report less time for patient care than their fee-for-service counterparts in group practice (Williams 1987). In this study, full-time equivalent (FTE) status calculated quarterly provides a comprehensive estimate of total physician-activity. While FFSS and FFSG physicians exhibit comparable levels of activity (1.10 FTE), SCHC practitioners achieve only 0.66 FTE (see Table 5.2). Had the SCHC members managed similar patient-loads, however, this estimate of total activity would have been comparable to that of the fee-for-service physicians.

In not facing financial incentives, SCHC physicians may employ the telephone and other non-reimbursable approaches (e.g., nurse practitioners, public health nurses) to follow-up acute-care patients (e.g., colds, flues) and chronic-care patients (e.g., hypertensive, diabetic) (Edwards 1991, Eisenberg 1986). For acute-care patients, only the quarterly visit-count would be reduced (see below); however, for chronic-care patients, both quarterly patient-counts and visit-counts would be underestimated while fewer patient-contacts over the year would be required (and reported). Alternatively, in not facing financial incentives to report all patient-contacts, salaried physicians may under report encounters and utilization.

Contrary to the requirements of Manitoba Health, some physicians may fail to file all medical claims (dummy billings). If this were the only encounter with the patient, then both the count of visits and patients are biased. However, the validity of these data was examined using three approaches. First, analysis of entire physician-profiles (all care and services rendered) detected no unexpected differences. Overall, the distribution of physician-workload by type of activity (e.g., office visits, emergency room, minor surgery) was comparable between salaried and fee-for-service physicians. Second, it is not obvious that all of the 90% of the salaried physicians designated as less than one FTE under report their activities by similar amounts to Manitoba Health. Nor is it obvious that high agreement (i.e., low CRV) should exist over the degree of under reporting. Finally, the percentage between-modality differences in mean discrete patient-loads managed by FFSG (+4.8%) and SCHC (-43%) compared with FFSS physicians compares well to estimates derived by Williams (1987) from 1982 national survey data (respectively +5.5% and -40%).

Overall, it is not likely that considerations other than practice-modality and certain characteristics associated with physician self-selection into alternative practice-modalities explain these findings. While the effect of practice-modality is complex, the importance of fee-for-service payment in motivating rural physicians to provide coverage to larger populations (i.e., seek out and retain patients) and the role of group practice-organization in mitigating its negative aspects (i.e., ambulatory medical care usage greater than patient-profile expected visits) and the implications of solo practice (i.e., poorer practice-stability) should interest policy-makers.

6.0 SUMMARY AND POLICY IMPLICATIONS

Sparse patterns of settlement, declining numbers of residents, aging populations, economic and other social disparities, difficulties in recruiting/retaining physicians, and the political/medical dominance of metropolitan regions limit the ability of governments to deliver mandated services in rural Canada. Enduring themes of rural ambulatory medical care delivery include imbalances in

- the distribution of physicians,
- patterns of population contact and resulting ambulatory medical care utilization, and
- in physician workload and practice-stability.

Other concerns, beyond the scope of this research, include disparities in the quality, effectiveness, satisfaction, and outcomes of rural medical care.

From the residents' perspective, key concerns include the local availability of physicians, overall access to medical care, and the stability of physician-practice. Shaped by expectations derived from the historic staffing of most villages by solo practitioners, rural residents continue to expect to obtain services from locally available physicians -- even if they do not routinely contact them. Rural residents are also concerned about endemic physician-turnover and its disruption of the process of medical care. Excessive gaps in practice-coverage and poor physician-retention are detrimental to the continuity of the patient--physician relationship.

Physicians have concerns about: competition for patients, the stability of physician-supply within the group and the wider community, excessive workloads and, among fee-for-service physicians, the related issue of achieving wanted levels of income within a competitive environment. The retention of physicians in rural settings is impaired by strained off-hours coverage arrangements (especially in the more isolated areas), limited professional support, and the constraints placed upon professional/personal lifestyles.

Finally, policy-makers are concerned about imbalances in the distribution of resources and access to health care. The total cost of medical care and its unexplained variation across small areas are currently the focus of policy-making. Policy-makers in Manitoba are troubled over physician-turnover and actively work with communities to recruit and retain physicians.

What is the myth and what is the reality of observed variations in patterns of ambulatory physician visits in rural Manitoba? Efforts to distinguish between myth and reality should consider

- the sensitivity of analytical findings to the broad policy environment in which research occurs (Titmuss 1974),
- how the process of utilization is conceptualized, how relationships bearing upon patient--physician interactions are operationalized, and
- the extent to which model variables can be estimated using the study data set.

