

ACCESSIBILITY TO PRIMARY HEALTH CARE IN WINNIPEG

by

ANDREW R. GELDARD

A thesis  
presented to the University of Manitoba  
in partial fulfillment of the  
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Master of Arts  
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Winnipeg, Manitoba

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## ABSTRACT

The general objective of this thesis is to examine public access to the primary health care delivery system in Winnipeg, Manitoba. The specific aims of the study are:- 1) to examine the patterns of accessibility across the study area, and 2) test the Inverse Care Law in Winnipeg. The examination is based upon a conceptual framework which views accessibility as dependent upon the interaction between supply and demand in relation to primary health care. Data relating to the supply of physicians' services and the socio-economic characteristics of the population are incorporated into a modified gravity model to calculate an index which describes the relative levels of accessibility in the study area. It is shown that the majority of the city is relatively underserved in terms of primary health care. A general pattern of increasing accessibility with increasing distance from the city centre is identified, with the inner city area of the 'North End' experiencing the lowest access levels. A comparison between the levels of accessibility and demand for health is made to test the Inverse Care Law. A moderate negative relationship is identified. Recommendations concerning the supply of primary health care are suggested.

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Chapter I  
INTRODUCTION

1.1 AIMS

The main objective of this thesis is an examination of public access to a primary health care delivery system. The focus of attention is the location of the supply of primary care practitioners in relation to the demand exerted by the population in the various neighbourhoods of an urban area. An index of relative accessibility will be used to determine the extent to which a hypothetical 'Inverse Care Law' (Hart,1971) operates in relation to the delivery of primary health care.

In an equitable health care delivery system we would expect to find a strong correlation between the supply of services and the relative need for the services in society (a situation known as 'territorial justice' (Pinch,1979)). In many cases, however, research has shown that there is a tendency for such services to be distributed according to an 'Inverse Care Law' (Hart,1971). This hypothesis states that the availability of good medical care tends to vary inversely with the need for it in the population served. Translated into a spatial perspective, this theory suggests

that the under doctored areas of a city tend also to be those of a poorer social character experiencing above average levels of social health problems. In comparison, the over doctored areas tend to be the more affluent sections of the city where the population is in a better state of health.

The inverse care hypothesis proposes that such a law operates more fully in health systems where free enterprise health care is the basis of the delivery system. In such a system, facilities tend to locate where the population is better able to pay for the services offered.

The majority of geographic research concerned with health care delivery has been conducted in the U.S.A., and to a lesser extent the United Kingdom. The health systems of these two countries occupy opposite ends of the philosophical spectrum in terms of health care delivery. In Britain there is a well established tradition of 'socialised medicine' formalised in the National Health Service. In the U.S.A., however, the free market system of health care delivery, to a large extent, prevails.

The Canadian health system exhibits characteristics of these two systems. The national health insurance scheme has adopted the principle of universal coverage, while it has retained certain aspects of the free market system in the fee-for-service method of payment for physicians

(Brown, 1983). The fee-for-service method of payment in the U.S.A. leads to physicians locating close to areas of demand. These areas tend to be those sections of the city where the population has an 'ability to pay'. Health insurance in Canada has, however, resulted in the onus of payment being removed from the individual and transferred to the provincial insurance schemes. Thus with fees guaranteed it might reasonably be expected that physicians will locate to serve ACTUAL demand. This study examines the primary health care delivery system in Winnipeg, Manitoba, in order to determine the extent to which the concept of the 'inverse care law' operates within the framework of the Canadian health system.

In this thesis the calculation of an index of relative accessibility is based on an extension of the simple gravity model. Such an adaptation to the model has been proposed, for the study of public service supply, by Symons (1971), Oberg (1976) and Smith (1977). More specifically, Knox (1978) has developed an extension of the gravity model for use in the examination of accessibility to primary health care. This thesis develops Knox's model a stage further so as to take into account the covert demand for health services. This is achieved through the weighting of a population potential element in Knox's model in order to reflect the social characteristics of the population in the various areas of the city.

The thesis is organised into six chapters. Chapter I is a basic introduction which states the objectives of the study. Chapter II presents a review of the literature relevant to the subject of the thesis, while Chapter III introduces the methodology of assessing accessibility and introduces the concept of demand for health care. On the basis of this concept, a gravity model is modified in order to incorporate the notion of 'covert demand'. Chapter IV contains a discussion of the data sources, while in Chapter V an index of relative accessibility to primary health care is constructed. This index is then used to assess the validity of the 'inverse care law' with respect to primary health care in Winnipeg. Chapter VI presents a summary of the results and conclusions of the thesis.

## 1.2 URBAN-SOCIAL GEOGRAPHY AND HEALTH CARE DELIVERY

Within geography, research into aspects of health and illness has developed into the coherent subfield of 'Medical Geography'. Within this field, attention has focussed upon a number of specific areas of study. These areas can be classified as having traditional and contemporary considerations (Phillips,1981). Traditional medical geography has been termed 'ecological medical geography' (Learmouth,1975). On the other hand, contemporary approaches to the discipline have been described as 'medical social geography' (Phillips,1981).

In traditional medical geography, research has examined patterns of ill-health and mortality. This, in turn, has stimulated research into the ecologies of specific diseases and the ways in which aspects of the physical and human environment affect the spatial distribution of illness. This ecological medical geography was the single focus of attention in medical geography throughout the early part of this century. However, during the 1960s and 1970s a contemporary approach has developed. Here the major concern has been the examination of various aspects of the health care delivery system which have been developed to combat the incidence of ill-health.

This thesis is written in the spirit of David Smith's welfare approach to geography (Smith,1977). The focus of attention for human geography within this paradigm is social well-being or, as Smith describes it, the study of "who gets what, where, and how" (Smith,1974). According to Smith:-

to respond adequately to the problems of the modern world, human geography must be firmly rooted in human life, calling on new methods to illuminate human problems rather than being moulded to techniques (Smith,1977,p.ix).

The initial emphasis for the study of health care in urban-social geography was in terms of it being a service provider in the urban system similar to a retail store. However, with the welfare approach receiving more emphasis within urban-social geography, the study of health care

delivery has taken on a new importance. In such a paradigm for human geography, health, or more appropriately ill-health, becomes an important consideration. HEALTH has long been classified as freedom from disease. However, in this thesis the definition adopted is that of the World Health Organisation's interpretation of health. Health is :- "a state of complete physical, mental and social well-being and not merely an absence of disease or infirmity" (W.H.O.,1965). This concept of 'social health' is a relative term with the acceptable level of health being defined by the aspirations and expectations of society in general.

Without adequate health care, individuals are placed in a disadvantaged position in society. This is well illustrated by the 'expanded cycle of poverty' as defined by Raynor et al (1974). They describe a closed cycle of cause and effects which provide a situational explanation of how poverty is sustained over time. Poor accomodation leads to 'strain' manifested in ill-health, which in turn makes for poor academic performance. Poor educational attainment adversely affects the individual's ability to compete in the employment market and normally leads to employment in low skilled, poorly paid positions or unemployment. The resultant low income helps to maintain the individual's situation below the established poverty level and thus hinders the chances of breaking out of the cycle through an

inability to compete in the housing market for better accomodation. Although this is a simplified summary of the nature of poverty, it is clear that health plays an important role in determining the level of social well-being in society.

Ill-health has not been totally eradicated by the advances which have been made in medicine and health care delivery during the twentieth century. Although an improvement in the general level of health has been achieved, when a state of illness is now encountered, its severity is heightened when comparison is made to the general level of health accepted as the norm in society as a whole. It is this sense of deprivation that places ill-health into the category of being a social problem (Eyles and Woods,1983).

The basic justification for the development of the health care delivery system is its function of treating the incidence of illness. This justification holds true even if, as may be argued, health care delivery developed more in response to corporate and political pressure rather than in direct response to the needs of the population (Navarro,1977 and Doyle,1979). Consequently, the delivery of health care is central to any discussion of health and social well-being in the city. Thus the accessibility to health care facilities is an important focus for urban-social geography within the welfare paradigm.

ACCESSIBILITY has been defined in general geographic terms as "the relative opportunity of interaction of contact", (Johnston et al,1981). In terms of medical services, PENCHANSKY and THOMAS (1980) define accessibility as the relationship between the location of supply and the location of clients, taking into account the clients' transportational resources, travel time, distance and cost. This thesis accepts the above definitions, but within the context of social well-being, emphasises that accessibility to health care services is a social opportunity which has an important bearing upon the quality of life.

This thesis focuses its attention upon the delivery of primary health care. PRIMARY HEALTH CARE is defined as that care which is provided by PRIMARY PHYSICIANS. This group includes 'General Practitioners' and 'Family Physicians', but excludes 'Specialist Physicians', 'Nurse Practitioners' and 'Health Visitors'. Primary care physicians are chosen as the focus for this study since they provide the formal primary health care requirements of the majority of the population. It must, however, be recognised that primary health care is also provided by other personnel. This may be in the form of treatment for minor injuries at a hospital out-patient department, or informal advice provided by pharmacists (Knox,1981). Specialist physicians also provide primary health care although their actual contribution to the primary health care delivery system is somewhat

undetermined (Aitken et al,1979). In addition, primary health care is also provided by non-professional health workers such as health visitors, home helpers and even social workers (Futrell et al,1980).

The role of the primary care physicians is one of a generalist in medical terms. Their role is to serve as the primary medical resource and counsellor for an individual or family, and in so doing provide the majority of care for that individual or family (Aitkin et al,1979). Primary health care physicians provide first contact care and take continuing responsibility for the health care needs of the patient (Mechanic,1983). The position of physicians as a source of first care has resulted in them being described as the 'gatekeepers' of the health care delivery system (De Vise,1973). A patient cannot obtain hospital care, ambulatory care, nursing care or even prescribed drugs without the sponsorship of a physician.

There is, however, doubts as to whether primary care physicians actually serve the needs of the population. Although it is assumed that the training received by such practitioners prepares them to provide 'primary care', evidence suggests that they often carry out medical procedures more appropriately performed by specialists (Mechanic,1978). In addition, primary health care must be regarded as as a set of functions as opposed to merely one

type of physician. Thus, the needs of the population can only be served by physicians working in conjunction with other health workers (Mechanic, 1978).

The primary care physician does, however, occupy an important position within the health care delivery system. More importantly the accessibility of primary physicians to the demands of the population is essential to the delivery of high quality health care to those in need. Where primary health care is not within easy reach of those who are encountering a state of illness, the sense of deprivation is inevitably increased.

### 1.3 A CONCEPTUAL FRAMEWORK FOR THE STUDY OF HEALTH CARE DELIVERY

Although a reasonable amount of research has been conducted into health care delivery, little attempt has been made to conceptualise the field of study. Giggs (1979) has, however, accepted that three major components of health care provision have been identified and investigated. These fields of research relate to the spatial analysis of health care, behaviour of the various actors within the system and the planning of alternative forms of health care delivery. These three areas of research can be identified as :-

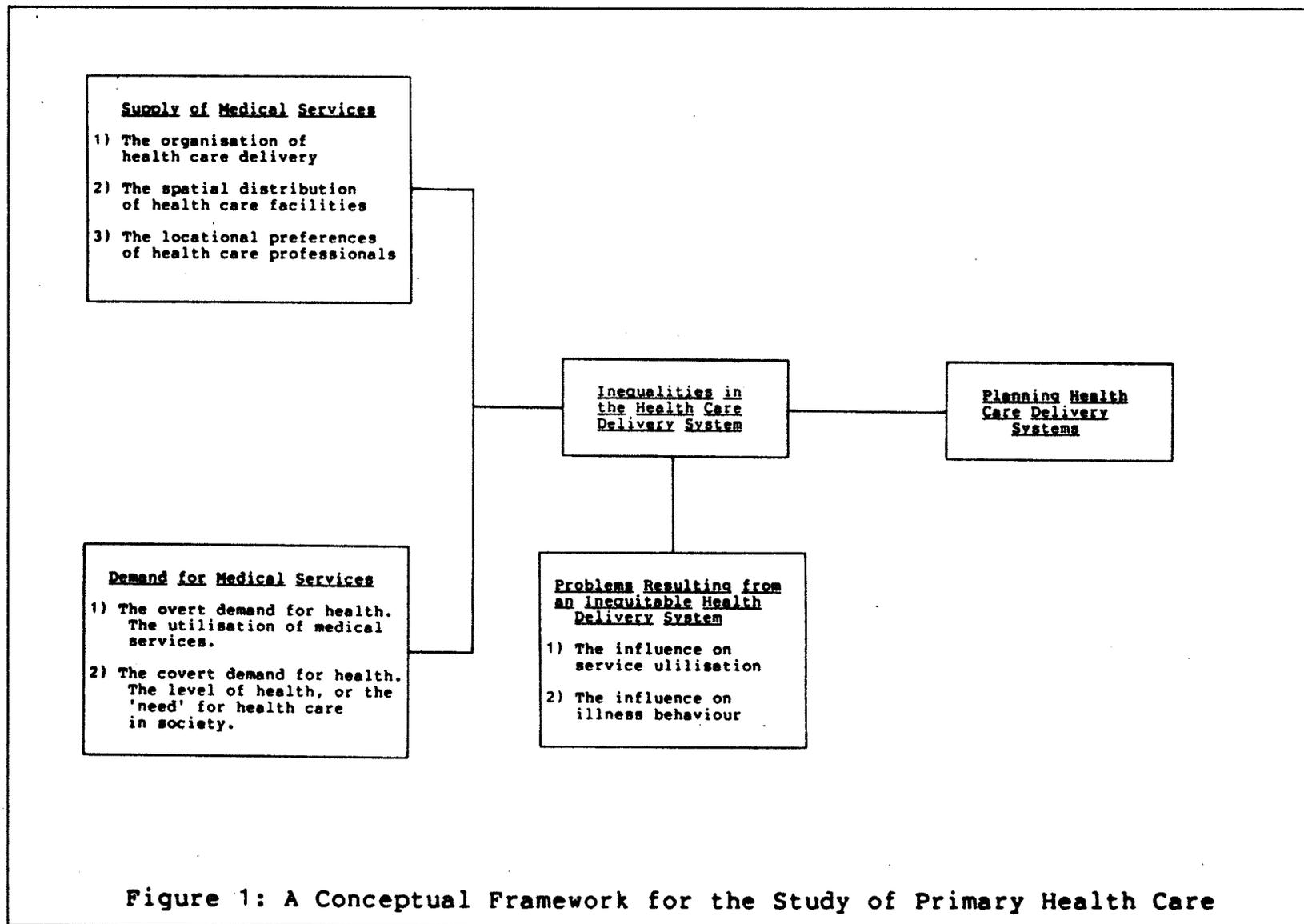
1. The examination of the organisation of the supply elements in the health care system, where the emphasis is placed upon the structure and spatial

patterning of the various resources which make up the system.

2. The study of patient utilisation of the various medical services and the factors that influence the patient's spatial behaviour.
3. The identification of patterns of inequality in the supply and use of services, and the planning of optimal health care delivery systems.

These three elements cannot be divorced from each other. It is a combination of the spatial patterns identified in 1, which combine with the spatial behaviour expressed in 2, that produce the inequalities in service provision isolated in 3. This view of research can be modified to produce a conceptual framework for the study of health care delivery in urban-social geography (see Figure 1).

The framework is based on the interaction between supply and demand within the health delivery field. Supply is examined in terms of the availability of services in a spatial and structural sense (what services are provided and where they are located). Demand is a more complex notion, and within the framework it is categorised under two headings; 'covert demand' and 'overt demand'. Covert demand is concerned with the underlying patterns of ill-health in society. Overt demand concentrates upon the actual utilisation of medical facilities. Overt and covert demand are not necessarily the same.



When these two elements of the system are combined, some evaluation of the health care delivery system can be made. Within this area of study, problems of accessibility and inequality of service provision can be highlighted. In examining the impact of problems of inefficiencies in the health delivery system, a number of research areas are opened. Amongst these are the influence difficulties of access have upon the utilisation of health facilities (overt demand) and the influence on the level of health in society (covert demand). Evaluation of the inefficiencies within the health care delivery system prompts the examination of alternative forms of delivery and planning improvements in the supply of health care.

This thesis examines the supply of health care in conjunction with the notion of covert demand in order to evaluate the primary health care delivery system within Winnipeg. The conceptual framework described here will be the basis for the literature review in Chapter II.

#### 1.4 SUMMARY

The general purpose of the thesis is to examine the equitable nature of a primary health care delivery system within an urban area using Winnipeg as a case study. The specific objectives of the study are :-

1. to describe the spatial distribution of primary health care facilities in the study area;

2. to describe the spatial distribution of the demand for health care across the city, and
3. to determine whether the supply of health services corresponds to the need for them in the study area, thus providing an efficient and/or equitable delivery system.

The final objective will be achieved through the production of an index of relative accessibility using a modified gravity model. This index will be used to determine the extent to which an 'inverse care law' is valid in Winnipeg.

This introductory chapter has stated the objectives of the thesis and has described how these aims will be achieved. The chapter has also explained the importance of the study of health care delivery to urban-social geography within the welfare paradigm. A conceptual framework for the study of health care within urban-social geography has been proposed and the position of this study in the framework has been identified.

Chapter II  
REVIEW OF LITERATURE

2.1 INTRODUCTION

This thesis focuses its attention upon accessibility to primary health care within the urban context. The subject matter of the topic is however, drawn from a variety of sources. Consequently, the topic must be seen in a wider context of research. Research concerning all forms of health care delivery and work within the wider field of medical geography need to be considered. The purpose of this chapter is to:-

1. briefly examine the broader context of research in medical geography in order to give some background information as to the subject matter of the discipline;
2. on the basis of a conceptual framework introduced in Chapter I, analyse the contribution research has made to the understanding of health care delivery, especially primary health care, and
3. identify how this thesis contributes to the existing literature.

## 2.2 BACKGROUND TO GEOGRAPHIC ASPECTS OF HEALTH AND ILLNESS

As stated in the introductory chapter, medical geography can be dichotomised as having traditional and contemporary considerations (Phillips, 1981). Traditionally, the focus of study has been concerned with the spatial variations in the distribution of illness and the factors which have produced those patterns. In more recent years, concerns essentially peripheral to these traditional studies have been brought under increasing scrutiny and a focus on the geography of health care has developed. This traditional/contemporary division of medical geography is rather simplified and a more comprehensive classification is desirable. Phillips (1981) has classified work under six headings: medical cartography; medical ecology and ecological associative studies; diffusion studies; modelling and simulation studies; and behavioural approaches.

MEDICAL CARTOGRAPHY is a well established technique which has been utilised in many areas of research. In early studies, the mapping of specific diseases or ailments was the substance of the research. A good example is Howe's "Atlas of Disease and Mortality" (Howe, 1963). MEDICAL ECOLOGICAL and ECOLOGICAL ASSOCIATIVE studies have, on the other hand, taken the spatial distribution of disease as their starting point. They have then gone on to examine the relationship between specific diseases and certain environmental factors. The pioneering work in disease

ecology was conducted by May (1950). May examined the factors which caused illness and emphasised the relationship between 'pathogens' (biological factors such as bacteria and other disease vectors) and 'geogens' (geographical factors such as climate and the social environment).

DIFFUSION STUDIES in medical geography have looked at the spread of disease in relation to time. Measles have been studied as they spread across urban areas (Pyle, 1973) and regions (Murray and Cliff, 1977). One extension of the studies of disease diffusion has been in the form of MODELLING and SIMULATION. The aim here has been to simplify the patterns of disease diffusion in order to predict future outbreaks of infectious diseases. Using this approach, Learmouth (1978) has simulated the spread of infectious hepatitis in New South Wales, Australia.

SOCIAL AREA STUDIES based at the aggregate level of analysis have concentrated on relating the health care delivery system and the incidence of disease to the variable social environment within urban areas. Such studies have shown that the spread of measles in an urban area is related to the incidence of poverty (Pyle, 1973). Similarly, patterns of hospital emergency admissions for children have been linked with economically substandard neighbourhoods of the city (Thomas and Phillips, 1978). Whereas social area studies have been based at the neighbourhood level, the

BEHAVIOURAL APPROACH in medical geography has focussed its attention upon the individual or household unit. The emphasis of this approach has been concerned with the variations in patient utilisation of health care facilities (Phillips, 1979a), and the influence of distance from the source of care on the illness behaviour of the population (Girt, 1973). The contribution of this field will be considered at greater length later in the chapter in a discussion of the utilisation of health services.

Phillips' six fold division of approaches has clearly stated how the variety of research within medical geography can be classified. In the examination of the health care delivery systems there is, however, a need for a perspective wider than that which Phillips' classification can provide. There is a need for a perspective to be based on social space in addition to geographic space. Consequently, geographic research concerning health care delivery needs to be integrated with approaches from other complementary disciplines such as Medical Sociology, Welfare Economics and Social Administration. The conceptual framework suggested in Chapter I (see figure 1) provides a guide for the interdisciplinary study of health care delivery. On the basis of this conceptual framework, research in health care delivery may be divided into five groupings which are concerned with:-

1. the supply of medical services;
2. the demand for medical services;
3. inequalities in the provision of health care;
4. problems arising from inequalities in the health care delivery system; and
5. planning health care delivery systems.