The funding/organization of primary care varies across jurisdictions (Angus *et al.* 1995a, 1995b; Groenewegen *et al.* 1991). Moreover, within a specific setting, temporal changes in the funding/organization of primary-care delivery also limit the generalization of research to informing policy-making (Aday *et al.* 1993). Similarly, failing to account for practice-organization may introduce analytical bias. For example, the large set of managed care models in the United States complicates efforts to estimate the effect of payment-modality on physician behaviour (Wolinsky and Marder 1985). Analysis comparing the performance of physicians practicing within fee-for-service groups to staff model health maintenance organizations (i.e., a stronger organizational effect) will likely yield different conclusions than comparison to Independent Practice Associations (i.e., a weaker organizational effect).

Moreover, the interaction of individual physicians with macro-level and meso-level effects matters. The "success" of community health centres in Canada and of the maintenance organizations in the United States may depend *jointly* on the physician, the practice-organization, *and the* prevailing macro-environment -- circumstances not necessary replicated in rural Manitoba (Birch *et al.* 1990; Bryan 1996; Lomas 1985; Luft 1986).

Although imbalances in the distribution of general practitioners across rural Manitoba continue to concern rural stakeholders, this research suggests that the focus of policy-making should shift towards redressing unexplained variations in patterns of ambulatory medical care utilization (i.e., realized physician-accessibility). Although imbalances in local physician-availability persist in Manitoba, realized physician-accessibility (utilization) is more equally distributed. In shifting the focus of policy-making from physician-availability to physician-accessibility, the determinants of residents' care-seeking and physicians' care-giving behaviours become the concern of policy-making. Whereas equity in populations' usage of ambulatory medical care has been achieved, imbalances in utilization compared with the expected need for physician visits remain to be readdressed.

What more can policy-makers do to redress imbalances in the use of physicians further? Practice-modality is one option that policy-makers can employ to influence physician care-giving behaviour, and, so, patterns of resource/service availability, medical care accessibility and practice-stability. As emphasized by the Barer-Stoddart Report (Barer and Stoddart 1992e), practice-modality is only one mechanism that policy-makers can use to influence physician care-giving behaviour. For example, serious efforts to recruit individuals predisposed toward the rustic lifestyle (i.e., rural residents) to train as general practitioners could stabilize the rural physician-supply over the long-run.

What can be done to improve physician performance over the short-term? Although signing bonuses and barrier placed on entry into urban practice may recruit physicians to under serviced areas, they generally are not successful in retaining practitioners beyond the contracted period. Therefore, particular attention is focused on the effect of alternative practice-modalities on physician performance (visit-workload, appropriative of care, practice-stability) in rural Manitoba.

What did this research contribute to our understanding of the epidemiology of rural ambulatory medical care? In focusing on the patterns and determinants of rural ambulatory medical care, this thesis undertook three tasks. First, a conceptual model of the determinants of the patient--physician relationship generating observed patterns of ambulatory medical care utilization was developed. Second, using this model, the empirical and theoretical literature was examined to identify key factors bearing upon demand, supply, and interactive behaviours. Finally, analysis focusing on macro-level population--physician-supply interactions was undertaken to investigate variations in utilization across physician service areas. In executing their mandate to deliver services to Manitobans, policy-makers, and planners should be concerned about such differences. Finally, analysis focusing on meso-level patient-profile--physician interaction was undertaken to investigate the potential of practice-modality (payment-modality and practice-organization) to redress imbalances in patterns of medical care utilization. Practice-modality, specifically payment-modality, is a controversial mechanism for influencing physician behaviour.

6.1 METHODOLOGICAL CONTRIBUTIONS

A conceptual model of rural medical care utilization was developed and applied to the Manitoba Physician Resource Data Set (see Chapter 2, Tables 2.1 and 2.2). This model emphasizes the relationship between individual physicians' workloads and population (aggregate) utilization, as linked by the prevailing physician-supply in PSAs. The contribution of the model includes distinguishing between patient-contacts (discrete patient-load and patient contact-frequency), the within-episode visits (visit-intensity), and the billings made for these visits (billing-intensity). For research examining the effects of practice-modality on patterns of ambulatory medical care usage, patient-contact and visit-intensity should be distinguished; moreover, for analysis investigating variation in patient-contact across rural physician-practices, the roles of discrete patient-load and patient contact-frequency should be identified. Explicit multivariate models of the determinants of utilization and physician performance were not developed as part of this thesis. Empirical analyses were limited to descriptive tables, graphs, correlations and two-way tests of statistical significance.

Analysis of macro-level interactions examines the equity of patterns of ambulatory medical care utilization and physician-availability while meso-level relationships highlight the role of practice-modality, and particularily SCHC funding, as a lever for reforming the delivery of rural health care. The application of the model to investigating macro-level patterns of medical care usage highlights the importance of population expected (comparative) need for ambulatory physician visits and of the role of physician-accessibility in redressing imbalances in physician-availability across rural Manitoba. Analysis of meso-level physician-practice--patient-profile interactions highlight the importance of physician, practice, patient-profile, population, and small-area characteristics on explaining patterns of ambulatory physician visits. Practice-modality matters, with fee-for-service payment combined with group-organization enhancing physician performance.

The comprehensive data set developed for this study

- includes all physicians and residents within rural Manitoba,
- is based on a spatial framework that accurately matches patterns of residents' care-seeking and physicians' care-giving,
- tracks physicians' movements to identify changes in practice-modality, practice-location, and gaps in practice,
- compiles data on physician, practice, patient-profile, population, and physician service area characteristics, and

- allows for quarterly and other aggregation of data.

The fairness of comparative analysis was enhanced by eliminating physicians not practicing for the full quarter.

6.2 EMPIRICAL FINDINGS

6.2.1 MACRO-LEVEL RELATIONSHIPS

Variation in the utilization of medical care across rural Manitoba exhibited little correspondence to the determinants of aggregate care-seeking -- estimated population expected need for ambulatory physician visits and physician-availability.

First, consider factors determining the aggregate demand for primary medical care. Analysis of the need--usage relationships estimated for rural Manitoba physician service areas detected a weak positive relationship between populations' expected need for, and their use of, ambulatory visits; however, this trend is obscured by substantial variation (noise). Although equity in physician-accessibility has clearly been achieved across rural Manitoba, patterns of inappropriate utilization remain -- that is, needy populations make too few physician-contacts while healthier residents consume excessive numbers of visits.

Little support was found for naive epidemiological or other need-based models predicting patterns of ambulatory medical care utilization. Rural PSAs characterized by greater numbers of physician contacts than predicted by expected need generally exhibit high proportions of out-of-area care-seeking to Brandon, Portage-la-Prairie (CP), and, especially, Winnipeg. These patterns of visits may reflect the (excessive) utilization of medical care typically found within these influential areas. The unexpectedly lower usage estimated for the rural influential area, PD, may reflect the high proportion of patients drawn from surrounding areas. In contrast, lower than expected usage estimated for "self-contained" areas removed from the influential communities may be explained by distance and the related opportunity costs of travel to all sources of primary medical care.

Physician-availability -- the potential of rural residents to obtain medical care from local sources -- is derived from complex interactions between physician-supply, average physician visit-workload and the proportion of ambulatory visits rendered to in-area residents. Comparable levels of physician-availability found across rural Manitoba (ranging from 0.5 to 1.1 FTE/000) are explained by compensating interactions between physician-workload and the proportion of this activity devoted to in-area residents.

Physicians in sites characterized by lower physician-supplies are characterized by greater levels of activity (e.g., E1, I2, P2, W3) while the reverse is generally true in areas where the physician-stocks are higher (e.g., W1, W10). Physicians in influential areas characterized by high proportions of patients drawn from outlying areas respond to these demands and maintain high in-area physician-availability by increasing their levels of activity. The correspondence between physician-supply and physician-workload, however, is not consistent across rural areas. The most active practitioners generally do not practice in areas characterized by low physician-supply and/or high proportion of into-area care-seeking. Moreover, as five of the six areas with the lowest physician-availability also exhibit usage greater than expected levels (i.e., E5, C5, C3, C10, E1), local physician-availability explains, at best, explains only part of the variation in patterns of medical care usage. The interaction of high proportions of in-area care-seeking with low levels of physician-activity typical of the areas more distant from influential sites, may explain patterns of low usage (e.g., I4, C1, P3). Higher physician-availability in the Parkland and Westman Regions is consistent with greater in-area care-seeking found in these areas; lower physician-availability in the Central and Eastman Regions reflects high out-of-area care-seeking to Winnipeg and, to a more limited extent, Portage-la-Prairie. Overall, physician-workload is an important determinant of physician-availability, particularly in the P2, P4 and CP areas.

Physician-accessibility -- actual patterns of ambulatory physician visits accounting for all sources of medical care -- was estimated as

- the rate of physician-contact,
- the average number of visits *per capita* (i.e., utilization), and
- the effective physician-supply seen (i.e., all physicians contacted).

The percentage of residents making at least one visit during the year is a key measure of rural residents' ability to contact generalist physicians. Variation in this measure reflects differences in the determinants of demand -- that is, perceived need, attitudes toward medical care, and barriers limiting access. Little variation in physician-contact was found in rural Manitoba -- either as a function of population expected need for ambulatory visits or physician-availability. While it is encouraging to find equity in physician-contacts for primary medical care across rural Manitoba populations, it is discouraging to find imbalances in usage in terms of the expected need for ambulatory medical care -- that is, the residents of lower need areas make many too many visits while those residing in lower need areas make too few.