### 2.3 THE SUPPLY OF MEDICAL SERVICES

A major question regarding the supply of physicians is that of how many physicians are required to serve the needs of the population. Schonfeld et al (1972) have suggested that for a good primary health care delivery system to exist, there needs to be, on average, 133 physicians for every 100,000 population. However, this is not a 'firm' figure, and indeed others have suggested alternate values that range from 118 to 165 physicians per 100,000 population (Shannon and Dever, 1974). In this section of the literature review the emphasis is not how many physicians are needed to serve a population (although this is important), but how those physicians that already exist spatially distribute themselves and what factors produce the given distribution.

### 2.3.1 The Spatial Organisation of Health Care Delivery.

Findings show that medical services within urban areas form a spatial hierarchy ranging from the single physician to the largest hospital (Morris and Earickson, 1968, 1969; Shannon et al, 1975). The pattern of spatial organisation has been examined in terms of its similarity to the spatial organisation of retail business in urban areas. Earickson (1970) has shown that physician location in Chicago, Illinois, is hierarchical (in terms of degree of specialty) and approximates the general spatial pattern of retail stores. Similar hierarchical patterns have been identified for hospitals in Chicago (Morris and Earickson, 1968) and in Cleveland, Ohio, (Shannon et al, 1975). The range of intra-urban medical facilities as a whole, have been linked to the commercial hierarchy (Thomas, 1976). The variety of services offered range from a simple consultation with a general practitioner to a broad range of treatments offered within large scale medical complexes. The differences in services offered between the two facilities is similar to the differences in services offered by a corner store and a large department store. Other works have looked at the organisation of medical services at a scale larger than that of the intra-urban level. Shannon and Dever (1974) have looked at regional variations in medical services in the U.S.A. Babson (1972) has based his study at the international level in his multinational survey of health care delivery.

### 2.3.2 The Intra Urban Distribution of Physicians

Investigation of the spatial organisation of health care delivery has prompted research in more specific aspects of the patterning of medical facilities. One focus of attention within geographic literature has been the intra-urban distribution of physicians. Such work has examined both the distribution of general practitioners and specialist physicians.

Research has shown that fewer physicians tend to locate in lower social class and/or ethnic areas of cities (Earickson, 1970; Morrill et al, 1970). Not only are fewer physicians located in these zones of the city, but such central areas of cities are losing physicians to suburban areas. Rosenberg (1979) examined Toronto using a nearest neighbour analysis. His work not only supports the idea of a suburban shift, but also shows that physicians are continuing to cluster in older residential areas, and areas close to hospital complexes. Conversely, Knox (1978) has demonstrated that an excess capacity of physicians exists within central cities, while at the same time there is a shortage of manpower in suburban areas. Knox's findings tend to conflict with those of other authors; this may be explained by the fact that he was examining the British city. In British cities there has been a tendency towards large scale public housing developments of low cost accommodation to be located in suburban areas. The

concentration of physicians in the central areas of British cities reflects a certain degree of inertia which physicians exhibit in their locational choices. Physicians have not yet responded to shifts in the location of the population (Knox, 1978). In Adelaide, Australia, another pattern has been isolated. The lower status neighbourhoods, which have fewer physicians, are more prone to have group practice medical care. Thus, Cleland et al (1977) point to a 'double jeopardy' where areas with fewer physicians have medical care concentrated at a smaller number of locations.

### 2.3.3 Locational Preferences of Physicians

The intra urban patterns of the location of physicians are a result of practitioners exercising their locational preferences. Thus the spatial decision making process of physicians has received some attention in geographic literature.

Some areas, due to devotion to residential or industrial use, will lack general practitioners. Others, with large commercial sectors, will have physicians in heavy concentrations since they offer both office space and a central location. A central location is not only an important factor in the supply of office space. It is also important in providing a sufficient amount of 'traffic' which is helpful in establishing and maintaining a successful practice (Elesh and Schollaert, 1972). As a

result, physicians tend to favour the more accessible sites within the city. Areas such as downtown and suburban shopping centres (Rosenberg,1984).

Physicians do not always locate in the more accessible areas of the city. They also tend to locate close to one another or in close proximity to certain support services, especially hospitals (Rosenberg,1984). The supportive facilities of hospitals (x-ray and other laboratory facilities) attract physicians. This is not only because of their facilities, but also because in many cases physicians work both within hospitals and in private practice. Practitioners who divide their time between office and hospital tend to locate their offices close to hospitals in order to reduce unproductive travel time. Proximity to other physicians is also an important consideration of the physician when making a locational choice. An office close to other physicians makes for an efficient referral system and more effective deputising procedures.

Physicians are discouraged from locating in low income areas, especially those with a predominantly ethnic composition. Working in 'blue collar' areas of the city is held not only to be unglamorous and unsatisfying, but time spent in practice in such areas is seen as a hinderance to further career advancement (Knox,1979a). Roth (1969,pp.226-228) summarised his findings on physicians

attitudes to the poor saying that they thought them to be:- "dirty, smelly, unreliable with respect to directions and appointments, observing poor health practices and generally living in unhealthy conditions". When racial prejudice is added to these opinions, physicians' reactions can be expected to be even more intense and cause avoidance of ethnic areas (Elesh and Schollaert,1972). Conversely physicians, especially specialist physicians, tend to be attracted towards high income areas. Not only do high income areas not possess the 'drawbacks' of lower class areas, but they generate, on a per capita basis, more business for the physician. This reflects the fact that the use of physicians tends to increase with the income of the patient (Elesh and Schollaert,1972). Similarly the higher the education level of the population the greater the demand for physicians services.

Physicians locate in such a way as to secure desirable practices consistent with their status preferences and the status characteristics of their potential clients. They locate in close proximity to their homes with a view to access to their leisure time activities, cultural opportunities, good schools for their children and other amenities (Elesh and Schollaert,1972). The desire for access to amenities suggests a work leisure preference easier to operationalise in high status neighbourhoods. In such areas (in the case of the U.S.A.), physicians can see

fewer patients and charge higher fees to obtain the same income as physicians in low income areas, who must see more patients at lower fees. Gober and Gordon (1980) investigating physicians in Phoenix, Arizona, concluded that medical practitioners do not respond in a spatially effective way in respect to the demands of the population. Physicians tend not to perceive themselves as providers of an urban service with a need and/or responsibility to locate in an efficient and spatially rational way.

The health care delivery system responds to its own needs rather than those of its patients (Shannon and Dever, 1974). Proximity to patients has little relevance to the locational decision. Physicians sense a need to be near one another to allow for an effective referral and consultation system, and to allow physicians to cover for one another in times of absence. Existing patterns of physician location are sustained by the attitudes of the profession. Practitioners see certain areas as undesirable locations if no other medical practitioner practices there already (Joseph and Phillips, 1984).

#### 2.4 THE DEMAND FOR MEDICAL SERVICES

The supply of physicians' services is only one aspect of the study of health care delivery. To determine whether a certain distribution of medical facilities constitutes an equitable health care delivery system, the patterns of

demand for health services should be examined. The demand for health services is not necessarily reflected in terms of the actual utilisation of facilities. When considering demand, we need to look at two notions. Firstly, we can examine the OVERT DEMAND which exists in the form of various patterns of utilisation of medical facilities. Secondly there is a more important but hidden aspect of demand. This COVERT DEMAND is based upon the variable level of health that exists in society.

#### 2.4.1 Overt Demand

The utilisation of medical services has been a topic of interest for geographers for some time. Research has shown that people do not necessarily attend their nearest source of medical care. Rather, their choice of physician is based upon a number of factors. Research has also illustrated that the utilisation of medical facilities as a whole is not equal across society. A number of economic and social variables affect an individual's decision to seek medical advice.

Wachs and Kumagai (1973) have demonstrated that various social/psychological barriers exist, which divert people from their nearest medical facility. These barriers include the perception of hostile territories located around or en-route to a physician and the patient's limited knowledge of both the transport network and the geographic location of

available medical facilities. Some people utilise facilities that are close to their place of work or in close proximity to a frequently used shopping centre. Other people use facilities that offer convenient hours such as in the evening or on Saturdays (Knox,1978). Phillips (1979a,1979b,1980 and 1981) has examined the spatial patterns of medical facility attendance in some detail. Using Swansea, Great Britain, as a case study, Phillips examined the effect of social status, personal mobility, age and previous residence upon the spatial pattern of attendance at general practitioners offices.

In terms of social status, lower class patients in Great Britain tend to visit their nearest general practitioner, but a large proportion consult with physicians outside their local area. Higher status patients tend to consult with a variety of physicians within their neighbourhood but not necessarily the nearest one. Higher status patients tend to prefer organised medical care as offered in the formal atmosphere of a health centre type facility. Lower status patients on the other hand tend to favour the more informal atmosphere offered by the physician in single practice (Phillips,1981).

Personal mobility, in terms of automobile ownership, is also an important factor in medical facility attendance patterns. As might be expected, higher status patients rely

more upon private transport, while lower status patients make more use of the public transit system for transport to medical facilities. In Great Britain, the majority of people however, from both higher and lower status groups, tend to walk to their physician (Phillips,1981).

Age tends to play an ambivalent role with regards to spatial patterns of attendance. Older people tend to retain links with the general practitioner they have consulted with for some time, even though they may have subsequently moved home. Similarly, families with pre-school age children do not necessarily substitute their nearest physician for their regular physician because their family circumstances have changed (Phillips,1981).

Residential moves seem to be a major determinant of patterns of medical facility attendance. Links with general practitioners, unlike other low class services in the consumer hierarchy, tend to be retained even after a residential move. This is because of the desirability to build a relationship with a general practitioner based on long standing mutual knowledge. High income groups, even though they possess a higher degree of personal mobility, tend to be more footloose and their links with their former areas are not sufficiently pronounced so as to retain their previous physician.

Certain cultural aspects affect the spatial patterns of utilisation of medical facilities. Bashshur et al (1971) have demonstrated, in a study of Cleveland, Ohio, that Black and Jewish groups may by-pass their closest source of medical care to receive treatment at an institution more amenable to their cultural traits. Earickson (1970) looked at hospital utilisation as an aspect of spatial interaction. His hypothesis was that the utilisation of medical facilities is related to an individual's social space. Cultural differences such as religion, race and ethnicity are seen as having an important influence upon social space and thus hospital utilisation.

Spatial patterns of medical facility use are not the only patterns which have been identified in relation to utilisation of medical facilities. The regularity with which sections of the population consult with medical practitioners is important. Elesh and Schollaert (1972) recognised that the income and educational levels of the population are major determinants of how much use will be made of physicians services. They demonstrated that a positive relationship exists between socio-economic status and the utilisation of medical services. Their findings were based on research within the framework of the American health system. Socio-economic differences in utilisation in health services have also prompted research in Britain, where a contrasting health system is in operation. The

National Health Service in Britain, with universal coverage, has attempted to remove socio-economic constraints from the access to medical services. Research has demonstrated, however, that social and economic constraints are in operation just as effectively, if not so openly, as in a system such as operates in the U.S.A.

Titmuss (1968) has argued that the middle and upper classes receive more medical attention and better treatment because they possess better knowledge of how the health system works and thus can exploit it to the fullest amount. This point has been supported by Cartwright and O'Brien (1976) who view the content of a medical consultation as an important aspect of the utilisation of medical facilities. They have demonstrated that middle and upper class patients derive more from their consultations with physicians than their lower class counterparts. Their consultations tend to be more lengthy and more comprehensive and so middle and upper class patients can gain more from them.

The question of the extent to which different social classes utilise medical facilities has been addressed by a number of researchers (Brotherston, 1976 and Blaxter, 1976). In Great Britain a government inquiry was conducted into inequalities in health. The resultant "Black Report" (D.H.S.S., 1980) examined in some detail the utilisation of medical resources. Manual workers were found to have higher

consultation rates than non-manual workers. Compared with their respective incidences of illness however, manual workers are under utilising the health system. The "Black Report" (D.H.S.S., 1980), using a series of 'use:need' ratios, demonstrated that there is a progressive decline in the utilisation of medical resources with decreasing social class.

Utilisation of medical facilities is also dependent upon cultural differences. Cultural differences influence utilisation in a number of ways. Apparent under-utilisation can be attributed to discrimination against particular groups. Cordle and Tyroler (1974) have drawn attention to the differential use of hospital services by blacks and whites in South Carolina. Blacks consistently under use medical facilities, and when they were admitted to hospital their conditions tended to be more serious than those experienced by whites. Discrimination against minority groups by the medical profession can lead to a loss of opportunity to seek medical care. De Vise (1971) has shown that a number of neighbourhoods in Chicago have lost medical facilities during the period when the neighbourhoods have changed from having a predominantly white population to having a predominantly black population.

Constraints of a more informal nature also act against the benefit of certain minority groups. Rathwell (1984)

points out that ethnic minorities, in certain cases, possess different conceptions of health which affect their utilisation of health services. Rathwell (1984) also notes that the language difficulties of ethnic minorities in Great Britain (mainly of Asian origin) prevent them from having effective consultations with their physician.

#### 2.4.2 Covert Demand

Patterns of utilisation of health care facilities show one kind of demand for health care. The demand these figures illustrate is overt demand or the amount of therapeutic behaviour that takes place. Utilisation patterns do not therefore represent the 'real' demand for health and health care in society. A more important, and more realistic, under-lying trend in demand for health does, however, exist in society. This covert demand corresponds to the amount of illness experienced in the community.

Problems exist in quantifying the covert demand for health. Generally speaking, medical problems do not find their way into a reliable statistical form until there is some form of medical consultation. A number of surveys have, however, attempted to deal with this subject. The "General Household Survey" (Office of Population, Censuses and Surveys, 1975) in Great Britain and the "Canada Health Survey" (Statistics Canada, 1981) have looked more closely at illness (or morbidity) in society. Both of these surveys

have relied upon self-reported morbidity statistics.<sup>1</sup>

In Great Britain the "Black Report" (D.H.S.S.,1980) undertook a comprehensive examination of health inequalities using data collected in the "General Household Survey" (Office of Population, Censuses and Surveys,1975). The survey demonstrated that the reported incidence of illness increased regularly with increasing social class. On the basis of such figures the report stated that if the population of the two lowest social classes had the same mortality rate as the highest social class, 74,000 lives of people under 75 years old would have been saved between 1970 and 1972 (D.H.S.S.,1980). Similarly life expectancy varies from social class to social class. A child with professional parents can expect to live five years longer than a child with unskilled manual workers as parents (D.H.S.S.,1980). Class based differences in the level of health in society have remained over the years. Even with the improvement in the overall standard of health in society (through public health measures and socialised medicine) the differences in the standard of health between socio-economic groups have remained constant or even widened (D.H.S.S.,1980). Variations in the level of health in society are not solely class related. Significant

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<sup>1</sup> One needs to recognise, however, that such self-reported statistics tend to under-estimate the incidence of morbidity, a tendency which increases with declining social class of the respondent (Blaxter,1976).

variations in the level of mortality and morbidity can be identified as being related to factors such as age and sex.

One important aspect of health in society is the variation in the levels of morbidity through the life cycle. Early childhood is a period of above normal risk of sickness, with serious illness often resulting in death. Morbidity figures often tend to obscure the extent to which the population is at risk during early childhood. Consequently, mortality figures portray a more representative picture of illness in the first few years of life. The level of health for the group in early adult life (15-44 years) is the best for all age groups, with studies showing low levels of morbidity for the age group. With the on-set of middle age (45-64 years) and later, old age, there is a progressive deterioration in the level of health associated with the aging process. Consequently the elderly in society tend to be in the poorest health (D.H.S.S.,1980).

Age differences in health can also be considered in conjunction with sex differences. One general rule is that, through the life cycle, women exhibit higher levels of morbidity than men. The mortality rates for the two groups are markedly different with females having a greater life expectancy than males. With more women surviving to old age, the sex differences in mortality can be added to the age differences for the elderly age group (D.H.S.S.,1980).

Differences in the level of health do occur in society with the poor and elderly being highlighted as having a relatively high demand for health care. The nature of residential patterns in the city results in the concentration of these higher demand groups in certain areas. Thus when examining the supply of physicians across a city the variable need (or covert demand) for health care should be taken into account before any judgement as to the equitable nature of the supply can be made.

Covert demand does not necessarily result in overt demand. A good indicator of this is the elderly population. Although the incidence of illness amongst the elderly is greater than that of younger age groups, their utilisation of medical facilities is only moderately higher than that of other groups (Roos et al, 1984). In addition it must be noted that it is only a small minority of elderly individuals who are heavy users of health care facilities with 5% of the elderly population consuming 59% of all the hospital days used by the elderly in a given period (Roos et al, 1984).

Even when covert demand is turned into overt demand, doubts exist regarding the suitability of physicians as the group to deliver primary health care. This is especially apparent in terms of the health requirements of the elderly population who receive the majority of their care from

non-professional or para-professional health workers (Von Mering and O'Rand, 1981). Home helpers and health visitors, who provide more personal care, may be a more appropriate source of primary care than the professionally trained physician or nurse. In addition it is only a very small minority of physicians (less than 1%) who express any interest at all in geriatric patient care (Steffl, 1984).

## 2.5 INEQUALITIES IN THE HEALTH CARE DELIVERY SYSTEM

Everyone at some stage in his/her life makes use of the health care delivery system. Consequently, the access to medical facilities by different social and spatial groups is of vital importance (Clarke and Wilson, 1984). The degree of access is governed by both the nature of the demand for health and the supply of medical facilities. The locational decisions of physicians coupled with the level of health in society produce a situation where certain areas of the city have lower levels of accessibility to primary medical care than other areas. Even within relatively well served urban areas, there is substantial inequality in geographical access to medical care (Giggs, 1979). The identification of these patterns of inequality within the city has prompted a major focus of research within urban-social geography.

The most comprehensive study of the health care delivery system in a single city was undertaken by the Chicago

Regional Hospital Study.<sup>2</sup> Working papers from the study have described the Chicago hospital system as 'apartheid'. Inequalities in the access to medical services appear on the basis of race, residence and age. Inequalities were proven not only to exist in terms of the socio-spatial group's relative location to medical services, but also in terms of waiting times, appointment delays, the quality of care and cost. The locational pattern of facilities in Chicago was somewhat similar to that of the retail structure of the city. Specialist facilities were located in the central area of the city, while general hospitals were decentralised in suburban locations. As a result, the nearest facilities to the predominantly Black sections of the city were mainly specialist or private hospitals which were effectively inaccessible to the population. The majority of the Black population had to travel across the city to Cook County Hospital where free medical care was available (De Vise, 1971).

The locational preferences of general practitioners has an important bearing upon the balance between medical needs and resources. In the U.S.A. the areas with the greatest levels of accessibility to physicians' services tend to be in and around nodes of commercial activity (such as downtown areas and suburban shopping centres) (Earickson, 1970), and

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<sup>2</sup> De Vise (1973) provides a comprehensive overview of the findings of the study.

in affluent white neighbourhoods (De Vise,1973). Conversely, predominantly Black areas of the city lack any form of primary health care (De Vise,1973). Studies have shown that the inequalities in the spatial distribution of physicians are increasing over time (Rosenberg,1979). The North American trend is one of a centrifugal movement of general practitioners away from inner city neighbourhoods to more suburban locations.

In Great Britain, by comparison, locational inertia has been a feature of the present day pattern of physician distribution. The current spatial pattern of physician location within urban areas has changed very little from its pre-National Health Service era. Physicians continue to practice in the more central areas of cities, especially those areas of a higher socio-economic status. In those sections of the city, the typically large dwellings can be used as both a residence and a place of practice (Knox,1982). Physicians have not become suburbanised to the same extent as in North America. This, however, tends to contrast with the social composition of British cities where large scale housing estates (of both public and private housing units) have been constructed on the urban fringes in the post war period.

The resultant mal distribution of physicians is a part of what is known as the "Inverse Care Law" (Hart,1971), which

hypothesises that there is a tendency for the supply of medical care to vary inversely with the need for it in the city. In areas of a lower social status where there is a tendency towards more illness, general practitioners are fewer in number (and as a result have more work), have less hospital support and inherit more clinically ineffective traditions of consultation than do the healthier, higher status areas of the city. The force that creates and maintains the inverse care law is the free market. The more the health system is linked to the free market, the more complete is the working of the inverse care law (Hart,1971).

Physical inaccessibility is only one way in which medical deprivation contributes to the multiple deprivation of certain urban areas. There is also an "Inverse Care Law" in terms of the quality of care. In one study of Glasgow, Great Britain, it was shown that the inner city areas which experienced the highest levels of social deprivation were serviced largely by elderly physicians working in single practice (thus, finding it difficult to employ a nurse or secretary, attend updating courses and to obtain a deputy) from inadequate and physically decaying offices (Knox,1982). Areas, which on the surface appear to be experiencing high levels of physical accessibility, in fact are served by a depleted group of physicians working in an unco-ordinated way from under-equipped offices.