The six areas exhibiting the lowest rates of physician-contact (< 80%) also exhibited low rates of utilization. Two areas (CM and adjacent C1) contain heathier populations whose low rates of physician-contact and medical care use is likely explained more by Mennonite ethnicity (i.e., attitudes toward care-seeking) than by barriers limiting access. The remaining four areas (E3, I3, W10, W19) are sparsely settled and distant from influential communities. All six areas, however, obtain most of their primary medical care from in-area physicians.

The six areas exhibiting the highest rates of contact (>83%) also reflect diverse patterns of behaviour. One area (IS) is likely influenced by the patterns of medical care in Winnipeg. The populations of three areas (C5, I1, W9) are characterized by greater expected need for primary medical care and high proportions of Status Indians. Besides these determinants, the high rates of contact in these areas are influenced by the outreach efforts of physicians from CP, Winnipeg and Brandon. The remaining two areas (I2, W3) are distant from influential communities. Patterns of care-seeking in I2 are in balance with expected need, but excess usage was estimated for W3. While variation across rural Manitoba areas is small, it is very encouraging to find that the more needy areas exhibited higher rates of physician-contact.

Physician-availability and estimated population expected need for primary medical care is not likely to explain lower rates of physician-contact and ambulatory visits in E3, I3, W10 and W19; however, the collective attitudes of these populations, physician-supplies or other factors may explain these findings. Further survey and qualitative research may help to provide insights into the attitudes and behaviours underlying these patterns of utilization.

The average number of contacts (visits) per resident reflects variation in the rate of physician-contact and/or visit-utilization by these patients. Whereas population contact-rate displays little variation, patient visit-intensity exhibits a strong positive relationship with expected need for ambulatory visits. The residents of areas with low physician-availability obtain care from out-of-area sources (mostly Winnipeg, but, to a lessor extent, Brandon and selected rural influential communities). Although finding evidence of comparable population access to physicians, realized-accessibility (utilization) exhibits perverse patterns not predicted by expected need for primary medical care nor physician-availability.

Yet, what explains variation in rural utilization of primary medical care: population contact-rate and/or patient visit-intensity? Given high, comparable rates of physician-contact, differences in patient visit-usage following the initial contact is the key factor explaining patterns of utilization. Comparison of the average visits per patient used versus expected levels finds agreement among high-need areas, but excess usage for mid-need to low-need settings. This finding implies that the residents of mid-need to low-need areas make excess contacts with physicians and/or they receive (or demand) too many visits. Rather than high-need populations using too little ambulatory care, the issue may be the contact-rate and/or visit-intensity of the residents of mid-need to low-need sites.

Finally, the effective physician-supply used by in-area residents accounts for the full spectrum of medical services (generalist and specialists) used by rural populations no matter the source of care. Effective physician-supply also exhibits a very weak positive association with the expected need for ambulatory visits. Not surprisingly, little difference was found when the physician service areas were compared based on effective physician-supply and the average number of visits *per capita*.

While residents (and policy-makers) remain concerned about physician-supply, no evidence was found that greater physician-availability enhances rural populations' usage of ambulatory and all medical care (realized-accessibility). Patterns of ambulatory visits in rural Manitoba reflect complex interactions between flows of patients and physician-workload. Therefore, policy-makers may wish to consider differences between groupings of physician service areas -- that is, influential communities and their adjacent areas face different issues requiring different policy remedies than the more distant (and self-contained) sites.

From the perspective of physician care-giving behaviour, physician-supply is the traditional measure of in-area physician-competition for scarce patients. Physician-supply is sensitive to average physician visit-workload and the effective population served by these physicians (i.e., in-area population adjusted for the inflow of patients and the outflow of residents seeking care from outside sources). Comparable levels of physician-competition suggest that imbalances in physician distribution (physician-supply) are compensated for by corresponding levels of average physician-workload and, especially, the effective population served. Physician-activity exhibits little relationship with population expected need for ambulatory visits, but is strongly inversely correlated with physician-supply and physician-competition.

Overall, physician patient-load is expected to decrease with increasing physician-competition while visit-intensity should increase with greater population expected need for ambulatory medical care and, possibly, with higher physician-competition (i.e., lower patient-load). Average physician visit-workload is essentially comparable across rural areas. Although the workload of individual physicians varies widely, no association was found with the expected need for ambulatory visits or with physician-supply. Physician-competition, however, is a key determinant of average patient-load and, indirectly (assuming supplier-induced demand behaviour), of average visit-intensity. As expected, patient-load strongly decreases with physician-competition and physician-activity strongly increases with patient-load.

Although physician visit-intensity exhibits a weak association with population need and with physician-competition, these trends are obscured by substantial within-group variation (i.e., noise). The spectrum of physician visit-workload observed in rural Manitoba is determined by three distinct sets of interactions between patient-load and visit-intensity (see Figure 4.17):

- for PSAs with higher physician-competition, decreases in patient-load are partially offset by increases in visit-intensity, with the net-result of lower overall physician visit-workload;
- for PSAs with intermediate-levels of competition, since patient-load does not vary, variation in physician visit-workload is solely determined by visit-intensity; finally,
- for PSAs with lower physician-competition, increases in patient-load are partially offset

by decreases in visit-intensity, with the net-result of higher overall physician visit-workload.

Although physicians *may* adjust their level of visit-intensity in response to the number of patients seen, patient-load is the key determinant of larger workloads -- that is, on average, whereas each patient is equivalent to five visits *per annum*, supplier-induced-demand would generate at most 1.5 additional visits per patient within a practice.

Finally, practice-stability -- as measured by physician-turnover, gaps in practice-coverage, and physician-retention -- varies with the location of practice (see Figure 4.18). Practices within influential communities systematically exhibit the lowest physician-turnover, the shortest gaps in practice-coverage, and the longest retention of physicians. In the other extreme, however, practices in more isolated areas generally exhibit the lowest practice-stability -- that is, the highest turnover, the greatest gaps in practice-coverage, and the shortest retention of physicians.

6.2.2 MESO-LEVEL RELATIONSHIPS: THE EFFECT OF PRACTICE-MODALITY ON PATTERNS OF PHYSICIAN PERFORMANCE

Whereas practice-modality matters, the effects of payment-modality (fee-for-service, salary) and practice-organization (group, solo, community-health-centre [group]) on physician performance should also be understood. Physicians exercise discretion over the components of their workloads -- with the greatest control exercised over visit-intensity and, to some extent, discrete patient-load, and patient contact-frequency. Compared with salaried practice, fee-for-service payment motivates physicians to manage greater total and ambulatory visit-workloads. This key finding is explained by manage greater total and ambulatory visit-workloads. This key finding is explained by the complex interaction of fee-for-service payment-modality and group practice-organization.

While practice-organization among fee-for-service physicians did not significantly affect mean visit-workload, between-modality differences in visit-intensity may be important (see Section 5.1.2). FFSG and FFSS practitioners see similar levels of patient-contacts, but FFSS physicians render more visits per contact (episode). Differences in estimated mean patient-profile expected need for ambulatory medical care do not explain this finding. Therefore, the higher visit-intensity of FFSS may generate excess amounts of care. In contrast, FFSG physicians achieve a balance between expected and provided rates of visits. Additional analyses using multivariate methods would provide further assurance about the size of estimated between-modality differences.

Whereas fee-for-service physicians achieve similar levels of patient-contacts, the mix of discrete patient-load and contact frequency employed differs. Compared with their FFSS colleagues, FFSG physicians manage greater numbers of discrete patients, but they see them less often during the year. These differences, which are consistent with other findings in Manitoba (Roos 1980) and elsewhere (Williams 1987), arise from the nature of group practice-organization. Through formal arrangements that govern practice-coverage, FFSG physicians come to see more patients, but not for all episodes presented by these patients over the year. In contrast, because solo practitioners are available for all routine contacts (and likely many after-hours and emergency care) they essentially see all of their patients for all contacts. However, FFSS physicians appear to compensate for higher contact-frequency by managing smaller discrete patient-loads. Overall, fee-for-service rural Manitoba physicians see (approximately) 900 contacts per quarter.

In contrast, salaried physicians see substantially fewer patient-contacts per quarter (n = 475). This finding is explained by differences in both discrete patient-load and patient contact-frequency. As patient contract-frequency is *equal*, the effect of salary payment is expressed through discrete patient-load managed -- that is, 322 patients managed by salaried practitioners compared with the 593 and 566 patients respectively seen by FFSG and FFSS physicians. In the face of the common effect of group practice, comparison of the SCHC and FFSG modalities provides the fairest comparison of the effect of salaried payment on discrete patient-load. ***The effect of payment-modality is clearly expressed through differences in all-contact patient-load, with fee-for-service payment motivating physicians to manage greater numbers of discrete patients and to see them more frequently over the year. The effect of practice-organization is expressed through patient contact-frequency, with physicians in group practice managing greater numbers of discrete patients, but in seeing them less often over the year.***

Visit-intensity is influenced by both payment-modality and practice-organization. Whereas fee-for-service payment motivates physicians to render more visits per contact (episode), the lower visit-intensity rendered by fee-for-service practitioners may be explained by group practice-organization and/or graduation from the University of Manitoba (i.e., as a proxy measure of practice-style).

The three dimensions of practice-stability are also affected by practice-modality. The lowest physician-turnover and the greatest physician-retention are associated with the FFSG-modality. Although SCHC-modality exhibits the shortest gaps in practice-coverage, the FFSG-modality places a close second. As FFSG physicians are mostly in influential communities and these positions are mostly staffed by Manitoba graduates, however, some combination of practice, community and physician characteristics may explain the high practice-stability among FFSG practices.