The assumption that follows from highlighting areas with problems of accessibility is that there is a negative influence on the health of the population served. This assumption has been substantiated by researchers examining the in the levels of health between rural and urban areas. The population of rural areas, which suffer more acutely from problems of access, tend to suffer higher rates of illness and infant mortality (Shannon and Dever, 1974). Similarly, Hadley (1982) in examining the influence of the supply of physicians upon the levels of health across the U.S.A. has noted a decrease in the mortality rate associated with an increase in the supply of physicians.

#### 2.6 PROBLEMS RESULTING FROM INEQUALITIES IN HEALTH CARE DELIVERY

Once a problem of geographic accessibility is identified, one can assume an obvious conclusion. That is, the population of an area of the city which is less accessible to physicians will have to travel an increased distance to receive medical attention. Travelling longer distances places an obvious drain on the time and money resources of the patient, not to mention the increased inconvenience to the patient. Inaccessibility, however, also acts in a more subtle way to influence both the patient's utilisation of medical facilities and entire illness behaviour.

### 2.6.1 The Influence upon Service Utilisation

The basic pattern underlying the utilisation of health care facilities is one of a distance decay effect, where patients make decreasing use of general practitioners with increasing distance from the source of the care. This was concisely illustrated by Hopkins et al (1968), a group of four general practitioners working in Liverpool, Great Britain, who examined the spatial distribution of their patients. Knox (1978), using the data presented by Hopkins et al (1968), has calculated the relationship between the distance from a physician's office and patient utilisation of that physician. The result was a negative exponential function valued at 1.52. Parkin (1979) also noted that increasing distance has a negative effect upon the utilisation of health care facilities. A common finding of both Hopkins et al (1968) and Parkin (1979) was that the distance decay effect was not equal for all groups within the population. Hopkins et al (1968) discovered that the fall-off of patients with distance was more prominent for patients over sixty-four years old. Parkin (1979) concluded that the distance decay effect was especially marked for the elderly, women and the lower social classes.

Haynes and Bentham (1982) compared the utilisation of medical facilities in both rural and urban areas of Norfolk, Great Britain. They confirm the results of other studies in that they found that utilisation decreases with increasing

distance from the source of medical care. Thus, Haynes and Bentham (1982) showed that utilisation rates were much lower in the rural areas compared with the urban areas of the country. The disparities between the two areas were, however, most marked for those groups with the highest need (the elderly, manual workers and people lacking automobiles).

The influence distance from the source of medical care has on utilisation has been partly explained by Shannon (1977). Distance from a source of medical care is associated with a delay in seeking treatment or a rejection of medical care. This de-sensitisation to medical care may be the result of adjustments, on the part of the individual, to alter the everyday time and space activities to accommodate the traveling and time necessary to obtain medical care.

#### 2.6.2 The Influence upon Illness Behaviour

Problems of accessibility act as a barrier to effective care. A person living at a distance from a source of medical care will tend to utilise the service to a lesser extent than would normally be expected. To avoid making use of the medical service, however, patients will have to make light of their symptoms and put up with the discomfort and the uncertainty of the severity of the problem (Knox, 1978).

Girt (1973) has looked at how problems of accessibility affect the utilisation of health care facilities in rural areas. He examined how the distance between the patient and the source of medical care affects the readiness of the individual to recognise that a state of illness exists (illness behaviour). In addition, he examined the influence of distance upon the decision to consult with a physician (therapeutic behaviour) once a state of illness was recognised. Girt (1973) found that with increasing distance from the location of treatment, individuals (through increasing isolation from a physician) have a stronger motivation to maintain health and avoid ill-health. Thus, illness behaviour is positively related to the distance from a physician. However, once a state of illness is recognised to exist the desire to eliminate ill-health decreases with increasing distance. Thus, therapeutic behaviour is negatively affected by distance.

## 2.7 PLANNING HEALTH CARE DELIVERY SYSTEMS

The ultimate aim of research into health care is to gain a better understanding of the characteristics and deficiencies of the delivery system. The value of such work is reduced if it has no practical application in the modification of existing delivery systems or the planning of new ones. This chapter has reviewed the literature concerned with health care delivery according to an

organisational framework. This conceptual framework views inequalities in the health delivery system as a result of interaction between the supply of health care and the demand for it in the community. Since supply and demand are spatially separated, the planning task can be seen as a location/allocation problem (the location of facilities and the allocation of the population to particular facilities). Health care planning tends, however, to be outside the bounds of normal location/allocation problems. There are, generally, few opportunities for the relocation of the medical resource infrastructure or the development of new sites (Clarke and Wilson, 1984).

A number of approaches have been adopted in looking at the problem of planning alternative facility locations. De Vise (1973) has given an overview of the Chicago Regional Hospital study which examined Chicago's 'Apartheid Health System'. This study looked at hospital location efficiency models to simulate the need for new facilities in the 1980's. Bosnac and Hall (1981) examined a method of developing primary health care in rural areas. They used small area profiles to delineate the various service areas that existed within their study area. On the basis of these service areas, they were able to predict the most efficient location for medical services. Sixsmith and Beaumont (1984) have examined the problem of increasing pressure on the health care delivery system due to the growing proportion of

elderly people in the population. They examined the possible sites for proposed future 'Elderly Severely Mentally Infirm Units' in Lancashire, Great Britain. Mayhew and Leonardi (1984) have adopted a modelling approach to determine the optimal resource allocation of acute care facilities in Massachusetts, U.S.A. The optimal efficiency of the system is examined with an emphasis being placed upon the patients' preferences for treatment in certain locations.

Other studies have attempted to predict future demand, and changes in future demand, for health services and plan new facilities accordingly. Pyle (1971) has examined the changing nature of the distribution of heart disease, stroke and cancer in an urban area. He has demonstrated that these ailments in Chicago are becoming increasingly suburbanised. Consequently, Pyle (1971) suggests that the suburban health care delivery system needs a reappraisal. Bennett (1981) has examined an un-doctored area of Michigan, U.S.A. He used a location/allocation approach in determining the optimal location of four primary health care centres that were to be established in his study area. Bennett (1981) considered the need for health care services to be a function of the socio-economic characteristics of the population served. The idea was to minimise the distance between the centres of supply and the overall demand. Clarke and Wilson (1984) have produced a simulation model of

demand for health care facilities based on one particular Regional Health Authority in Great Britain.

Knox (1979a) has reviewed how public policy in Great Britain has been used to improve accessibility to primary health care in certain areas of the country and in certain areas of cities. The Regional Health Authorities have offered monetary incentives for physicians to move into areas which are relatively under-doctored. Knox (1979a) says, however, that such area based policies need to be implemented at a fine geographic scale in order to be successful.

## 2.8 CONTRIBUTION OF THE THESIS TO THE EXISTING LITERATURE.

The review of literature in the previous sections of this chapter has indicated a number of deficiencies in the geographic knowledge of health care delivery which this thesis attempts to address.

Firstly there has been little attempt to bring together research within a common organisational framework. This thesis proposes a conceptual framework for the study of health care delivery (see figure 1) based on the interaction between supply and demand. This conceptual framework has been used as the basis for the organisation of the literature review in this chapter.

Secondly the thesis considers the concept of covert demand in the study of health care delivery. Geographic literature has been pre-occupied with the variable patterns of utilisation of health care facilities. Although the study of patterns of utilisation is most pertinent to the study of health care, the consideration of covert demand is essential for a better understanding of the need for health care facilities in society.

Most of the works reviewed have focussed upon specific sections of the conceptual framework. Some authors have confined their efforts to the study of the level of health in society (Blaxter, 1976). Others have looked solely at the utilisation of medical facilities (Phillips, 1979a, 1980). Some authors have drawn upon the more specific pieces of research and have examined the supply of medical services in order to evaluate the equity of the health care delivery system. Attempts to bring together elements of the conceptual framework within a single piece of research have been rare. This thesis attempts to combine elements of the demand for primary health care with an examination of the services provided in order to examine accessibility to a primary health care system. This is achieved by using a mathematical method specifically developed for the evaluation of accessibility to primary health care by Paul Knox (1978).

## 2.9 SUMMARY

This chapter has reviewed the literature relevant to the subject of geographic accessibility to primary health care. The literature review is organised on the basis of a conceptual framework which has been outlined in Chapter I. The chapter commences with an examination of the background research in medical geography. The chapter then focusses upon more specific aspects of health care delivery, in particular, primary health care. Initially a discussion of the research concerning the spatial location of physicians is conducted. This is followed by an examination of overt and covert demand. The review then examines inequalities in the provision of health services and the problems resulting from inequities in the health delivery system. The contribution of geographic research to the planning of health care delivery systems has also been examined. The chapter concludes by examining the contribution of the present study to the existing literature.

## Chapter III

### METHODOLOGY

#### 3.1 INTRODUCTION

This chapter examines the methodology used to analyse accessibility to primary health care. The chapter is divided into a number of sections which are concerned with:-

1. the importance of the concept of accessibility;
2. the methods of determining accessibility to health care;
3. the notion of covert demand, and
4. the measurement of covert demand and its incorporation into a gravity model which is used to assess accessibility to primary health care.

#### 3.2 ACCESSIBILITY

In many instances there is a marked difference between the needs of the population for an essential public service and the actual fulfillment of those needs. The failure of services to cater for the needs of the client population results from problems of availability of medical care. Consequently, accessibility is a fundamental source of 'real income', acting as a 'hidden mechanism' which affects the

welfare of different socio-economic groups (Harvey, 1973). Dear (1974) notes that some inequality inevitably exists as a result of the discrete location of facilities in a spatially continuous population. However, the net benefits of services such as physicians' offices, schools or even parks are generally greater for people who live nearby. These people enjoy increased choice and opportunity and usually pay relatively low transport costs. Thus accessibility to various service opportunities is an important component of the quality of life and is constantly being modified by public policy.

In its simplified form, the accessibility of a location is related to the ability of the population to reach it. In such a form, accessibility implies some measure of proximity between two points. The concept may be viewed as the advantage of a place with respect to overcoming some form of spatially operating source of friction. Accessibility is important in explaining the form and function of the city. Sites with a high level of accessibility would be desirable for public service facilities. Public services have, however, to compete for office space in such areas with more affluent commercial operations. Consequently, high land prices will force many potential service providers to occupy small inadequate premises in the more accessible areas or to seek alternative facilities in less accessible areas.

Accessibility has both social and spatial dimensions (Phillips and Williams, 1984). There are social constraints on accessibility which relate to the individual's ability to purchase transport and services. Spatially, accessibility is influenced by physical distance which acts as a barrier to service utilisation. These two types of constraints are inevitably linked, since those sections of the population with higher incomes are more likely to possess their own form of transport which will reduce their problem of spatial access (Phillips and Williams, 1984). Higher income groups are not only more mobile, but are also better able to make alternative arrangements for the supply of a service in great demand. This may take the form of travelling a greater distance to an alternative supply, or the substitution of a more expensive supply. Those with lower incomes more often have to cope with the inadequacies of the most proximate source of supply.

Accessibility acts as a hidden mechanism sorting the relative positions of the different groups and individuals in society. This is based on the notion that success in life is based on the ability to compete for a good or service to the extent which is required as normal by society. A problem of accessibility to essential public services (such as health care) will significantly influence an individual's ability to compete, and thus, affect the person's level of well-being. The influence accessibility

has upon the quality of life is increasingly being recognised as a major source of real income (Harvey,1973).

Even though the importance of accessibility has been accepted, few territorial social indicators have been used to address areal variations in accessibility to urban resources (Knox,1980). The reason for this is that accessibility or demand for movement is a derived need rather than an important objective in its own right (Wachs and Kumagai,1973). Transport is not a need in itself but one which must be realised in order to achieve other objectives. However, poor accessibility affects those most who can least afford it. Groups such as the elderly, mothers with young children and those of lower social status are those most vulnerable. Not only do these groups have more financial restrictions, but also may have tighter constraints imposed on their time budgets.

### 3.3 METHODS OF ASSESSING ACCESSIBILITY TO HEALTH CARE

A number of methods have been used which attempt to examine accessibility to medical facilities. The two simplest ways of determining the efficiency with which the supply of medical practitioners serve the population are the 'ratio method' and 'nearest neighbour analysis'. In the ratio method, the number of physicians in the various areas of the city are expressed as a proportion of the population of that area (such as 1 physician to 2500 population).

Comparison of figures obtained for the entire city gives some indication of the distribution of physician services. Such a method has been used to examine medical manpower trends in Ontario in the 1960s (Spaulding and Spitzer, 1972). Nearest neighbour analysis produces similar results in that it gives an indication of the spatial pattern of medical services. It will, however, provide no clue as to how the spatial distribution compares to the pattern of need for the medical services. Rosenberg (1979) used a nearest neighbour analysis in the study of Toronto's physicians. Using this method, he was able to show that the location of physicians' practices are changing over time.

Other methods have also been used to examine accessibility across the city. Shannon et al (1975) have used a series of Lorenz curves to show variations in the accessibility to hospital services in Cleveland. Each Lorenz curve shows a cumulative percentage of the population within a certain distance from the location of the facility. By comparing the Lorenz curves for each area of the city, a picture of varying accessibility can be produced. The distance measured need not necessarily be to the nearest source of medical care, but rather the nearest source of medical care that is willing to accept the patient (the latter is particularly relevant to the American context, see De Vise, 1973). Lorenze curves are also useful in that they may be used to determine the potential impact of a new

facility in any area, thus helping in the planning of future medical facilities. The Lorenz curve method, however, fails to take into account factors such as personal mobility in the population and the differential need for medical services. In addition, the accessibility levels produced by the method are in diagrammatic form and so numerical comparison is not easy.

Shannon and Bashshur (1982) have developed a subjective index of accessibility based on the individual's perception of the availability of medical services. They have used the technique in a study of the accessibility of urban native Indians to health care services. An index is calculated for each person of a group based on the patient's perceived waiting time, travel time and appointment delay. A "mean aggregate index" is produced by averaging the index calculated for each person. This can then be used to compare the levels of accessibility in different neighbourhoods of the city. This index takes into account the very important factor of time. Time is not simply measured in terms of travelling time. The index includes weighted indices of satisfaction since perceived delays and travel times are as important as overt behaviour in determining an individual's accessibility to particular facilities.

The techniques of assessing accessibility outlined above have worked adequately in the research context for which they were originally formulated. They are, however, considered inappropriate for use in the study of potential accessibility to primary health care in this thesis. The method required in this study is one which contrasts the potential supply of physicians with the need for their services across a large urban area. For this reason, a technique based on a gravity model is used. The added advantage of using a gravity model is that it measures human spatial interaction in terms of a distance decay function (decreasing interaction with increasing distance between points). The nature of this distance decay function is fundamental to the assessment of potential accessibility to primary health care.

The equity of public service facilities in the urban system has been of interest to geographers for some time. Symons (1971), Odberg (1976) and Smith (1977) have proposed similar gravity models to determine the spatial equity of public services. Gravity models were initially developed for the examination of patterns of migration (Ravenstein, 1887) and later became popular in the evaluation of catchment areas and spheres of influence of cities, shopping centres and individual stores (Haggett, 1965). The methodology of the gravity model used in this thesis is intended to provide a reasonably representative evaluation

of the relative accessibility of different neighbourhoods of the city to a given distribution of physicians.

The gravity model used in the thesis is one which has been developed specifically for the evaluation of the varying levels of access to physicians' services across an urban area by Paul Knox (1978). A "basic index of accessibility" (Knox, 1978) is produced by:-

$$A_i = \sum_{j=1}^n \frac{S_j}{D_{ij}^k}$$

(Equation 1)

Where:-

$A_i$  = accessibility in neighbourhood  $i$

$S_j$  = amount of physician time  
available in neighbourhood  $j$

$D_{ij}$  = distance between neighbourhoods  $i$  and  $j$

$k$  = distance decay function

By means of the gravity model, the physician time located in

each census tract is allocated<sup>3</sup> to each other census tract to form a 'basic index of accessibility' ( $A_i$ ) (Knox,1978). The formula is based on the proximity of the source of the supply of medical care to the place of residence. It ignores proximity to the workplace which is potentially as important. Physicians often work hours that are inconvenient to people with job commitments and a trip to a physician often means taking time off work. Therefore a physicians office may be more convenient if it is located close to the place of work rather than close to the place of residence.

This basic index is acknowledged by Knox (1978,) to be insufficient since it fails to take into account the personal mobility of the population. The sensitivity of the index may, therefore, be improved by taking into account the automobile ownership in the various neighbourhoods of the city (Knox,1978). Car ownership is important in determining the accessibility of different groups to urban amenities (Sumner,1971). In fact it has also been found that the mode of transport used can be more important than actual distance in affecting accessibility to health care facilities (Wachs and Kumagai,1973). In order to take car ownership into

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<sup>3</sup> The distance decay function of the gravity model determines how much of the physicians time located in census tract 'j' is available to the residents of census tract 'i'. Due to the nature of the distance decay function, the further i and j are apart the less the time is available to census tract 'i'.

account, Knox (1978, p425) weights the basic index of accessibility to produce a "time based index of accessibility" which describes the relative availability of physicians time in each census tract of the city.

$$TA_i = C_i \frac{(A_i)}{(S_a)} + (100 - C_i) \frac{(A_i)}{(S_t)}$$

(Equation 2)

Where:-

$TA_i$  = time based index of accessibility  
for neighbourhood  $i$

$A_i$  = basic index of accessibility  
for neighbourhood  $i$

$C_i$  = % of households owning a car  
in neighbourhood  $i$

$S_a$  = average time to travel a given  
distance by car

$S_t$  = average time to travel a given  
distance by transit

The index for each area is, thus, weighted according to the rates of automobile ownership. The index also uses travel time rather than linear distance in order to contrast

the ease of movement of those groups with access to a car with those portions of the population who rely upon the public transit network for their transportation needs. For ease of comparison, the TAI values are scaled as a percentage of the highest computed value in the study area to give an index (Knox, 1978).

It may be argued that areas with low accessibility are not disadvantaged if they contain few people (Knox, 1978). It is, therefore, necessary to look at the population potential in each neighbourhood and thus the accessibility per person at each node. In addition, it must be realised that patients are free to select their own physician and consequently do not necessarily choose to utilise their nearest facility. In this analysis it would, therefore, be false to assume that the population of a census tract use only the physicians in that census tract. Thus, the demand the population of one census tract places on the medical facilities of all the other census tracts must be determined. Knox (1978, p425), therefore, calculated a second index which describes the differences in potential demand for primary health care services between neighbourhoods.<sup>4</sup>

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<sup>4</sup> In a similar way to distribution of physician time across the city, the distance decay function of the gravity model predicts the potential amount of the population of census tract 'j' who will use the physician time available in census tract 'i'. In general, the distance decay function expresses a negative relationship between the distance separating i and j and the level of demand that that the

$$M_i = \sum_{j=1}^n \frac{P_j}{D_{ij}^k}$$

(Equation 3)

Where:-

$M_i$  = potential market for the primary health care facilities in neighbourhood  $i$

$P_j$  = population of neighbourhood  $j$

$D_{ij}$  = distance between neighbourhoods  $i$  and  $j$

$k$  = distance decay function

The values of  $M_i$  can be scaled as percentages of the highest computed value to give an index (Knox, 1978):

A "final index of accessibility" (Knox, 1978), which contrasts the potential supply of services with the potential demand for those services, is given by:-

$$I_i = \frac{T_{Ai}(\%)}{M_i(\%)} \times 100$$

(Equation 4)

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population of  $j$  places upon the services available in  $i$ .

Where:-

$I_i$  = final index of accessibility  
neighbourhood  $i$

$TA_i(\%)$  = time based index of accessibility  
in neighbourhood  $i$

$M_i(\%)$  = population potential index  
in neighbourhood  $i$

Values for  $I_i$  in excess of 100 indicate a relative over-provision of physicians in a given neighbourhood. Conversely, a value under 100 shows a relative under-provision. This index is based on an opportunity framework in that it does not include trips which are actually made, but utilises the potential amount of health care available (Knox, 1978).

With the model utilised being a 'closed model', there is a problem concerning the influence of the boundary of the study area. It can be argued that accessibility in peripheral areas may be under-estimated by the index due to the influence of service facilities located immediately outside the study area (Knox, 1978). It is, however, felt that the Winnipeg study area (see Chapter IV) is adequately bounded<sup>5</sup> since there is little population in districts

<sup>5</sup> An under-bounded city is one in which the continuous urban area exceeds the legal boundary of the city and becomes the jurisdiction of the adjacent municipality

spatially contiguous to the city boundary. More importantly, there are no physicians located outside the study area who are serving the population of these peripheral areas. This partly reflects the fact that the city of Winnipeg is over-bounded<sup>6</sup> with some peripheral census tracts only being sparsely populated.

Actual linear distance is used as the basic measure of the degree of spatial separation between the supply of physicians and the client population. Linear distance is the most appropriate measure because of the relatively dense road network which allows for equal ease of movement in all directions within the study area. The time based index of accessibility does, however, allow the relative accessibility between automobile and non-automobile owners to be contrasted.

The index provides an 'average' measure of accessibility. Some important variations in accessibility will, however, inevitably occur. For example, actual accessibility may be reduced during peak traffic periods. Such periods also tend to be the most popular consultation times for people with long and inflexible working hours.