6.3 POLICY SIGNIFICANCE OF RESEARCH FINDINGS

First, what are the implications for policies concerned with the distribution of physicians in rural Manitoba? Although pockets of under serviced communities may exist within rural areas, broad policies increasing the physician-supply to improve physician-accessibility are questionable unless the substantial out-of-area care-seeking can reduced. In contrast, distant areas characterized by high proportions of in-area care-seeking, but facing poor physician-availability, may benefit from enhanced physician-supply. Also, if the workloads managed by these physicians are excessive, then practice-stability may be enhanced by additional physicians. The message distilled from these findings is for policy-makers to distinguish between these two groupings of physician service areas for physician resource planning.

Although traditional fee-for-service payment has fallen out-of-favour with policy-makers, its role in attracting physicians to, and retaining them in, rural general practice may be underappreciated. This research finds a potential role for both FFSS and FFSG practice in rural Manitoba and argues that incentives not attached to physician performance may produce perverse results.

Fee-for-service payment motivates physicians to secure and manage "reasonable" numbers of discrete patients. Although capitated practice (i.e., payment per patient) may also motivate physicians to manage larger discrete patient-loads, this practice-modality is currently unavailable in rural Manitoba. Furthermore, as no evidence from rural settings elsewhere in Canada is reported, it is not clear if capitated payment is compatible with rural physician practice in Manitoba.

Undesirable effects attributed to fee-for-service payment include greater patient contact-frequency (episodes) and higher visit-intensity within episodes. However, patient contact-frequency is mitigated by group practice. Moreover, while visit-intensity is the highest among FFSS physicians, it was also high for SCHC practitioners. Though FFSG physicians also face fee-for-service financial incentives, they also report the lowest level of patient utilization (visit-intensity). The interpretation of these findings is complex. Although both of the FFSS and SCHC practice-modalities are associated with the higher visit-intensity, these relationships are confounded by the practice-style of the International medical graduates who staff these sites. In contrast, the lowest visit-intensity of FFSG practice may also be influenced by the practice-style of the University of Manitoba graduates who staff these sites. Insight distinguishing between the effects of payment-modality and practice-style is gained by comparing FFSG and SCHC physicians. Although these groupings differ by place of graduation, they have group practice in common. The finding that FFSG and SCHC practitioners both render visit-intensity comparable with their patient-profiles' expected need for ambulatory visits suggests that group practice is the more important influence.

Finally, the combination of fee-for-service payment and group practice is associated with greater practice-stability. For FFSG practice, physician-turnover is the lowest, physician-retention the longest, and gaps in practice-coverage are the second shortest. Overall, FFSG is associated with greater physician visit-workload and practice-stability. Moreover, the higher FFSG physician visit-workload is not generated by rendering visits exceeding patient-profile expected need for ambulatory medical care. In contrast, the performance of SCHC practitioners was disappointing. While these physicians exhibited levels of visit-intensity and contact-frequency similar to their FFSG counterparts, they manage substantially fewer discrete patients. In not facing financial incentives, SCHC physicians limit their care-giving to their immediate community -- typically the village and surrounding rural municipalities. Similarly, while FFSS physicians experience also larger numbers of patient-contacts, they render excess visits per episode (contact) and exhibit poorer practice-stability.

FFSS and SCHC physicians are mostly graduates of International medical schools and they generally practice in areas beyond the influential communities. These two practice-modalities are both associated with higher physician-turnover and shorter physician-retention. In contrast, Manitoba graduates mostly locate in influential communities, which are characterized by high practice-stability. The poorer practice-stability of the areas staffed by FFSS and SCHC practitioners may reflect their unpopularity with Manitoba graduates and the resulting recruitment of International medical graduates willing to (at least) staff these positions for the short-term.

FFSG practice is associated with superior performance: high visit-workload, appropriate patterns of patient contacts, and stable practice. However, as FFSG practices are mostly sited within influential communities serving large effective populations, it is not clear if these arrangements will migrate into other rural settings. Two options are available to policy-makers. First, to continue with the current situation -- that is, to continue staffing the historic distribution of practices using a mix of Manitoba, other Canadian, and International medical graduates. Second, to disseminate the FFSG practice-modality from influential communities to other rural sites -- that is, to set up the conditions necessary to support group practice in more sparsely populated settings.

The current situation allows physicians to select practice location (and modality), with less desirable areas being staffed by International medical graduates. While the current situation is working to the extent that highly comparable levels of physician-accessibility have been achieved, imbalances in terms of the comparative need for ambulatory medical care remain: populations exhibiting greater need systematically consume fewer ambulatory physician visits while the converse is true for lower need residents, but this finding must be interpreted cautiously.