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(Haggett, 1983, pp. 360-361).

<sup>6</sup> An over-bounded city is one in which the legal boundary of the city exceeds the continuous urban area (Haggett, 1983, pp. 360-361).

### 3.4 THE COVERT DEMAND FOR HEALTH SERVICES

The population potential index ( $M_i$ ) is included in the calculation of a final index of accessibility ( $I_i$ ) as a way of contrasting the actual supply of medical resources with demand for them in the study area. Knox (1978) considered demand to be equated with the population size of certain sectors of the city. This thesis takes an alternative view of demand. Rather than accepting that an equal demand exists across society, an emphasis is placed upon the idea of COVERT DEMAND or NEED. Social justice, in terms of the distribution of health services, will only be achieved if the supply of services corresponds to the need for them. Need is, however, a relative term dependent upon human consciousness (Harvey, 1973). As society changes, so too does the notion of relative need. Harvey (1973) details three objective ways of determining the need for health services.

The first method is to equate need with the level of utilisation of medical resources. To accept "market demand" as a socially just measure of need requires that the other conditions prevailing in society are themselves socially just. Although utilisation does vary within society it does not truly reflect the need for medical services.

Secondly, the notion of need may be based upon the idea of relative deprivation or "latent demand" (Harvey 1973).

The difference between a person's reference group's expectations for health care and the service received provides a measure of relative deprivation. The disadvantage in using this method is that real need is not reflected by perceived need. Poorly served sections of the population often have low levels of felt need.

The third method is to examine the idea of "potential demand". Harvey (1973) suggests that "potential demand" in terms of health care can be evaluated by an analysis of the factors which generate particular kinds of health problems. The characteristics of the population will thus have an important impact upon territorial needs. Illness may be related to age, occupational characteristics, sociological and cultural circumstances as well as to income levels.

This thesis uses the notion of covert demand which combines elements of Harvey's (1973) "potential demand" and "latent demand". Market demand is not a good measure of need. A "clinical iceberg" has been shown to exist, with only a few people suffering from ailments actually seeking consultations (Last, 1963). It is, however, accepted that aspects of the social environment do affect the health of the population. In addition, the notion of relative deprivation is seen as important since inequalities in health are apparent in society. This covert demand is based upon the idea that the level of health in society is

dependent upon certain factors in the social environment. The social environment does, however, affect social groups differently. Therefore, the idea of relative deprivation is important. Thus, the population potential index ( $M_i$ ) needs to be adjusted to reflect different levels of health in society so that it portrays the true level of demand for health services.

### 3.5 THE MEASUREMENT OF COVERT DEMAND

Health has traditionally been measured in terms of life expectancies, death rate and infant mortality.<sup>7</sup> The reliability of such data has been accepted but there is, however, a problem in that the death rate focusses upon chronic illness and tells us little about the health of the living population. As a result, morbidity statistics are receiving a greater emphasis.

Morbidity surveys examine the prevalence of illness in the population at a given time or over a period of time (see Walters, 1980) and involve an intense investigation of a sample population. Morbidity surveys have been used to examine the variations in the level of health. As a result, they have isolated specific groups who are in a position of relative deprivation in comparison with the majority of

<sup>7</sup> The mortality rate refers to the number of deaths in a population over a period of time. The value may be adjusted to remove the influence of age and/or sex from the mortality rate (see Ibsen, 1979).

society. Morbidity surveys, therefore, give an idea of the covert demand for health care that exists in society.

Morbidity surveys may take a variety of forms. The survey may require an actual clinical examination of the population, or it may just involve a questionnaire. Morbidity surveys that are based upon clinical diagnosis tend to provide a reliable measure of the levels of health in society. Such studies 'because they require medical personnel to actually examine each subject in the sample population, tend to be time consuming and costly. Consequently, clinical surveys are conducted on sample populations of a limited size. A significant drawback in clinical surveys is that they rely upon professional definitions of illness which generally fail to take into account the subject's own experience of ill-health. Other surveys have involved a more subjective questionnaire in their format. The respondents are consulted about the illness or disability they have experienced in a given time period. Such surveys have stressed the personal and social consequences of morbidity and measures those dimensions of illness which are important to the individual. These experiences may not be identified by medical diagnosis. The existing measures of the level of health in society, as provided by morbidity surveys, may not be as reliable as desired due to the small sample sizes in relation to the population. However, since it is important to have some

indication of social variations in health, it was decided to rely upon those morbidity data which are available. The covert demand for health is quantified in this thesis using the data obtained by the 1980 Canada Health Survey<sup>8</sup> (Statistics Canada, 1981).

The data presented in tables 1 and 2 were taken from the 1980 Canada Health Survey (Statistics Canada, 1981). By examining these tables we are able to determine which groups within the population exhibit the greatest covert demand. The calculation of a ratio, which shows the proportion of each group with or without illness, allows the extent of covert demand to be determined.

Table 1 shows the distribution of illness according to family income. Examining the ratios presented in the table, most income groups have a similar level of health (the ratios are close to 1.0). The two lower income groups, however, exhibit higher levels of illness. The figures generally have a tendency to show a gradient in the health of the population with the level of health improving with family income.

Table 2 shows the distribution of illness according to age and sex differences in the population. One general trend indicated by the table is the higher prevalence of health problems amongst the female population. A striking

<sup>8</sup> The role of the 1980 Canada Health Survey as a data source will be discussed in Chapter IV.

TABLE 1

Prevalence of Health Problems by Economic Family Income  
1978-79.

FAMILY INCOME \$	TOTAL POPULATION	POPULATION WITH AT LEAST ONE PROBLEM	%	POPULATION WITHOUT HEALTH PROBLEMS	%	RATIO
UNDER 5000	1288	939	72.9	349	27.1	2.69
5000-14999	5727	3459	60.4	2268	39.6	1.53
15000-24999	7721	3941	51.0	3780	49.0	1.04
25000-34999	4252	2185	51.4	2067	48.6	1.06
35000-44999	1658	854	51.5	804	48.5	1.06
45000+	1033	535	51.8	499	48.2	1.07
INCOME NOT KNOWN	1344	605	45.0	739	55.0	0.82
TOTALS	23023	12517	54.4	10506	45.6	1.19

Figures in 1000s

The ratio is expressed as the population with a health problem compared with the population without a health problem

SOURCE: Canada Health Survey  
(Statistics Canada, 1981)

TABLE 2

Prevalence of Health Problems by Age and Sex 1978-9.

AGE	TOTAL POPULATION	POPULATION WITH AT LEAST ONE PROBLEM	%	POPULATION WITHOUT HEALTH PROBLEMS	%	RATIO
0-4						
BOTH SEXES	1719	539	31.4	1180	68.6	0.46
MALE	880	279	31.7	602	68.3	0.46
FEMALE	838	260	31.0	578	69.0	0.45
5-14						
BOTH SEXES	3813	1389	36.4	2423	63.6	0.57
MALE	1952	726	37.2	1227	62.8	0.59
FEMALE	1860	664	35.7	1197	64.3	0.55
15-64						
BOTH SEXES	15473	8858	57.2	6615	42.8	1.34
MALE	3971	3971	51.6	3726	48.4	1.07
FEMALE	7775	4887	62.9	2889	37.1	1.69
65+						
BOTH SEXES	2019	1731	85.7	288	14.3	6.01
MALE	1887	742	83.7	145	16.3	5.12
FEMALE	1132	989	87.4	143	12.6	6.92
ALL AGES						
BOTH SEXES	23023	12517	54.4	10506	45.6	1.19
MALE	11417	5717	50.1	5699	49.9	1.00
FEMALE	11606	6800	58.6	4807	41.4	1.41

Figures in 1000s

The ratio is expressed as the population with a health problem compared with the population without a health problem

SOURCE: Canada Health Survey  
(Statistics Canada, 1981)

occurrence, however, is the magnitude of the covert demand for health exerted by the elderly (a ratio of 6.01).

From the two tables we can draw the necessary information needed to measure the covert demand for health in society. An inspection of the ratios reveals three 'high demand' groups. These are the two lower family income groups and the over 65 age group. These three groups tend to form spatial groupings within urban areas (Herbert, 1972) and so there will be spatial differences in covert demand.

The 'population potential index' (Knox, 1978) presented earlier (see equation 3) can now be modified to take into account covert demand.

$$CD_i = \sum_{j=1}^n \frac{(2.69W_j + 1.53X_j + 1.0P_j + 5.01E_j)}{D_{ij}^k}$$

(Equation 5)

Where:-

$CD_i$  = covert demand for the primary care facilities in neighbourhood  $i$

$W_j$  = population in neighbourhood  $j$  with a family income of less than \$5000 per year

$X_j$  = population in neighbourhood  $j$  with a family income between \$5000 and \$14999 per year

$P_j$  = population in neighbourhood  $j$  in  
other income groups.

$E_j$  = population in neighbourhood  $j$   
who are over 65 years old

$D_{ij}$  = distance between neighbourhoods  $i$  and  $j$

$k$  = distance decay function

The ratios contained within tables 1 and 2 have been used to weight the population of each census tract according to the prevalence of high risk groups.<sup>9</sup> One problem in the use of the ratios is that there is overlap between elderly group and the various income groups. This is especially important when one considers that the elderly population is generally a low income population. Thus, in order to eliminate some of the over estimation of demand due to this overlap, the weighting attached to the elderly population group has been reduced by a numeric value of 1.0 when presented in equation 5.<sup>10</sup>

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<sup>9</sup> The weighting for the group 'population in other income groups' has been taken as 1.0. The actual value in table 1 is 1.05, but the small increment is seen as insignificant.

<sup>10</sup> The ratio for the over 65 population group in table 2 was 6.01. In equation 5 it becomes 5.01.

The final index of accessibility taking into account covert demand is:-

$$I_i = \frac{TA_i(\%)}{CD_i(\%)} \times 100$$

(Equation 6)

Where:-

$I_i$  = final index of accessibility  
in neighbourhood  $i$

$TA_i(\%)$  = time based index of accessibility  
in neighbourhood  $i$

$CD_i(\%)$  = index of covert demand  
in neighbourhood  $i$

Using this equation we can examine the contrast between the supply of medical services with the covert demand for health across the study area. Values obtained for  $I_i$  (the final index of accessibility for neighbourhood  $i$ ) which are in excess of 100 will indicate a relative over-provision of physicians while values lower than 100 will result from a relative under-provision.

### 3.6 SUMMARY

This chapter has examined the methodology concerning the determining of accessibility to health care. The chapter begins with an examination of the importance of accessibility to essential public services and social well-being. This is followed by an assessment of a number of methods that have been used to describe accessibility to health care facilities. In this second section the gravity model used in the analysis is presented. The model is one which has been specifically developed for the study of accessibility to primary health care by Paul Knox (1978). The chapter then examines the notion of covert demand and how it can be measured. Finally, Knox's gravity model is modified so as to take into account covert demand for health.

Chapter IV  
THE STUDY AREA AND DATA SOURCES

4.1 INTRODUCTION

This chapter introduces the study area for the analysis of a primary health care delivery system and the sources of the data used in the analysis. The chapter:-

1. briefly examines the study area of Winnipeg to indicate the character of the city and outlines the basic workings of the Manitoba health insurance scheme;
2. examines the sources from which the data have been collected, and
3. on the basis of the data collected, describes the form of the primary health care delivery system in Winnipeg.

4.2 WINNIPEG AND THE MANITOBA HEALTH INSURANCE SCHEME

This thesis focuses its attention upon Winnipeg, Manitoba. In 1981 the city had a population of 580,000 people out of a Manitoba total of 1,026,000 (Statistics Canada, 1982). Consequently, the city occupies a preeminent position within the province. Winnipeg is one of the oldest

urban areas in Western Canada, growing in prominence during the late nineteenth and early twentieth centuries as a major transport and service centre for the surrounding prairie agricultural region. Winnipeg, in common with many other North American cities, is now experiencing problems of inner city decline resulting from continued suburban expansion.

The city (see figure 2) is the provincial capital of Manitoba, and as a result is the major administrative centre for provincial affairs. The importance of the city in the prairie region has also made it an important administrative centre for a variety of federal government agencies. Culturally, Winnipeg has a diverse population composed of a number of major ethnic groups. These range from the Anglophones, who occupy a majority position, to Francophones and sizeable ethnic minorities of Germanic, East European and Asiatic origin. Economically, the city primarily functions as a service centre. Few people are employed in primary industries (1% in farming and mining) while the manufacturing and construction industries account for 20% of the employment available. The majority of the workforce (79%) are employed in the tertiary (retail and commercial businesses) and the quaternary (public administration) sectors of the economy (Statistics Canada, 1982).

The provincial government administers a health insurance scheme which covers hospital and medical services

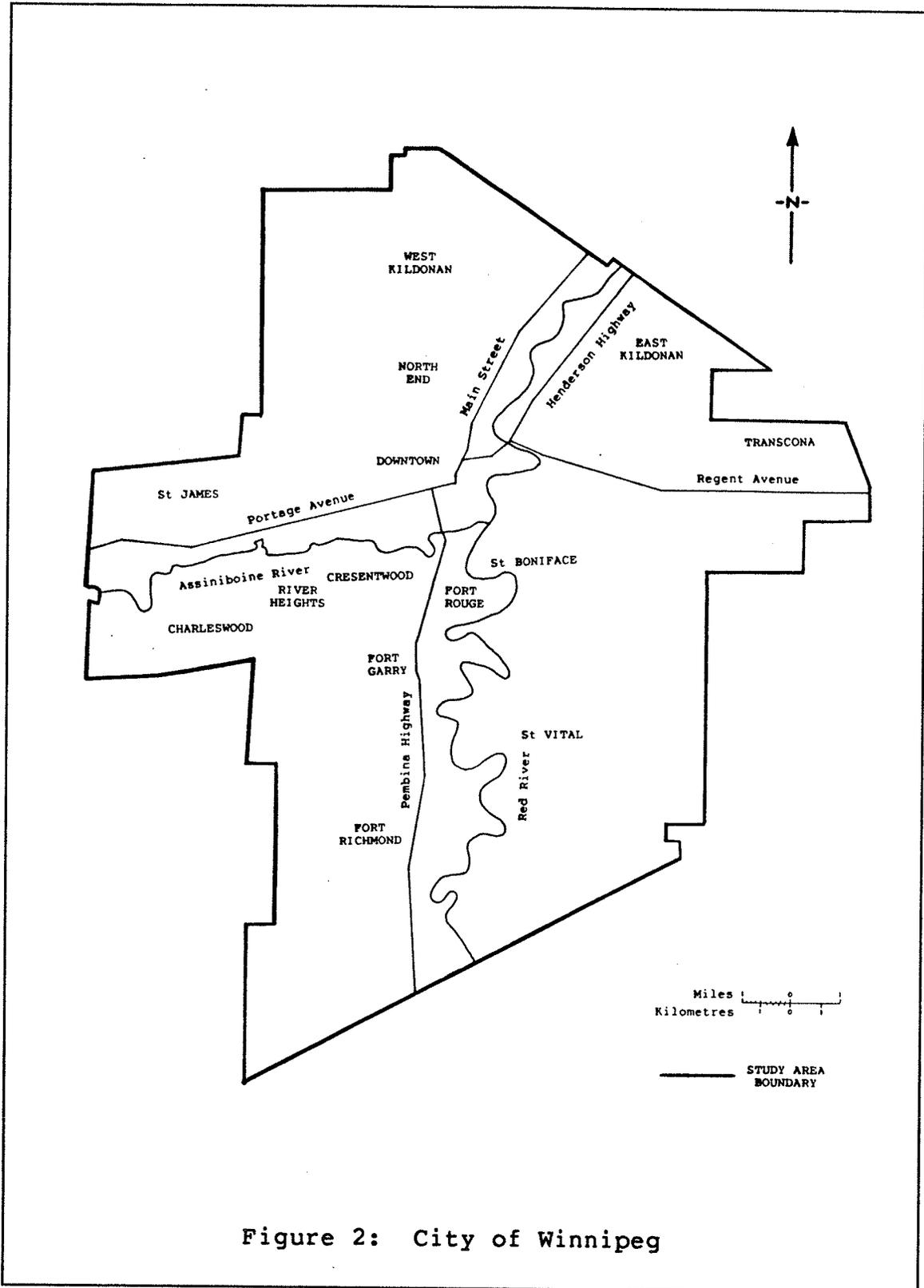


Figure 2: City of Winnipeg

according to the guidelines established by the federal government. These guidelines ensure that universal and comprehensive coverage of the population exists for all medically required services. The financing of the health insurance scheme is based on a cost sharing arrangement between the provincial and federal governments. The scheme comprises two elements; hospital insurance as established under the Federal Hospital and Diagnostic Services Act 1957, and medical insurance (physicians fees) as provided for by the Medical Care Act 1966 (medicare) (Brown, 1983). Since 1977, the cost sharing arrangements have been in the form of a bloc grant by the federal government to the provinces. The bloc grant covers Canada's three major conditional grant programs; hospital insurance, health insurance and post-secondary education with the amount of the grant paid being based on a funding formula (Brown, 1983).

The principles of the provincial health insurance scheme correspond with the idea of 'socialised medicine'. However, it differs from other socialised schemes (such as the British National Health Service) through the method of payment for the services rendered by medical practitioners. Physicians are paid on a fee-for-service basis and are free to work without locational restrictions. The integral part of the fee-for-service system is the 'fee schedule'. This is a document listing possible medical procedures and a corresponding list of fees which the physician will receive

for performing one of the procedures. The level of the fees in the schedule is determined through negotiations between the provincial Minister of Health and the Manitoba Medical Association (which represents the medical profession in the province).

Physicians are permitted to 'opt-in' or 'opt-out' of the provincial health insurance scheme. Where a physician chooses to opt-in, there is an acceptance of the negotiated fee schedule as full payment for the services supplied. If a patient consults with an opted-out physician, services remain covered by the provincial health scheme. However, rather than the health insurance scheme paying the physician directly, it reimburses the individual for the payments already made to the opted-out physician.<sup>11</sup>

This thesis focuses on a certain group of physicians (namely general practitioners) and considers their spatial distribution within the prevailing health insurance scheme. The efficiency of the primary health care system (in relation to the demands of the population) in the study area of Winnipeg is analysed using the methodology described in

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<sup>11</sup> Until January 1985, opted-out physicians in Manitoba were allowed to bill the patient over and above the rate in the negotiated fee schedule. The patient was responsible for the amount over and above the fee schedule. The Medical Care Act of 1984, however, was implemented to discourage over-billing by penalising those provinces where over-billing was continuing. In January 1985, agreement was reached in Manitoba whereby physicians gave up the right to over bill patients.

Chapter III. The data required to operationalise the methodology were drawn from a number of sources.

#### 4.3 DATA SOURCES

In order to determine the equitable nature of Winnipeg's primary health care system, it is necessary to obtain data on both the supply of medical services and the demand for health care. In addition, because a gravity model is to be utilised in the analysis, a number of data are needed before the methodology can be utilised successfully. These data relate to the distance decay function of the gravity model.

##### 4.3.1 Service Supply Data

Details regarding the specific location of primary physicians were obtained using two independent sources. Initially a list of physicians was prepared using the 'Winnipeg Yellow Pages' telephone directory which includes a 'physicians' section. However, as some physicians were not classified according to their specialty, cross referencing was needed. This was achieved using a list of medical practitioners licensed in Manitoba published by the College of Physicians and Surgeons of Manitoba.<sup>12</sup> This document contains a comprehensive list of all licensed physicians in Manitoba, complete with their specialty (if

<sup>12</sup> The regulating body of the medical profession in Manitoba.

any) and a mailing address (which is not necessarily the location of their practice). Using these two sources, a list of non-specialist physicians, and their locations, was obtained. No distinction was made between those physicians 'opted-out' of medicare and those 'opted-in' since medicare essentially covers the services of both groups of physicians.

Using the list of physicians obtained by the above method as a starting point, a brief telephone survey was conducted. All of the physicians within the study area were asked a number of questions. The initial question was:- "Are you a general practitioner or a family physician?". This question was asked to check whether the physician was in fact a practicing primary care physician. Fifteen physicians were eliminated from the analysis by this method due to the fact that they had retired or were specialists. Thus, an original list of 319 physicians was reduced to 304.

The second question was:- "What are your office hours during which you are available for consultation?". This question was asked to determine the extent to which medical services were available to the population. Some problems regarding office hours were encountered since not all physicians work to a fixed regular schedule. Some physicians divide their time between working as a general practitioner in their office and as a surgeon or physician

in a general hospital. Other physicians worked variable hours according to the demand for consultations. In such cases the physicians were asked to indicate their consultation hours in a typical working week. The third and final question asked was:- "Do you work in a single practice, a partnership or a group practice?". This question was asked to gain an idea of the form of the delivery of primary health care within the city. The consultation time data were aggregated to determine the total amount of consultation time (in hours) available within each census tract. In total 157 interviews were attempted and 157 were successful representing a 100% response rate.

To assess personal mobility, accessibility to an automobile and the ease of transport by automobile and public transit needs to be measured. Data concerning automobile ownership at the census tract level were unavailable since the 1971 Census survey. The latter data are, however, considered acceptable even though they are somewhat dated because there has been apparently little change in the levels of automobile ownership in Manitoba between 1971 and 1981.<sup>13</sup> Using the 1971 census data, percentages of the population with access to an automobile

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<sup>13</sup> Figures are available at the provincial level which show the number of households which have/have not automobiles. See Appendix A for more details.

were computed for each census tract of the study area.<sup>14</sup>

Ease of movement was measured by estimating the travel time per unit distance by bus and automobile. The ease of transport by bus was measured using selected bus schedules. Corresponding journeys were taken by car by the researcher to obtain an average measure for transport by automobile in the city.<sup>15</sup> The measurements for each mode of transport were made during the post rush hour period of a weekday morning (9.30-11.30am). This time corresponds to the primary physician's busiest consultation period. Thus, the data set related to the supply of health services includes both the amount of physician time (in hours) and a measure of automobile ownership (% of households with a car) in each census tract. In addition, a measure of the ease of movement by both automobile and public transit (time per unit distance) was calculated.

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<sup>14</sup> One problem concerning the use of 1971 Census statistics in conjunction with the more recent 1981 Census data stems from the fact that there have been several changes to the census tract divisions within the city. This problem was overcome through the utilisation of the 'conversion tables' contained within the 1976 and 1981 Census publications. These showed the changes in the census boundaries subsequent to the 1971 census. The 1971 Census data was adjusted in a number of ways. Appendix B details how alterations to the 1971 data were made.

<sup>15</sup> The measurements made and the calculation of time per unit distance by bus and automobile are contained in Appendix C.

#### 4.3.2 Covert Demand Data

Covert demand data were collected from secondary sources. Firstly, the Canada Health Survey (Statistics Canada, 1981) was used to determine the levels of covert demand in society. Secondly, 1981 census data (Statistics Canada, 1982) was used as a source of socio-demographic data for the population of the study area.

The Canada Health Survey (Statistics Canada, 1981) was conducted during the period July 1978 to March 1979 and involved the investigation of a sample population of 40,000 people in 12,000 households. These households were spread across the provinces in 100 geographic clusters. The health survey sampled 10 households per cluster per month. The household was considered to be the most efficient sampling unit for the health data required by the survey.

The sample population was subjected to three forms of questionnaire. Firstly, a respondent administered questionnaire was used to obtain details of the subject's health history and life style. Secondly, an interviewer administered questionnaire was conducted in order to obtain more detailed information about medical complaints. Finally, a physical measure questionnaire was administered by trained medical personnel which involved the physical measuring of blood pressure, height, weight and cardio-respiratory fitness. A blood sample was also taken

to determine immune status.<sup>16</sup>

Socio-demographic data were obtained from the 1981 Census document "1981 Profile Series B" (Statistics Canada, 1982). This document contains selected population characteristics based on a 20% sample of the population in each census tract.<sup>17</sup> From this source the number of people per census tract 1) with an income of less than \$5000, 2) with an income between \$5000 and \$14999 and 3) aged over 65 were obtained.<sup>18</sup> Thus, the data set related to covert demand included a measure of health in society based on socio-demographic characteristics, and details of the age and income of the population in each census tract of the study area.

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<sup>16</sup> A number of sampling errors have been acknowledged by the report, but in the case of the data used in this thesis there is a reported error of 20%. The data utilised is, however, drawn from sections of the survey that concentrate on the general level of health rather than specific ailments. This data will tend to be more accurate because of its generalised nature.

<sup>17</sup> The census publication estimates the number of population in specific socio-economic groups within each census tract based on the 20% sample.

<sup>18</sup> Because the Canada Health Survey looked at illness within economic families, the data used related to family income. Single people are not contained within economic families. Thus the population of each census tract within an income group is not the same as the number of people contained in economic families. The figures for the actual population within a certain group had to be estimated using the family income figures as a guide.

#### 4.3.3 Distance Decay Function

The access to the medical resources of the study area can be assessed by the gravity model using a distance decay function. Knox (1978) calculated a distance decay parameter of the actual decline in registration of patients with distance from the physician's office. His analysis was based on data presented in an investigation of general practice in Liverpool, Great Britain, by Hopkins et al (1968). In the latter study, the authors presented data indicating the numbers of registered patients at various distances from the site of their medical practice. Using these data Knox conducted a regression analysis to calculate a distance decay parameter. The relationship between the distance from a primary physician's office and level of registration with that physician was found to be described by a negative exponential function with a value of 1.52. Knox (1978) subsequently used this parameter in his study of accessibility to primary health care in four British cities. The generality of the exponential function is based on its capacity to describe patterns of relative accessibility rather than the prediction of actual movements of patients. Thus the parameter may be used in the present study since attention is limited to comparing levels of accessibility between census tracts.

To operationalise the distance decay function the distances between the medical resources and the population to be served must be measured. For ease of calculation it is assumed that all medical facilities and population within a census tract are located at a single point, the centroid of the census tract.<sup>19</sup> To measure the centroid of each census tract the following procedure was followed. The centroids of each census tract were visually estimated on a City of Winnipeg street map. However, in the case of those tracts located on the urban-rural fringe, not all of the census tracts were turned over to residential use. Where census tracts included large amounts of non-urban land the centroids of the populated sections only were estimated. A grid of one kilometre quadrats was next superimposed over the street map. The position of the centroids in relation to the origin of this grid were expressed as (x,y) co-ordinates. These co-ordinates were then used to calculate the distances between the centroids of the census tracts. Thus, the data set relating to the distance decay function contains a distance decay parameter and the centroids of the census tracts in the study area.

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<sup>19</sup> The accessibility within any part of a census tract is assumed to be equal to that at the centroid. Such an assumption may cause problems if the census tract is very large (such as a rural municipality). It is, however, reasonable to use the centroid method in the study of intra-urban levels of accessibility since the areas in question are relatively small.

#### 4.4 THE FORM OF PRIMARY HEALTH CARE IN WINNIPEG

Winnipeg's health needs are served by a variety of facilities. There are seven general hospitals distributed across the urban area (see figure 3). Working in conjunction with the hospital system are 1484 licensed physicians (College of Physicians and Surgeons of Manitoba, 1984). Using the methods outlined above in section 4.3.1, 304 non-specialist physicians were identified delivering care from 108 different locations (see figure 3). These physicians form the primary health care delivery system in the study area.

However, there is a variety of forms of primary health care in Winnipeg, each having its own geographic pattern. On the basis of the data collected by the telephone survey and through details given in the Winnipeg telephone directory, primary health care in Winnipeg can be classified as being delivered from four different professional settings:-

1. Professional Building Practice.
2. Group Practice.
3. Single/Partnership Practice.
4. Walk-in Clinics.

A description of the nature of each of these professional settings will allow a better understanding of the form of primary health care delivery in Winnipeg and more insight to the implications of the spatial distribution of facilities.

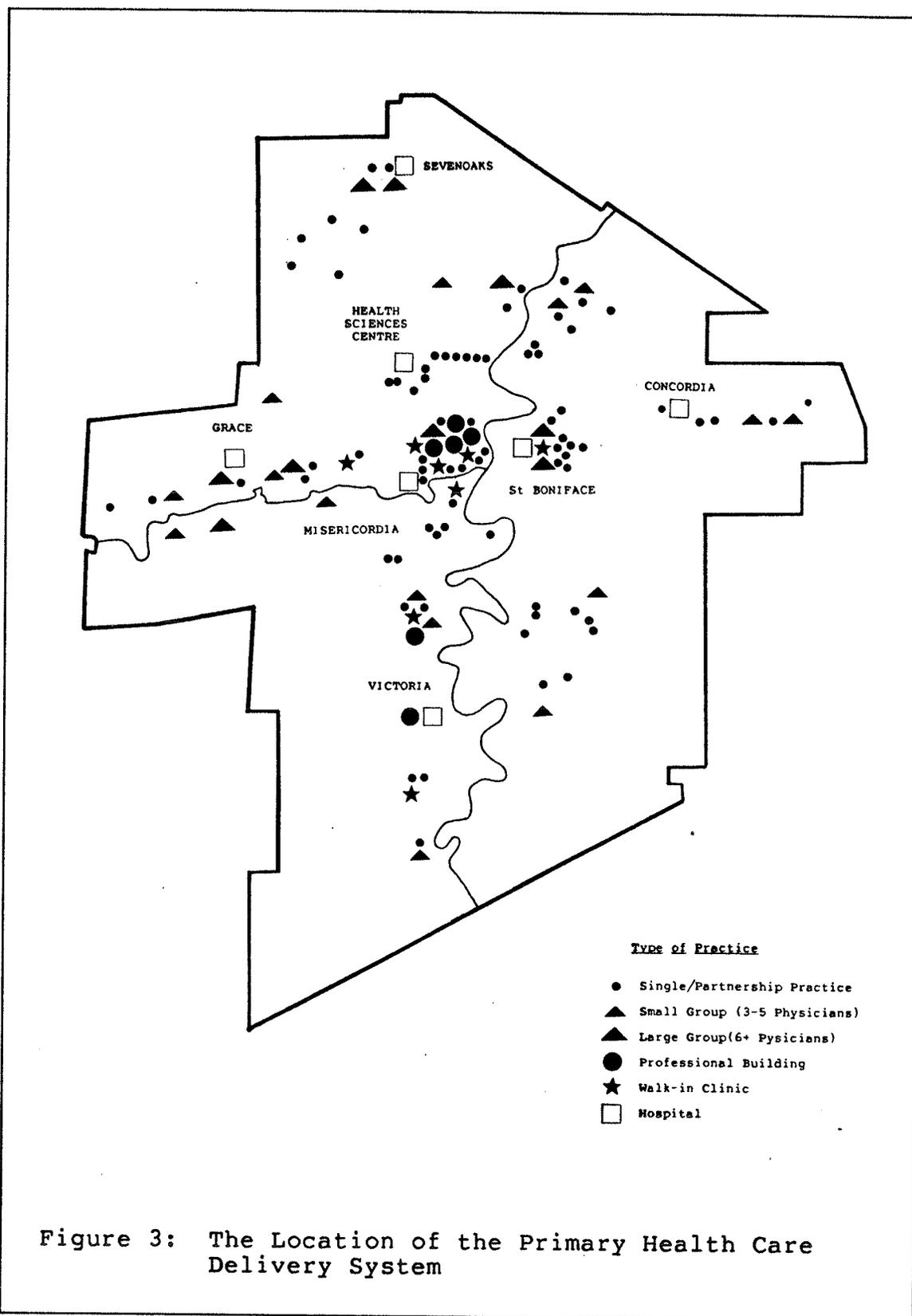


Figure 3: The Location of the Primary Health Care Delivery System

#### 4.4.1 Professional Building Practice

Professional building practice refers to those physicians who rent office space within structures reserved solely for the use of medical practitioners. The larger of these buildings are multi-storey and usually include a pharmacy and a retail optical store at street level. The buildings house a large number of physicians from a variety of specialties. In fact, such facilities are mainly occupied by specialists, with general practitioners forming a minority of the tenants. The general practitioners working in such settings are in single practice or in partnership practice (see section 4.4.3) Such physicians tend not to work full hours in general practice since they also work in nearby hospitals. The rental of two or three rooms in a professional building allows physicians to divide their time between their two locations.

The larger professional buildings may house in excess of 50 physicians. However, they may be the least available group of primary physicians. Since such physicians usually work in hospitals in addition to their own private office they tend to restrict their hours of general practice to two or three hours, weekday afternoons. Consequently, this may present difficulties of access for those with time restrictions on their activities.

#### 4.4.2 Group Practice

A group practice is:-

the application of medical services by three or more full time physicians formally organised to provide medical care consultations, diagnosis and or treatment through joint use of equipment and personnel and with income from medical practice distributed in accordance with methods previously determined by members of the group (Jonas and Rimer, 1977, pp.139).

Group practice facilities contrast with professional buildings in that the building is owned or leased by a group of physicians. The group itself may be single specialty with the focus on primary care, or multi-specialty where general practitioners work in the same group as specialists and surgeons (Jonas and Rimer, 1977). In the study area, the distinction can also be made between large and small group practices.

The large group practice facility may contain over 5 physicians. Such facilities represent the most organised form of primary care available to the population. The physicians working in such groups tend to be 'certified family physicians'. In the larger of the groups there is a tendency towards multi-specialty, in that they contain certain specialties, namely paediatrics, general surgery or internal medicine in addition to family practice.<sup>20</sup> Such

<sup>20</sup> One large group practice located downtown is specialty based. Of the 33 physicians, only 8 are general practitioners. Five of the general practitioners only work 1 day/week at the downtown building. The remainder

physicians work a fixed 9 to 5, Monday to Friday schedule, although some groups do offer evening consultations (with physicians working on a rotational basis). Small groups are more limited in the scope of the medical services they offer due to the fact that they have fewer members (3 to 5). The physicians within such groups tend to be general practitioners although, on occasion, the group may include a paediatrician. They are generally housed in small, purpose built or specially converted buildings.

#### 4.4.3 Single and Partnership Practice

In single practice, physicians have complete responsibility for their own patients with no other physician involved except for a formal referral, consultation or night and weekend coverage (Jonas and Rimer, 1977). In a partnership, two physicians share the cost of office space and staff and act as cover for each other. Depending upon the relationship between the two physicians they may also share billing procedures and profit.

Of the total of 108 locations where primary health care is delivered, 62 are single practices and 14 are partnerships. This group of physicians thus represent the most widespread form of primary health care delivery. The

of the week they work at 'satellite' offices in residential areas of the city.

weekly working hours of the single/partnership practitioner varied greatly with the amount of consultation hours available ranging from 2 hours per week for one physician who was in semi retirement to 60 hours per week. On average the single/partnership practitioner works a 25 hour week.

#### 4.4.4 Walk-in Clinics

The walk-in clinic is a 'retail approach' to medical care. It provides long, more convenient, hours of service (usually 10am to 10pm, often 7 days per week). Obtaining care at these facilities requires no prior registration with the physician. Patients are treated on a 'first-come first-served' basis, with no need for appointments to be made. The clinics are staffed by a number of physicians working on a rota basis. There is always at least one physician on duty. The walk-in clinic often has access to laboratory and x-ray facilities within its own building, and, in most cases, the centre has a pharmacy. The aim of such centres is to treat as many patients as possible. The fee-for-service method of payment allows physicians to enhance their income by increasing their business. The consequence of the walk-in clinic is, however, not only to increase business but to put medical attention on the same level as retail sales. Walk-in clinics serve as minor emergency centres taking business away from hospital outpatient departments. The long hours that the clinics

operate means that they are more available to those sections of the population with time constraints on their activities.

#### 4.5 SUMMARY

This chapter has introduced the study area of Winnipeg, Manitoba. Some background information about the city is given including a description of the medical health insurance scheme in Manitoba. The data sources are presented in three main sections. Firstly, there is a description of service supply data. Secondly, the data sources relating to the covert demand for health are discussed. Thirdly, there is an examination of data related to the distance decay function within the gravity model used in the analysis. The chapter closes with a description of the form of the primary health care delivery system in Winnipeg.

## Chapter V

### ACCESSIBILITY TO PRIMARY HEALTH CARE IN WINNIPEG

#### 5.1 INTRODUCTION

This chapter examines accessibility to the primary health care delivery system in Winnipeg. The methodology outlined in Chapter III is used to construct an index of relative accessibility to primary health care in the city. The chapter is divided up into four sections which are concerned with:-

1. a description of the spatial distribution of the elements that comprise the primary health care delivery system;
2. an examination of the patterns of covert demand across the study area;
3. the construction of an index of accessibility to primary health care, and
4. the testing of the 'Inverse Care Law'.

## 5.2 SPATIAL DISTRIBUTION OF THE PRIMARY HEALTH CARE DELIVERY FACILITIES

The 304 primary physicians identified in Chapter IV deliver their care from 108 different locations and from a variety of facilities (see section 4.4). The general spatial distribution of the medical facilities in the study area (figure 3) is similar to the patterns of delivery that have been isolated in other cities (see Chapter II).

In particular the main cluster of physicians is located in the downtown area. This spatial focus may not only be explained by the CBD's highly accessible location, but also by its close proximity to three major general hospitals.<sup>21</sup> A downtown location is thus especially attractive for physicians who divide their time between working in general practice and working in hospitals.<sup>22</sup> St Boniface hospital, which is located to the east of downtown, also acts as a node which attracts physicians. There are numerous primary care physicians located in the immediate vicinity of the hospital.

In comparison with physicians located downtown, those in St Boniface tend to work full-time in primary practice. The physicians tend work in the group practice or

<sup>21</sup> The Health Sciences Centre, St Boniface Hospital and Misericordia Hospital are all located a short distance away from downtown.

<sup>22</sup> Seventeen out of forty physicians located downtown devote half their working time or less to general practice.

single/partnership practice setting rather than dividing their time between working in the hospital environment and working in general practice based in a professional building. The fact that the St Boniface hospital acts as a major attraction for general practitioners contrasts sharply with the situation of the Health Sciences Centre. The Health Sciences Centre acts more as an attraction for specialist physicians (not dealt with here). Although both hospitals are the major teaching hospitals in the city, the Health Sciences Centre is the location for both the University of Manitoba's Faculty of Medicine and other allied disciplines. Consequently, it is the major centre for medical research in the city and as such tends to attract the more specialist physicians to locate closeby. In addition, the suburban hospitals also attract physicians to locate nearby.<sup>23</sup> This is especially apparent for the Sevenoaks and Grace General hospitals. It is, however, less marked for the Concordia and Victoria hospitals.

Other than the clustering of facilities in the downtown and close to hospitals, medical facilities are distributed across the city in a number of clusters based on the major routes in the city outside of the inner city area<sup>24</sup> (see

<sup>23</sup> At the time of the study, an additional new medical building was being constructed close to the Victoria General Hospital in the south of the city.

<sup>24</sup> The inner city is equivalent of 'Downtown', 'Crescentwood', 'The North End', Fort Rouge and St Boniface (see figure 2).

figures 2 and 3). In St. James, facilities are generally located on Portage Avenue, while in Transcona they are mainly situated on Regent Avenue. In Fort Garry and Fort Richmond medical facilities tend to cluster on Pembina Highway. Such locations allow easier access to medical facilities for both the population which relies on the city transit system as a means of transport and those who have automobiles. Roadside locations also make the medical facility more conspicuous to the potential client and consequently, may increase the utilisation of that facility.

This general description of the spatial distribution of primary health care services can be elaborated by examining the geographic patterns of the different forms of primary health care delivery. The larger professional buildings are located in the downtown area of the city (see figures 2 and 3). These buildings provide 'cheap' medical offices for physicians who work both in general practice and the hospital environment. The central location of professional buildings allows physicians to divide their time between two locations without losing too much time on un-productive travel. The smaller professional buildings which generally cater for full time general practitioners, in comparison, occupy less central positions, either on the fringe of downtown or in suburban locations such as Fort Garry.

Large group practices are generally not included in the downtown area but are usually found close to general hospitals (even though their personnel tend to work full time within the practice). Large group practices are found close to the Grace Hospital in St James, Sevenoaks Hospital in West Kildonan and St Boniface General Hospital in St Boniface (see figure 3). In comparison, smaller group practices are drawn toward more residential areas of the city such as East Kildonan, Fort Garry, St Vital and Transcona (see figures 2 and 3).

Walk-in clinics are attracted to locations that can generate a high volume of patient 'traffic'. Thus, walk-in clinics are generally located in or around the downtown area of the city (see figures 2 and 3). Two facilities are however located close to major suburban shopping centres, one in St. James and one in Fort Richmond. In addition, one walk-in clinic is located in a downtown shopping centre. The walk-in clinic is becoming increasingly popular in Winnipeg with two new clinics being established during the last eight months (September 1984 to April 1985). A further new facility has also been included in the re-development plans of a major shopping centre in St James.

Of the total of 108 locations where primary health care is delivered, 62 are single practices and 14 are partnerships. Single/partnership practices form the basis

of the primary health care delivery system in areas not served by professional buildings, group practices or walk-in clinics (see figure 3). This is especially the case in the heavily populated inner city areas outside of downtown (Crescentwood and Fort Rouge). Single/partnership practices occupy a variety of facilities. They may be contained in a converted house in a residential area, office space in small roadside retail development, or in medical offices in large shopping centres.

The spatial distribution of medical practice across the study area gives only a limited view of the spatial distribution of physicians' working hours in the city. A more complete description is given in terms of the amount of consultation time available per census tract (figure 4).