Rural residents' concerns about physician-turnover, gaps in practice-coverage, and the loss of continuity of care from poor physician-retention will not be redressed under the *status quo* -- the key concern of physicians in rural practice is professional and personal lifestyles, not income. For rural residents, the issue is local physician-availability -- that is, to continue the historical staffing of single physician practices in rural villages distant from influential areas. Clearly, given physician freedom (and ability) to choose the site of practice, these concerns are incompatible and recent (let alone established) Manitoba graduates are unlikely to migrate into rural practice. However, policies forcing Manitoba graduates into rural practice likely will not solve the concerns raised by the employment of International medical graduates -- that is, physicians are unlikely to be retained after contractual requirements are satisfied. Moreover, this situation will increasingly become critical as long-serving physicians dedicated to rural medicine stop (or reduce) practice.

One option available to policy-makers is to introduce FFSG practice more widely into rural settings. Greater numbers of Manitoban (and Canadian) graduates may be recruited into rural Manitoba if more practices combining the income potential of fee-for-service payment and the collegiality of group practice were available. However, not all communities currently serviced by FFSS physicians can support group practice and concentrating these practices in central sites raises the concern of local physician-availability. Perhaps the initiatives of the physicians in certain influential communities (e.g., CM, CP, PS) in operating satellite clinics staffed on a rotating basis from the central site may resolve these concerns.

Introducing capitated payment-modality, particularly into group practices, may improve physician performance. If the capitation rate (i.e., an annual amount paid per patient) is adjusted for practice-profiles' need for medical care, capitated payment could reduce incentives for physicians to render excess care (as found for FFSS) while resolving inequity in physician payment. Capitated solo practice in rural areas may be unpopular if physician income is lowered by the elimination of payments for excess care. While capitated group practice is advantageous, it requires a critical mass of residents to generate income to support the practice and advantages beyond those already afforded by the FFSG-modality may not be forthcoming.

6.4 STUDY LIMITATIONS AND RECOMMENDATIONS FOR FURTHER RESEARCH

The most important limitation of observational research using administrative data is self-selection bias and missing variables. In this study, physicians clearly are not randomly distributed by practice-modality. Populations also are not randomly distributed across practices and PSAs. As noted above, this analysis cannot distinguish between the effects of physician practice-modality and practice-style (as estimated by place of graduation) as alternative explanations of observed patterns of visit-workload and its components. Also, physician time used for direct patient care is unknown. Future research will use econometrical methods to adjust for the effects of self-selection bias and missing variables (see Kennedy1992).

While the direction of payment-modality and practice-organization effects are convincing, their size is unknown. Multivariate analyses controlling for important co-determinants of utilization would increase the accuracy of the estimated size of these effects. Similarly, multivariate analyses would also enhance our understanding of variation across rural PSAs.

Another important limitation of the study was not accounting for possible physician-commonality. Commonality occurs when patients contact several physicians simultaneously for doctor-shopping or other reasons. This limitation raises two concerns. Patient-induced and/or physician-induced commonality would bias estimates of the relationship between patient-profile expected need for, and its utilization of, ambulatory physician visits. For example, if residents contact their local physicians and a practitioner in an influential site for the same complaint, both physicians will report a contact, but record only partial sets of visits. Knowledge of the extent and determinants of physician-commonality would provide greater insight into patterns of rural primary medical care utilization and it is essential for estimating capitation rates. Future research will distinguish between sources of physician-commonality, including:

- certain (e.g., commuting) residents obtaining their care from outside sources;
- certain residents obtaining some care from both inside and outside providers; or
- most residents obtaining a mix of care from both in-area and out-of-area sources.

As all study data were derived from secondary sources, certain variables cannot be estimated. Information about the time used for direct patient care would enable analysts to distinguish between limited time and poor productivity as alternative explanations of differences in physician visit-workload (see Wall *et al.* 1995). Although population and patient-profile expected (comparative) need for ambulatory visits are estimated, knowledge of patient perceived need and physician evaluated patient-need would provide further insights into patient, physician, and patient--physician behaviours.

Quality-of-care and patient outcomes are not measured. The ultimate measures of medical care effectiveness -- changes in mortality, morbidity and health-related quality-of-life -- are difficult to relate to patterns of primary medical care utilization, especially when the continuity of rural practice is continuously disrupted by physician-turnover.

Although group and community health centres were assumed to have common meso-level (organizational) effects on patient--physician behaviour, significant differences may exist. For example, community health centres have a greater orientation toward preventive care and may employ nurse practitioners to provide portions of medical care. If nurse practitioners undertake some physician activities, however, what are SCHC physicians doing with this freed-up time? They clearly are not using it to handle more patients.

6.5 CONCLUDING REMARKS

The concerns of stakeholders regarding the delivery of rural ambulatory medical care in rural Manitoba are complex and defy simple solutions. Two sets of policies are available to redress imbalances in ambulatory medical care utilization in rural Manitoba:

- policies affecting the distribution of physicians across rural practices; and,
- policies altering the distribution of rural practices to enhance the recruitment and retention of physicians.