The main cluster of facilities in the downtown area account for 15% of the total time available in Winnipeg. The two census tracts adjacent to downtown also contain 16% of the city's consultation time. In addition to this central concentration of consultation time, there is a focus of office hours located around the suburban hospitals in the city. One census tract in St. James which contains the Grace Hospital has over 5.5% of the city's total consultation time, while the census tract containing the Victoria Hospital in Fort Richmond contains 4%. In comparison, the inner city area has relatively less

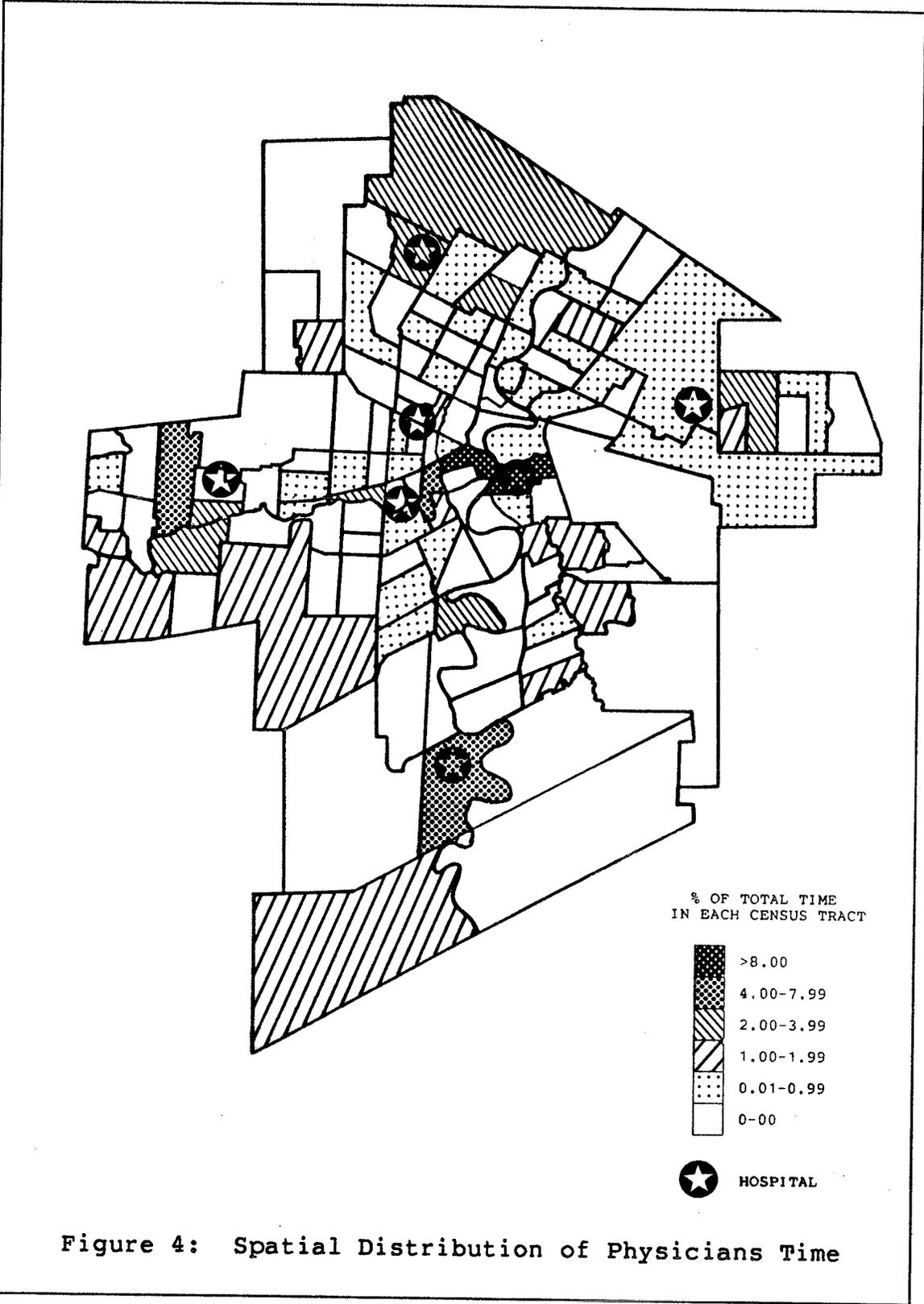


Figure 4: Spatial Distribution of Physicians Time

consultation time available than both downtown and the city's suburbs. Many census tracts in the North End and Fort Rouge are unserved as are areas of Crescentwood and River Heights. This is possibly due to the unsuitability for medical practice of buildings in these areas since all four are essentially residential in nature. The areas do, however contrast in their social composition or social status. In the case of the 'North End' there may be some avoidance of the area by physicians due to its lower class/ethnic composition. This may also be true to a lesser extent with respect to Fort Rouge.

### 5.3 THE DEMAND FOR HEALTH

The real demand for health is associated with the notion of covert demand. Covert demand is based on the fact that there are inherent inequalities in the level of health in society. Consequently, certain groups in society exert a comparatively higher potential demand for health care. On the basis of the discussion in Chapter III, covert demand is measured in terms of:-

1. the actual population in each census tract;
2. the number of people in each census tract aged 65 and over, and
3. the number of people contained within specific family income groups.

### 5.3.1 The Distribution of the Population

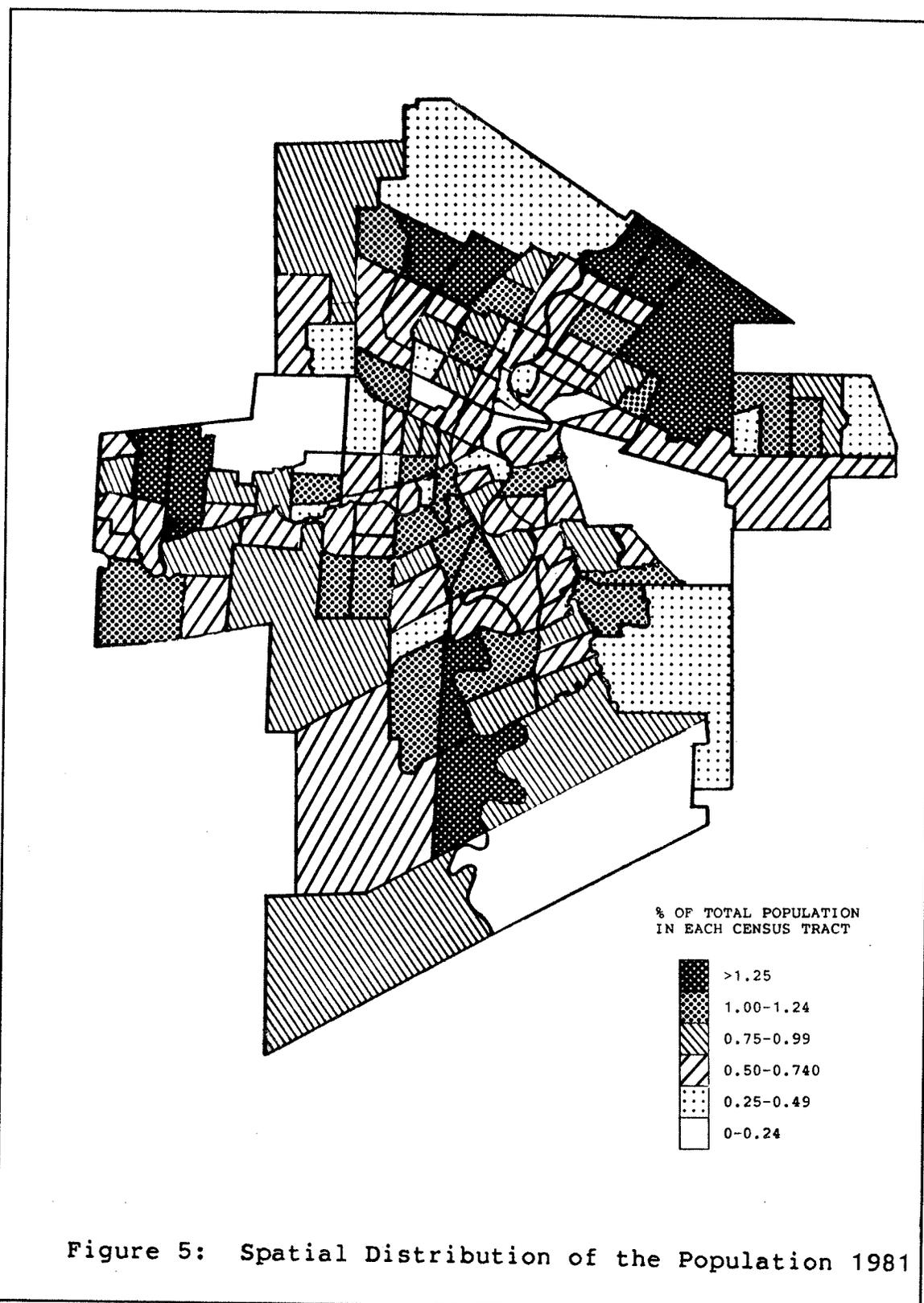
The population in the study area, as would be reasonably expected, is not distributed evenly across the city. Figure 5 indicates the proportion of the total population of Winnipeg which is contained within each census tract.<sup>25</sup>

Within the inner city, population varies between census tracts thus reflecting the variable land use in the area. For instance, the downtown retail area has only a small resident population as do the surrounding commercial and warehouse zones. Similarly, census tracts that are primarily occupied by the railways are sparsely populated (i.e., each census tract contains <0.5% of the city's total population). In contrast, the remaining inner city areas<sup>26</sup> contain larger percentages of the city's total population (0.75 - 1.25%). Of the suburban areas, Fort Garry and Fort Richmond have major concentrations of population in the southern part of the city (>1.25%). Other heavily populated census tracts in the suburbs comprise St James in the west (1.25%), and West Kildonan (1%) and East Kildonan (1%) in the north of the city.

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<sup>25</sup> The actual population per census tract, as opposed to some measure of population density, is given since these values are used in the subsequent analysis.

<sup>26</sup> Areas such as Fort Rouge, Crescentwood and St Boniface.



### 5.3.2 Spatial Distribution of the Elderly Population

The pattern of distribution of the elderly population in the study area broadly corresponds with the overall population pattern (figure 6). The major concentrations are in the inner city residential areas with each of the census tracts having in excess of 1% of the total elderly population of Winnipeg. The more peripheral suburban areas have a younger population with fewer elderly people being represented in those census tracts. This is especially apparent in the southern section of the city, with areas including Fort Richmond and St Vital having <1% of the city's elderly population. The general pattern is thus characterised by decreasing proportions of elderly persons associated with increasing distance from the city centre.

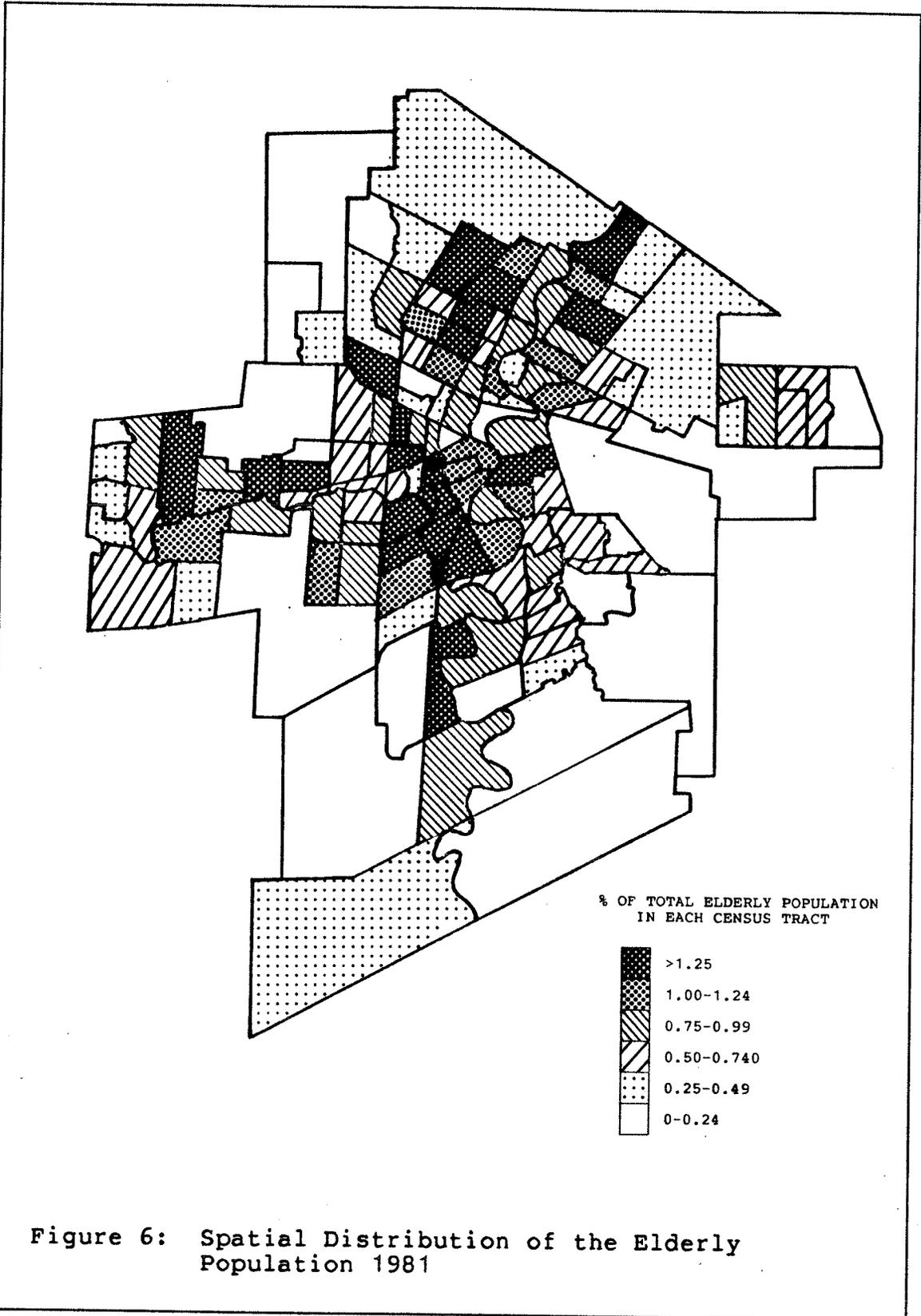


Figure 6: Spatial Distribution of the Elderly Population 1981

### 5.3.3 Spatial Distribution of Family Income Groups

The spatial distribution of the low income population (<\$5000/year) of the study area is illustrated in figure 7. There is a notable concentration of low income persons in residential areas of poorer housing quality on the fringes of downtown (>1.25% of the total population in the low income group). From this inner core area, important concentrations of low income population are also found in a northward direction.

In the western section of the city there is a major under-representation of low income families. This is a reflection of the higher income status of the Charleswood/St James areas. The southern sections of the city, in comparison, appear to have a more 'mixed' population (with Fort Garry and Fort Richmond both having in excess of 1.25% of the total low income population).

The spatial distribution of population contained within the family income group of \$5000 to \$14999 per year (figure 8) corresponds closely to the that of the <\$5000 group with a large concentration of these households in the inner city areas. There is, however, a greater representation of this group than the low income group in the Charleswood/St James areas.

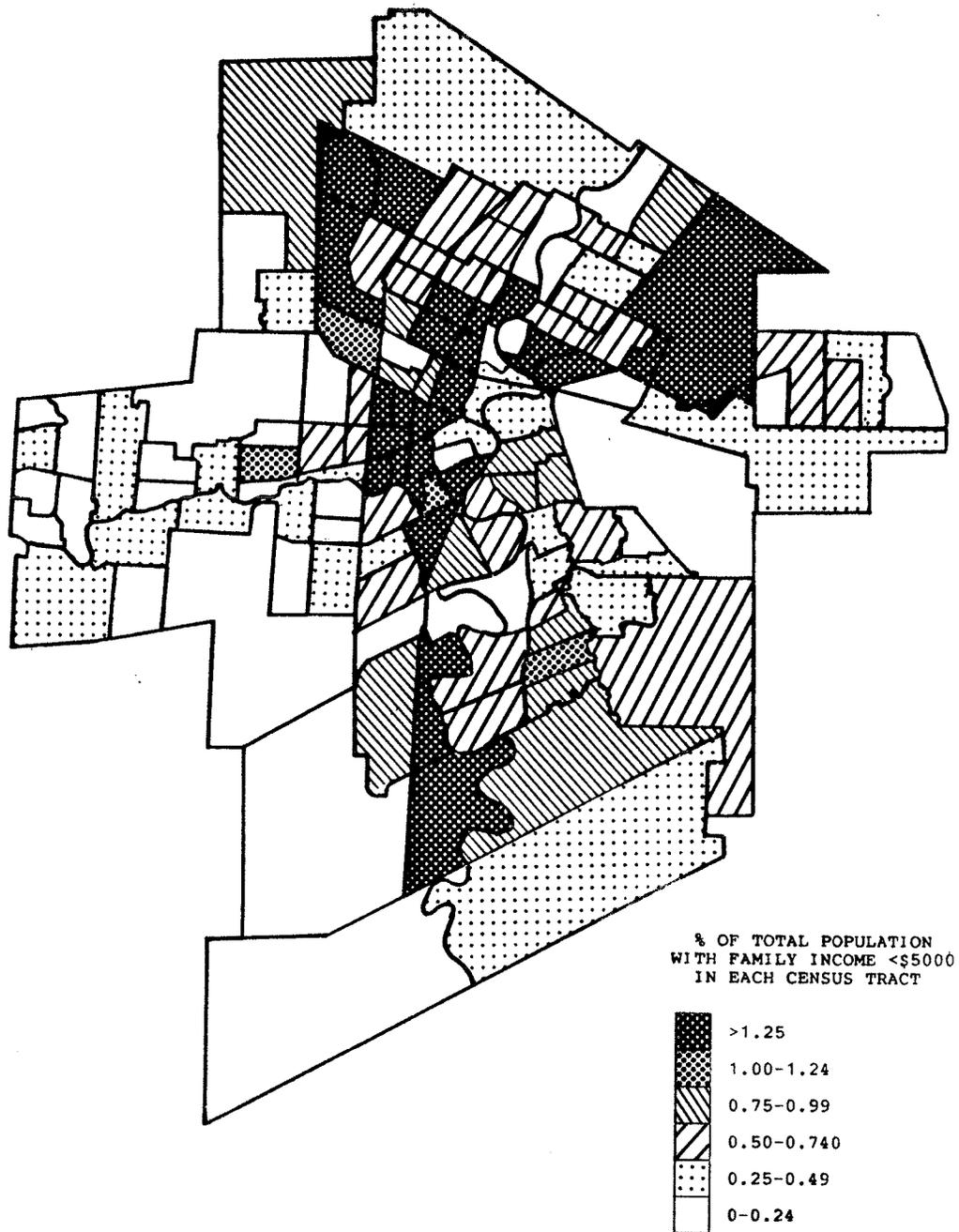
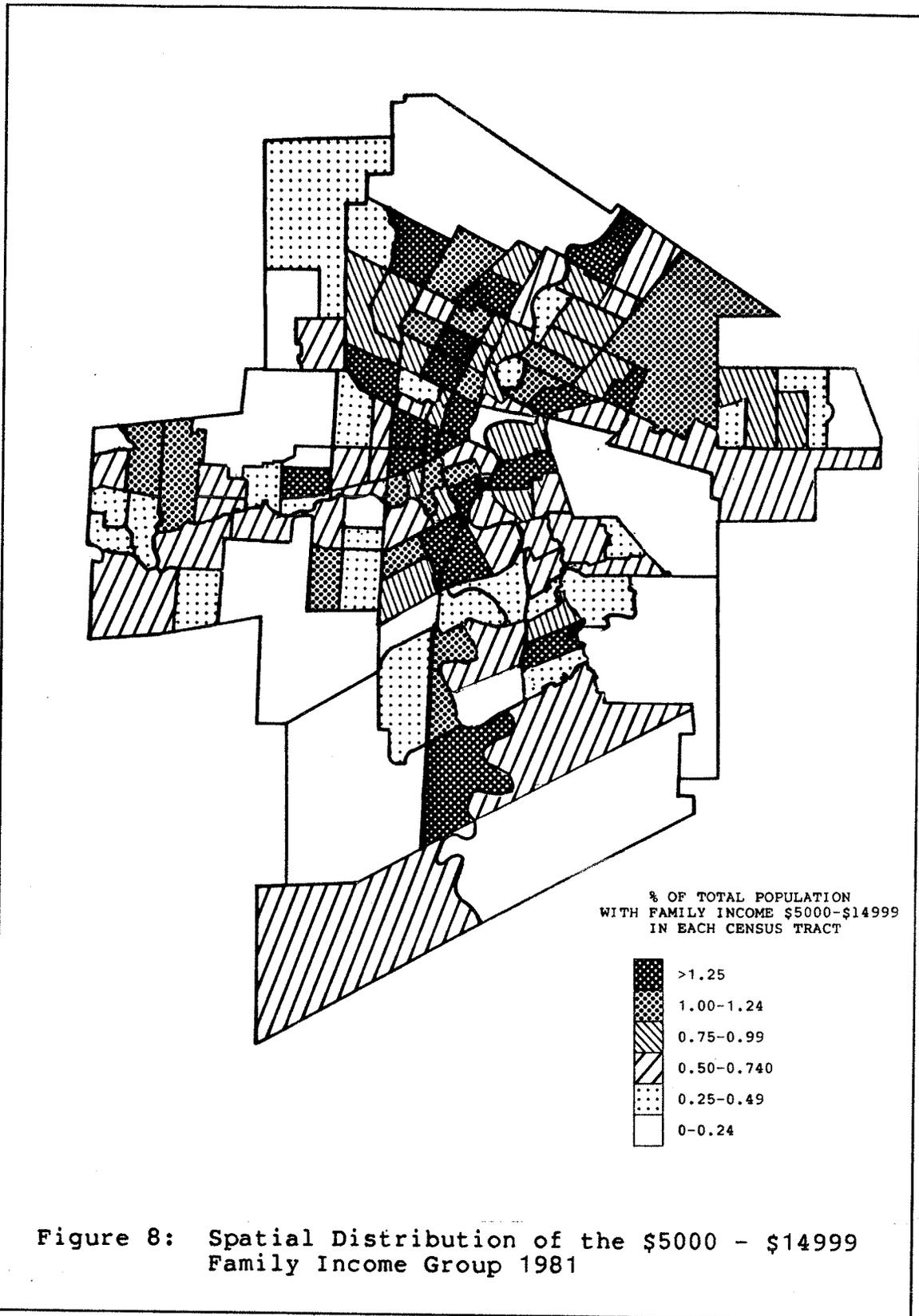
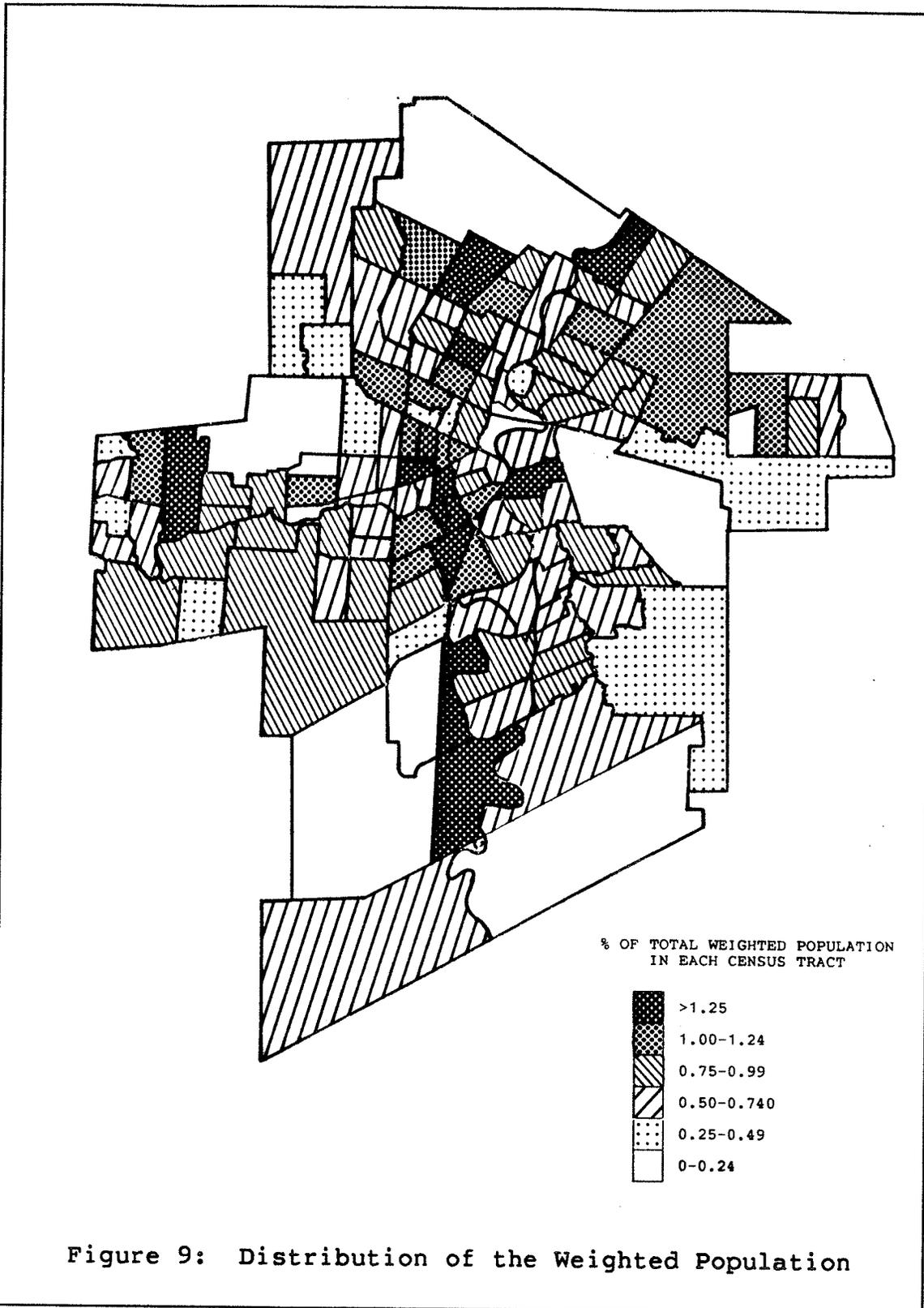


Figure 7: Spatial Distribution of the under \$5000 Family Income Group 1981



In the calculation of the index of covert demand (see equation 5, Chapter III), the original population of each census tract is weighted to reflect the greater health needs of the lower income and elderly population. The spatial distribution of the weighted population is shown in figure 9. By comparing the spatial distribution of the weighted population with that of the original population one notes that the weighted population is more concentrated in the central part of the city. Thus, a greater demand for primary health care services exists in central areas of the study area if a weighted measure is used rather than if raw population figures are relied upon. This is reasonable considering the higher prevalence of low income and elderly (high demand) groups in the inner city.



#### 5.4 SPATIAL PATTERN OF ACCESSIBILITY TO PRIMARY HEALTH CARE

Using the data measuring the supply of physician services and the covert demand for health, an assessment of the accessibility to the primary health care system in Winnipeg is offered. This section is divided into three subsections. Firstly, a "time based index of accessibility" is calculated using data relating to the supply of primary health care services and the mobility of the population. Secondly, an "index of covert demand" is calculated using data relating to the covert demand for health. Finally, the indices of time based accessibility and covert demand are combined to produce a "final index of accessibility".

##### 5.4.1 Time Based Index of Accessibility

The availability of physicians' time across the study area can be assessed by calculating a "time based index of accessibility" (Knox, 1978):-

$$TA_i = C_i \frac{(A_i)}{(S_a)} + (100 - C_i) \frac{(A_i)}{(S_t)}$$

(Equation 2)

Where:-

$T_{Ai}$  = time based index of accessibility  
for neighbourhood  $i$

$A_i$  = basic index of accessibility  
for neighbourhood  $i$

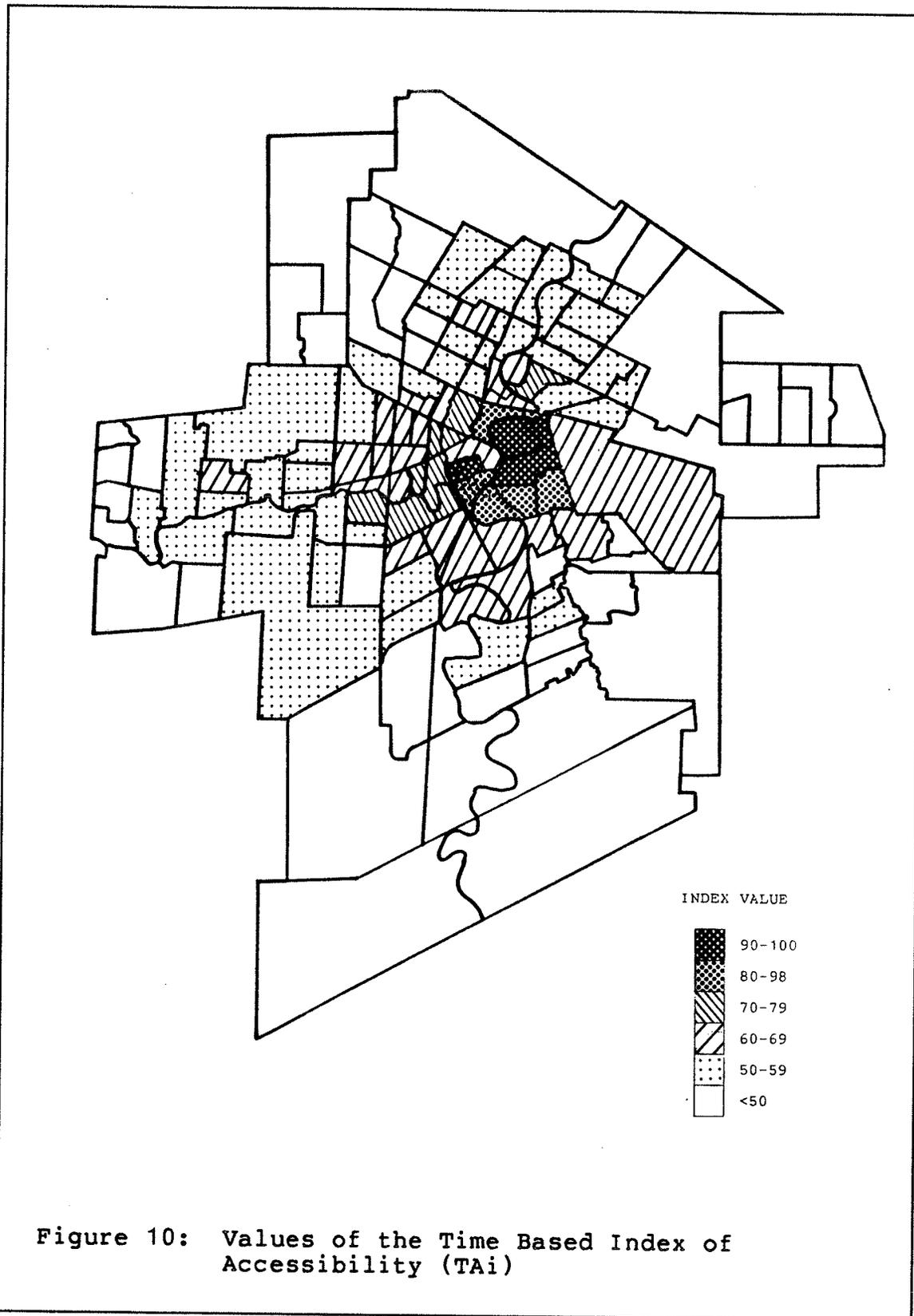
$C_i$  = % of car owning households  
in neighbourhood  $i$

$S_a$  = average time to travel a given distance  
by car in the study area

$S_t$  = average time to travel a given distance  
by transit in the study area

An index value ( $T_{Ai}$ ) is calculated for each census tract in the study area. These raw index values range from 50916.9 to 199389.5. The values for each census tract are then scaled as percentages of the highest value obtained for any census tract so as to allow easy comparison. These  $T_{Ai}(\%)$  values range from 25.5% to 100% (figure 10).

The basic pattern of physicians' time ( $T_{Ai}$  index) is a gradient of decreasing availability with increasing distance from the downtown area. The central city is seemingly the best served, with the suburban periphery of the city being poorly provided for. However, the 'availability gradient' is relatively gentle in the western part of the city,



reflecting the relative affluence and high levels of automobile ownership in those areas. In comparison, the availability gradient northward from the city centre is relatively steep, reflecting the comparatively low income and mobility levels in that section of the city.

It would be premature to draw final conclusions on the pattern of access to the primary health care delivery system in Winnipeg purely from the data disclosed by the time based index of accessibility (figure 10). A census tract which has a large amount of physician time available may not necessarily be an area with a high degree of accessibility. This is the case where a census tract contains a large amount of people. Therefore, the availability of medical services must be combined with a measure of covert demand in the same census tract before a complete assessment of the accessibility to the medical services can be made.

#### 5.4.2 Index of Covert Demand

The covert demand for primary health care services can be assessed by calculating an index of covert demand:-

$$CD_i = \sum_{j=1}^n \frac{(2.69W_j + 1.53X_j + 1.0P_j + 5.01E_j)}{D_{ij}^k}$$

(Equation 5)

Where:-

$CD_i$  = covert demand for the primary care facilities in neighbourhood  $i$

$W_j$  = population in neighbourhood  $j$  with a family income of less than \$5000 per year

$X_j$  = population in neighbourhood  $j$  with a family income between \$5000 and \$14999 per year

$P_j$  = population in neighbourhood  $j$  in other income groups

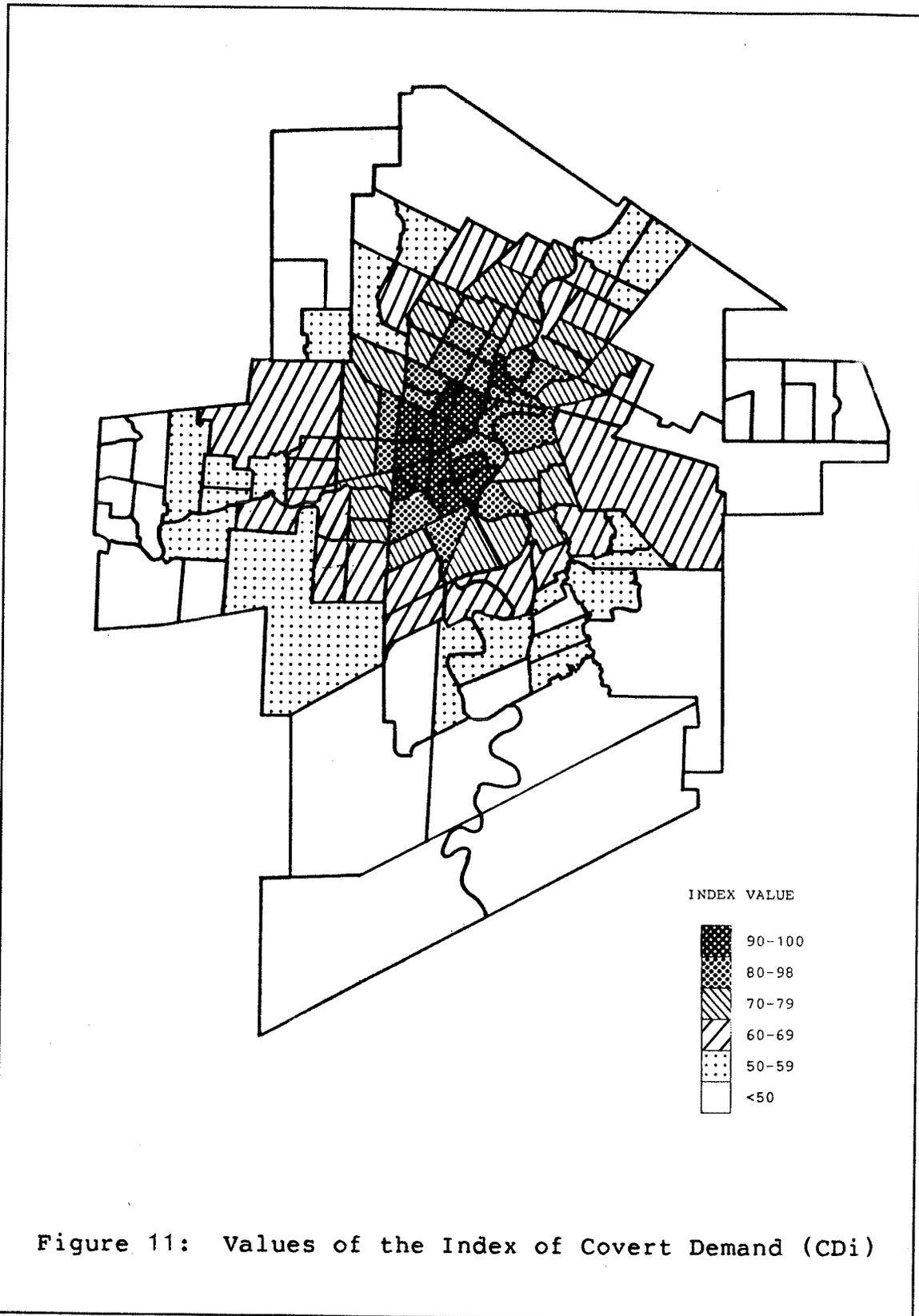
$E_j$  = population in neighbourhood  $j$  who are over 65 years old

$D_{ij}$  = distance between neighbourhoods  $i$  and  $j$

$k$  = distance decay function

An index value ( $CD_i$ ) is calculated for each census tract in the study area. These raw index values range from 89240.25 to 295218.8. The values for each census tract are scaled as percentages of the largest value obtained for any census tract so as to allow easy comparison. These  $CD_i(\%)$  values range from 30.2% to 100% (figure 11).

Figure 11 reveals that there is a gradient of decreasing demand with increasing distance from the city centre. In contrast to the pattern of availability of medical services,



the 'demand gradient' from the city centre to the north periphery of the city (East Kildonan and West Kildonan) is comparatively shallow. The demand gradient from the city centre to the west periphery (St James and Charleswood) of the city is, however, relatively steep. The variations in the demand gradient reflect contrasting levels of health<sup>27</sup> in different parts of the city. Thus, the prevalence of low income elderly groups is clearly more widespread in the northern areas of the city than elsewhere.

#### 5.4.3 Final Index of Accessibility

When the availability of physicians' time (TA<sub>i</sub>) and the covert demand (CD<sub>i</sub>) for those services are combined, an overall assessment of the spatial variations in accessibility to primary health care can be made. Such an assessment can be achieved using equation 6:-

$$I_i = \frac{TA_i(\%)}{CD_i(\%)} \times 100$$

(Equation 6)

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<sup>27</sup> The level of health of the population is reflected by their covert demand for health.

Where:-

- $I_i$  = final index of accessibility  
in neighbourhood  $i$
- $TA_i(\%)$  = time based index of accessibility  
in neighbourhood  $i$
- $CD_i(\%)$  = index of covert demand  
in neighbourhood  $i$

If the relative availability of physicians' time in a census tract exceeds the relative covert demand for those services (that is an  $I_i$  value in excess of 100%) the census tract is comparatively over served. Conversely, if the relative covert demand exceeds the relative availability of physicians' time (that is an  $I_i$  value less than 100%), the census tract is comparatively underserved. Figure 12 shows the pattern of accessibility to primary health care in Winnipeg based on the computed  $I_i$  values. The values range from 62.1% to 124.4%.

The  $I_i$  index gives a clearer picture of accessibility since it is produced by combining indices of supply and demand. The pattern of accessibility disclosed in figure 12 suggests that only a few areas of the city are highly accessible to primary health care. Only 14 out of the 131 census tracts that comprised the study area registered values in excess of 100%. The census tracts having

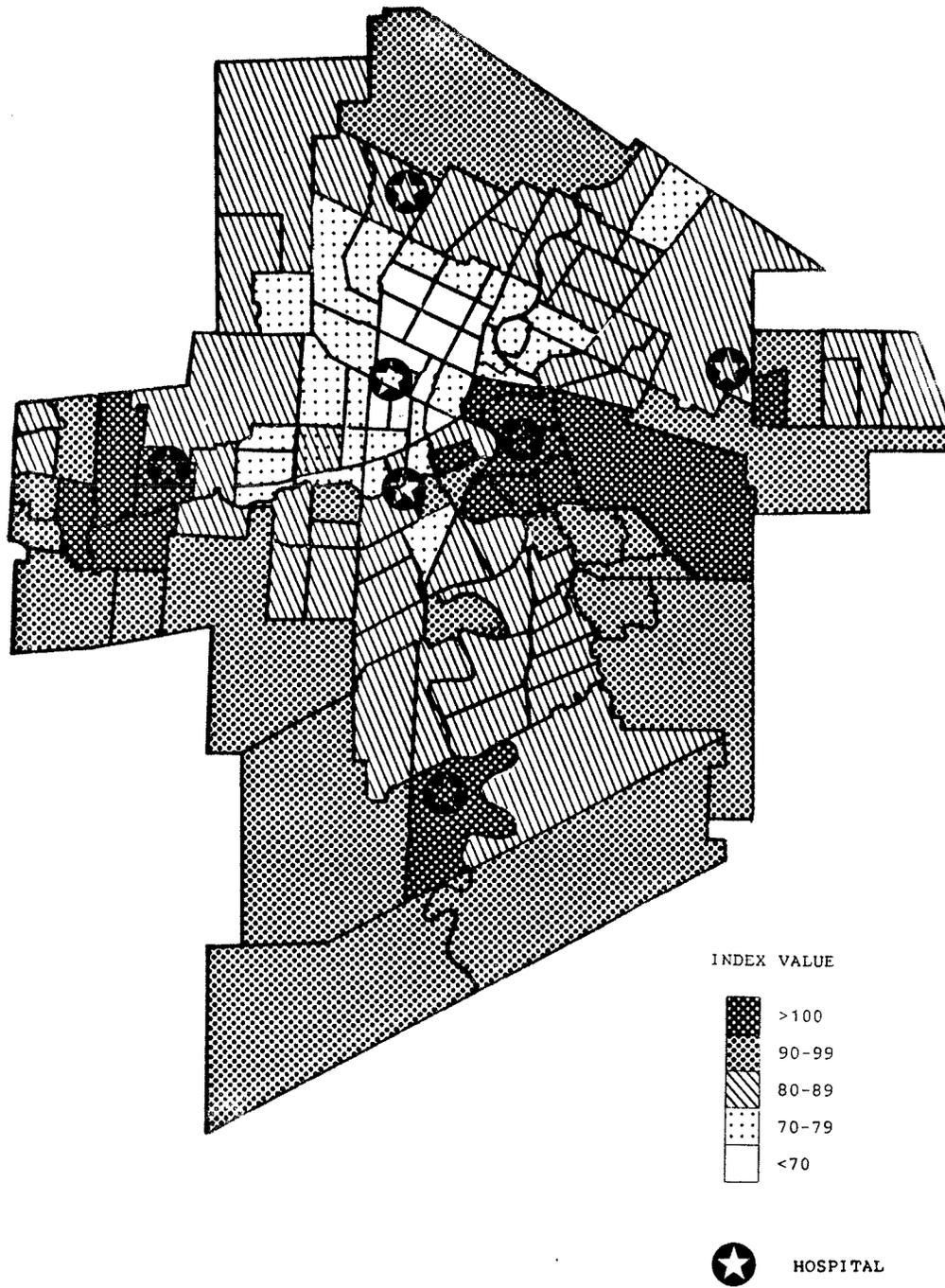


Figure 12: Values of the Final Index of Accessibility (Ii)

comparative high accessibility to of primary health care are mainly those which possess large amounts of physician time (see figure 4). These census tracts are clustered into three broad groups. First the largest group is the St Boniface area of the city to the east of the downtown, and also the census tract located immediately to the south of the downtown retail core.<sup>28</sup> This cluster is based upon the major concentration of primary physicians that are located downtown and in close proximity to St Boniface General Hospital. A second group is located in the St James/Charleswood area. This cluster is partly related to a large concentration of physicians located close to the Grace General Hospital in the western suburbs of the city. The third area of comparative over-provision consists of one large census tract in the Fort Richmond where a number of physicians are located near to the Victoria General Hospital. Thus, these results indicate that in many cases the actual physical location of general hospitals exerts a major and direct influence on the accessibility to primary health care.<sup>29</sup> Some hospitals, however, exert more of an influence than others. The influence is less pronounced in the case of the Sevenoaks and Concordia hospitals. In

<sup>28</sup> The downtown census tract itself, which contains 15% of the city's physicians' time, is relatively underserved.