First, consider the role of Manitoba medical graduates. Although Manitoba graduates are willing to enter rural practice, they prefer fee-for-service groups in influential communities. As these settings are characterized by high physician performance, some thought should be given to the potential consequences of imposing broad policies dictating where new graduates can practice. For rural settings outside the influential areas, however, financial incentives, alone, may not be sufficient to recruit and retain Manitoba graduates. Staffing these areas is clearly problematic as residents' concerns about local physician-availability conflict with Manitoba graduates' aversion to solo practice, especially in isolated settings. Clearly, the prevailing distribution of rural practices (including many solo practices) cannot be staffed using only Manitoba graduates.

Second, practice-modality could be employed to improve physician performance. While FFSG practice is associated with greater physician performance (visit-workload, appropriateness, practice-stability), it is not clear that any policies would be sufficient to induce the establishment of fee-for-service group practice in more sparsely settled areas. Perhaps the existing set of influential communities could be used to staff outlying clinics (e.g., see the example of CP, CM, PS). Although community health centres are conceptually appealing, the introduction of these practices is determined by communities and their practice-stability is little better than that of the FFSS practices.

Average physician visit-workload is essentially comparable across rural areas. Although the workload of individual physicians varies widely, no association was found with the patient-profile expected need for ambulatory visits or with physician-supply. Physician-competition, however, is a key determinant of average patient-load and, indirectly (assuming supplier-induced demand behaviour), of the excess usage of ambulatory visits. Moreover, whereas population physician-accessibility is comparable across rural Manitoba, patterns of utilization are not fully in concordance with the levels predicted by population expected (comparative) need for ambulatory medical care. Both too high and too low levels of visits were found. Therefore, policy-makers need to consider the tradeoff between retaining the *status quo* or shifting to a more centralized model. Given the high degree of out-of-area care-seeking already occurring in many rural settings, efforts improving access to centralized sources of care may redress current imbalances in utilization -- especially among the more needy and poorly supplied areas.

Clearly, while the current approach to providing primary care in rural settings works, stakeholders must decide if they will continue to tolerate the *status quo* or if they are willing to consider alternative arrangements that my redress imbalances in the utilization of ambulatory medical care and improve physician performance.

As the first stage of a research agenda, this study has raised important issues for future research. The next stage of this research will use panel data multivariate methods to investigate further the determinants of utilization generated by the physician-practice--practice-profile (inter)relationship.

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CORRELATION COEFFICIENTS OF SELECTED MACRO-LEVEL RELATIONSHIP (SHERMAN'S RANK CORRELATIONS)

CONCEPT	VARIABLE	EAV/R	AV/R	IAV/AV	#/000	FTE/#	IAFTE/000	AP/R	AV/AP	EFTE/000	FTE/E000	000/E000	AV/FTE	AP/FTE
need	EAV/R	1 0000												
usage	AV/R	0 6253#	1 0000											
in-area visits	IAV/AV	-0 0647	-0 0661	1 0000										
supply	#/000	0 1054	0 0020	0 5943#	1 0000									
workload	FTE/#	0 2990	0 2749	0 2126	-0 2302	1 0000								
availability	IAFTE/000	0 1418	0 0603	0 7756&	0 8372&	0 1992	1 0000							
contact rate	AP/R	0 0211	0 5692#	-0 3017	-0 3022	0 2386	-0 2367	1 0000						
utilization	AV/AP	0 63336&	0 8738&	-0 3050	-0 1826	0 2650	-0 0997	0 5135*	1 0000					
accessibility	EFTE/000	0 4546*	0 5796#	-0 0165	0 4621*	-0 0070	0 3740*	0 2377	0 4183*	1 0000				
competition	FTE/E000	0 4206*	0 2590	0 0060	0 5336*	0 1773	0 5792#	0 0362	0 2237	0 7026&	1 0000			
practice	000/E000	-0 0036	-0 0123	-0 9414&	-0 6067&	-0 2975	-0 7410#	0 2419	0 2444	-0 0511	-0 0311	1 0000		
activity	AV/FTE	0 0591	0 3595*	-0 2390	-0 6003#	-0 0347	-0 6254&	0 3828*	0 4367#	-0 2516	-0 7008&	-0 2196	1 0000	
patient-load	AP/FTE	-0 4223*	-0 2604	-0 0102	-0 5398*	-0 1726	-0 5806#	-0 0347	-0 2256	-0 7012&	-0 9992&	0 0355	u 6999&	1 0000

*, p between 0 05 and 0 001

#, p between 0 001 and 0 0001

&, $p < 0 0001$

IMAGE EVALUATION TEST TARGET (QA-3)

150mm

6"

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