<sup>29</sup> This study did not include hospital emergency/out-patient departments in the providers of primary health care. If such departments were included, the influence that hospitals have upon accessibility to primary health care in the study area would be increased.

contrast, the Misericordia hospital and the Health Sciences Centre are located in areas of low accessibility.

Apart from the areas of high accessibility, the general pattern is one of increasing accessibility with increasing distance from the city centre. This is in direct contrast to the patterns of accessibility found in Knox's(1978) study of four British cities where decreasing accessibility was associated with increasing distance from the city centre. This is based on the fact that the primary care physicians in the city tend not to locate in the inner city except in the downtown area. The district with the lowest level of accessibility is the 'North End' which is located approximately four kilometres north of the downtown. This area is not only deficient in the number of available physicians, but also registers a large covert demand. The latter clearly reflects the area's lower income and elderly population. The area is, however, located relatively close to the downtown but the advantages of being located close to the city's major concentration of physicians is nullified by the large covert demand and low levels of mobility being experienced.

One striking feature of the patterns of accessibility (Ii) is that the level of accessibility can vary drastically over a small geographic area. For instance the St Boniface area has index values in excess of 100%. while in

comparison areas of the 'North End', only two kilometres away, have index values ranging from 60% to 69%.

#### 5.5 TEST OF THE INVERSE CARE LAW IN WINNIPEG

The 'Inverse Care Law' hypothesises that:-

the availability of good medical care tends to vary inversely with the need for it in the population served (Hart,1971).

In the context of primary health care, an 'Inverse Care Law' operates if there is a negative relationship between accessibility and demand.

In this thesis it is possible to calculate the relationship between the pattern of accessibility and the distribution of the demand for health care across the study area. The final index of accessibility ( $I_i$ ) is expressed in percentages. This is similar to the method used by Knox(1978), but in the present thesis a measure of covert demand is used in a calculation of the index of accessibility (Knox(1978) only used a measure of population potential with no provision made for the differential level of health in society). This measure of covert demand reflects the social character of the city. Thus, to determine the validity of an inverse care law in Winnipeg, a correlation analysis is undertaken between level of accessibility ( $I_i$ ) and level of covert demand ( $CD_i$ ). The method employed is the Spearman Rank-Order correlation

analysis. The Spearman Rank-Order correlation coefficient is a non parametric measure of the relationship between two sets of ranked data (Ebdon,1981). This method is deemed more appropriate than a Pearson Product-Moment correlation analysis since the relevant data sets are subjectively weighted in order to produce the required indices. It is thus doubtful whether these data should be treated as interval data in a correlation analysis.

The value obtained by calculating a rank-order correlation coefficient is  $-0.5001$ . This value suggests that there is a moderate negative relationship between levels of accessibility and covert demand for primary health care. This suggests that physicians do not locate in an entirely equitable manner to serve the needs of the population. In particular some areas with the highest covert demand (CDi) (in the inner city), are also the areas with the lowest indices of accessibility (Ii). This suggests that those areas with the greatest need for health services are not always those with the highest accessibility to primary health care.

## 5.6 SUMMARY

This chapter has examined the spatial pattern of accessibility to primary health care delivery in Winnipeg in order to make an assessment of the equitable nature of the

delivery system. The initial sections of the chapter investigate the spatial distribution of the elements of the primary health care delivery system and the covert demand for health care. The data concerning the supply of primary health care and the spatial distribution of covert demand are then incorporated into a gravity model. The gravity model produced a number of indices which are then used to determine the variable levels of accessibility to primary health care across the study area. Areas of high accessibility were found to be related to the location of the hospitals in the study area. A general trend is one of increasing accessibility with distance from the city centre was also discovered. Finally, the validity of the 'Inverse Care Law' in the study is tested and only moderate support for the hypothesis was obtained.

Chapter VI  
SUMMARY AND CONCLUSIONS

6.1 INTRODUCTION

The general objective of this thesis is to examine the public access to the primary health care delivery system in the city of Winnipeg. The specific aims of are:-

1. to construct an index of accessibility to primary health care facilities;
2. to examine the pattern of accessibility to primary health care across the study area, and
3. to evaluate the extent to which an 'Inverse Care Law' operates in relation to the delivery of primary care.

Chapter I introduces the research objectives and discusses the background to the study. The importance of the study of health and health care delivery within urban-social geography is examined. In addition, a conceptual framework for the study of health care delivery is proposed. Chapter II presents a review of the literature pertinent to the subject matter of the thesis. Chapter III introduces the gravity model that is adapted to construct an index of accessibility to primary health care for each census tract in the study area. The gravity model is also

modified to incorporate the concept of covert demand. Chapter IV introduces the study area of Winnipeg and the organisational framework of the medical health system in Manitoba. A discussion of the relevant data sources is also undertaken in this chapter. On the basis of the data collected a brief description of the primary health care delivery system in the city is presented. Chapter V offers an analysis of the data on the primary health care delivery system in Winnipeg. This comprises 1) a description of the spatial distribution of primary health care physicians, 2) an examination of the spatial distribution of covert demand in the study area, 3) an assessment of the patterns of accessibility to primary health care facilities and 4) a testing of the 'Inverse Care Law'. This present chapter:

1. states the research design of the thesis;
2. summarises the findings of the study;
3. offers policy recommendations concerning the primary health care delivery system in Winnipeg, and
4. offers suggestions for future research.

## 6.2 RESEARCH DESIGN

This thesis examines accessibility to primary health care within the welfare paradigm of urban-social geography (Smith, 1977). Accessibility to health care is seen as an important component of the quality of life and thus, plays a major role in determining the level of well-being in

society. The examination of accessibility to primary health care in a selected city, Winnipeg, is based upon a conceptual framework proposed in Chapter I (figure 1). The conceptual framework views accessibility as being dependent upon the interaction between the supply of, and the demand for, medical services in the population served. If demand for medical services exceeds the supply, then a problem of availability will result. Within the conceptual framework, the demand for health services is not accepted as being equated with their actual utilisation (overt demand), but rather with the level of health of society (covert demand).

Data are collected which relate to both the supply of medical services and the covert demand for health care in the study area. These data are incorporated into a modified gravity model which is used to calculate a number of indices. Firstly, a 'time based index of accessibility' is calculated to determine the relative availability of physicians services across the study area. Secondly, an index of 'covert demand' is calculated which shows the relative demand for health services. These two indices are then combined to produce a third index which is termed the 'final index of accessibility. This index, by comparing the levels of supply and demand, identifies the levels of accessibility experienced in different sections of the study area.

### 6.3 FINDINGS

The analysis of the primary health care delivery system in Winnipeg progressed in four stages: 1) supply; 2) demand; 3) accessibility, and 4) the 'Inverse Care Law'.

#### 6.3.1 The Supply of Primary Health Care

In terms of the supply of primary health care, a number of observations can be made about the spatial distribution of physicians. The results disclosed a general tendency for physicians to cluster in certain parts of the city. The major concentration of physicians is found to be the central part of Winnipeg (The downtown area combined with two adjacent census tracts account for over 30% of the city's physician time). This concurs with the findings of Knox (1978), in Great Britain, and Elesh and Schollaert (1972), in the U.S.A. There are also clusters of physicians in the proximity of the city's suburban general hospitals. Overall, this pattern is similar to that identified in Toronto by Rosenberg (1979, 1984). It is also noteworthy that in the present study, the spatial distribution of physicians also reveals a relative absence of practitioners in Winnipeg's 'North End', an area with high concentrations of poor, elderly and ethnic groups. The avoidance of 'blue collar' and ethnic areas has also been identified in earlier research by Knox (1982) and Elesh and Schollaert (1972). In

general the data imply that the availability of primary health care decreases with increasing distance from the city centre (see figure 10).

### 6.3.2 The Covert Demand for Primary Health Care

The demand for primary health care was determined by weighting the population of the city to take account of variations in need. The general population distribution is a fairly evenly dispersed across the city. When the population levels are thus weighted and incorporated into a modified gravity model, a pattern of covert demand is produced (see figure 11). Covert demand is more concentrated in central parts of the city than the actual population due to the prevalence of low income and elderly groups. However, the overall pattern is characterised by a decreasing demand for health care services with increasing distance from the city centre

### 6.3.3 The Accessibility to Primary Health Care

When the patterns of availability of physicians time and the pattern of covert demand are combined, an overall assessment of accessibility to primary health care is produced. Only 14 out of 131 census tracts in the study area are recorded as having a relatively high levels of accessibility. These census tracts form three groups which

are based upon the clustering of physicians close to hospitals in both central and suburban areas. Thus, hospitals through attracting physicians to locate close by, have a major influence upon the patterns of accessibility to primary health care facilities within Winnipeg. Otherwise, the trend is one of increasing accessibility with increasing distance from the centre of the city with the suburban areas comparatively better served than the inner city areas. Even over a short distance, accessibility tends to vary greatly across the study area. The area with the lowest levels of accessibility (the North End) is located only a short distance from the area with the highest accessibility (St Boniface). In addition, the North End is located relatively close to Downtown which has the highest concentration of physicians services in the city. The advantage of being located reasonably close to such a concentration of facilities is nullified by the large covert demand for medical services in the area and the poor mobility of the population.

The pattern found here contrasts with that pattern found in a number of British cities by Knox(1978). Knox's results disclose a general pattern of decreasing accessibility with increasing distance from the centre of the city. The pattern of accessibility isolated in this study may, however, produce some consequences similar to those obtained by Knox(1978). The lower income and elderly (high need)

population in Winnipeg have remained in the central area of the city and have not decentralised to the same extent as in Great Britain. In Knox's (1978) case study, problems of accessibility were being experienced in areas of the city predominated by low income housing (public housing estates on the periphery of the city). In Winnipeg, the areas with the lowest accessibility are also those predominated by lower income housing which in this case is located in the central parts of the city.

#### 6.3.4 The Inverse Care Law

The fact that the area with the lowest levels of accessibility is also that with the highest concentration of high risk groups prompts the examination of an 'Inverse Care Law'. Earlier studies (Knox, 1978, 1979a) have used an element of 'intuition' to match the patterns of accessibility to primary health care with various social characteristics of the city. In this thesis these social characteristics are measured in different ways. Consequently, the relationship between accessibility and the social features of the urban population can be analysed in order to test the inverse care law. The results of a correlation analysis of this relationship offer only moderate support for the hypothesis of an inverse care law. However, this analysis considers only the quantity of care and not the quality of the services provided.

In the definition of the inverse care law given in Chapter V, emphasis is placed on the notion of 'good care'. An alternative way in which the inverse care law may operate is in that those areas of highest demand contain the poorest medical facilities, while areas of relatively low demand contain better quality facilities. The problems of those areas of low accessibility will be exacerbated if they also contain the lower quality primary health care facilities. Although in the collection of data concerning the supply of physicians no attempt was made to measure the quality of medical care, some observations about the quality of health care delivery across the study area may be offered.

The areas of poor accessibility not only suffer from an under-provision of physicians, but also have the least organised form of health care. For instance, the area with the lowest levels of accessibility is the 'North End'. The few physicians that are located in this area work in single practices based in buildings that are not altogether suitable for the delivery of high quality health care. On Selkirk Avenue, for example, two physicians work in small offices located above a drug store with access by means of a side door at ground level. Another has his practice in a converted bank building. These premises are typical of those occupied by most physicians in the area.

In contrast, the St Boniface area not only has a relative high accessibility to physicians, but also a wide variety of medical facilities. This area contains some single practitioners working from unsuitable buildings, as in the case of the North End. The majority of the primary health care available is, however, delivered by two very large organised medical groups, one of which provides the additional service of a walk-in clinic, housed within large, purpose built, medical facilities.

#### 6.4 RECOMMENDATIONS

In this thesis an index of accessibility has been derived from the interaction between supply and demand. Thus an overall improvement in the level of accessibility can be achieved through intervention in either the supply of primary health care, or the covert demand for health care. On the basis of this, two recommendations can be made which could reduce the inequality in accessibility to primary health care.

The first suggestion is that some of the inequalities in accessibility can be alleviated by a reduction in the disparities in the level of health in society. Removal of such disparities would have an effect of lessening the levels of covert demand across the study area. The thesis has measured covert demand in a rather crude way, focussing

only upon income level and stage in life cycle. In this case, the adjustment of income levels would thus be necessary to reduce covert demand. This recommendation was also the major suggestion of the "Black Report" (D.H.S.S., 1980) in Great Britain. Although a reduction in inequalities in health standards would be desirable, it is not anticipated that any real progression in this direction will occur. The recommendations of the "Black Report" were rejected by the British Minister for Health and Social Services because of the size and cost of the task involved.

The second suggestion is less fundamental and is based on the alteration of the primary health care delivery system. Such an alteration is comparatively straight forward and the least politically contentious of the two recommendations. Patterns of accessibility (or rather inaccessibility), as identified by the study, are related to the concentration of physicians in certain areas of the city. Increasing the supply of physicians in under-doctored areas would serve to reduce the variations in the patterns of accessibility identified. Increasing the supply is not a matter of introducing new physicians to the under-doctored areas since Winnipeg is adequately served by physicians.<sup>30</sup> The way to proceed is to relocate certain parts of the existing primary

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There has been some suggestions recently that Winnipeg, in common with other Canadian cities, has a surplus of physicians.

health care system. One way of doing this, which has been recently supported by the Provincial Government, is to introduce purpose built health centres to under-served areas. Such buildings may well be attractive for the single practitioner working from poorer premises. However, the physicians that this would most likely attract are those already working in under doctored areas since these physicians tend to work in single practice. Some effort would, therefore, be needed to bring physicians from the better served areas of the city into new health facilities in under served areas.

#### 6.5 SUGGESTIONS FOR FUTURE RESEARCH

This thesis has examined a number of specific aspects of a primary health care system. However, it is apparent that there is a need for research in other areas not covered by the thesis. On the basis of the conceptual framework proposed earlier, the suggestions for future research are divided into five groups.

Firstly, in terms of supply, there is a need for research concerned with the variable distribution and quality of different types of medical facilities. In the calculations used in the analysis, there was no distinction made between single and group practitioners in terms of the quality of care they offer. The only distinction made was based on the

numbers of hours of physician time available at each facility. Especially important here is the accessibility of different facilities with respect to the time geographic constraints of the population.

Secondly, there is a need for further investigation of other aspects of demand for health care. The majority of geographic research has examined demand in terms of overt demand or the utilisation of health care facilities. This thesis has not adopted this approach, rather it has introduced a notion of covert demand. As it stands, the measure of covert demand used in the analysis is rather crude. It needs further investigation and refining so as to take into account other 'high demand' groups within society. There needs to be a greater understanding of a variety of sociological aspects of health and illness, and a borrowing of material from Medical Sociology.

The third suggestion concerns research specifically examining inequalities in the health care delivery system. There is a need for further research specifically concerned with primary health care. The majority of past work has been concerned with hospitals at the expense of the primary physician. The primary physician is, however, the 'gatekeeper' of the entire medical system, controlling access to the larger health care system for the majority of the population. The primary physician's important position

in the health care delivery system warrants more research than has already been undertaken.

The planning of health care delivery systems forms the basis of the fourth suggestion. The literature concerning the planning of health care delivery systems is limited. Research has mainly been aimed at theoretical problems of designing health care delivery systems for undoctored areas. There is, however, little opportunity for designing entirely new delivery systems in urban areas. The real problem is one of an inequitable distribution of physicians across urban areas. The direction in which research should be aimed is that of developing a set of policies which could be implemented to bring about a spatial re-organisation of the elements of the primary health care system. Thus, research is needed on how to encourage physicians to relocate in a more spatially equitable manner.

The final suggestion for further research concerns the whole essence of the topic of accessibility to health care. The assumption of this thesis, in common with other work, is that an inequitable health care delivery system results in a social problem. To substantiate this argument, research is needed which examines the influence that inequalities in access to health care facilities have upon an individual's illness and therapeutic behaviour. Some pioneering research has been conducted by Girt(1972). His work, however,

focussed on a rural setting where the problem of access is translated into large travelling distances. In the urban context, distances are much shorter and the general transport system is more developed. A problem of access may have a different influence upon the illness and therapeutic behaviour of the urban population.

This thesis has attempted to contribute to the existing literature concerning health care delivery. It has presented a conceptual framework for the study of health care delivery, and has introduced the notion of covert demand. Using these as a basis, the thesis has examined the health care delivery system in a selected city, Winnipeg. It is hoped that this work has made a useful contribution to geographic knowledge and stimulates further investigation in this field of study.

Appendix A

AUTOMOBILE OWNERSHIP LEVELS IN MANITOBA 1971-81

YEAR	TOTAL NUMBER OF HOUSEHOLDS IN THE PROVINCE (1000s)	NUMBER OF HOUSEHOLDS WITHOUT AN AUTOMOBILE	% OF HOUSEHOLDS WITHOUT AN AUTOMOBILE
1971	270	61	22.6
1972	287	69	24.0
1973	292	74	25.3
1974	306	74	24.2
1975	311	67	21.5
1976	314	72	22.9
1977	319	68	21.3
1978	324	75	23.1
1979	335	71	21.2
1980	342	79	23.1
1981	348	80	23.0

SOURCE: Statistics Canada 'Household Facilities and Equipement' Annual Surveys 1971 to 1981

Appendix B

CENSUS TRACT BOUNDARY CHANGES

The census tracts have been altered in two ways:-

1. a census tract in 1971 has been divided to form two or more new census tracts,
2. a census tract has been formed by the amalgamation of two (or parts of two) census tracts.

In adapting the 1971 census data for use with the 1981 boundaries two rule were observed:-

1. where a census tract has been divided, the data used in the new tracts will be the same as for the original census tracts. For example

1971		1981	
Census Tract	% With Automobile	Census Tract	% With Automobile
130	92.3	130.01	92.3
		130.02	92.3

2. where a census tract has been formed as a result of an amalgamation of two (or parts of two) former census tracts, the value calculated will be an average of the two former tracts. However, if one of the areas combined is relatively small compared with the larger area, the value for the larger area is used.

1971		1981	
Census Tract	% With Automobile	Census Tract	% With Automobile
100	89.2	102.01	83.4
102	83.4		

In this example very little of the area of the 1971 tract '100' was incorporated in the 1981 tract '102.01' so that the value used is based on the figure for tract '102'.

Appendix C

TRAVEL TIMES IN WINNIPEG BY CAR AND TRANSIT

DIRECTION	DISTANCE (Km)	TIME (minutes)	
		BUS	CAR
North (Salter and Duffrin to Garden City)	6.4	19	9
West (Polo Park to Portage and Rouge Road)	7.5	20	7.5
South (Corydon and Pembina to University)	9.0	23	11
East (Portage and Edmonton to Tache and Saint Mary's)	3.6	14	6
TOTAL DISTANCE	25 Km		
TIME BY BUS AVERAGE	76 Minutes 2.9 Mins/Km		
TIME BY CAR AVERAGE	33.5 Minutes 1.3 Mins/Km		

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