

**VARIATION IN HEALTH CARE USE IN AUSTRALIA :
DEMAND VS SUPPLY OF SERVICES?**

by

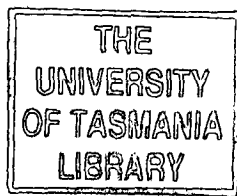
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Submitted in fulfilment of the requirements for the degree of

Master of Social Science (Research)

University of Tasmania

May, 1996



Ltn
Thesis
FARRELL
M. Soc. Sc
Social Work
1997

ABSTRACT

This study raises serious questions with respect to equity and quality of health care in Australia. It attempted to explain the variation in referral rates by general practitioners as a function of respondents' socioeconomic and health characteristics by adopting Andersen's behavioural model of health care utilisation to the Australian context. The study was conducted in three stages. The supply factor - the ratios of health personnel and facilities to population - was dropped from the analyses at Stages 1 and 2 because it was not feasible to obtain these data.

Stage 1, using a subset of the National Health Survey 1989/90 data (NHS89/90), examined the factors that determine GP consultation and referral rates at the individual level. Logistic regression analysis findings showed that Andersen's model was better at explaining the probability of consulting a GP than the probability of being referred to other health care services. Results showed that the model correctly predicted 68% of respondents as to whether or not they saw a doctor. This prediction compared to predicting 55% of respondents as to whether or not they were referred to other health care services.

Since the characteristics stipulated by Andersen's model were found to contribute to predicting utilisation rates (GP consultation and referral rates) these same variables were used in Stage 2. This stage, using the total sample from the NHS89/90 data, examined variation in referral rates at the aggregate level for the 47 health regions in Australia. Path

analysis was used to examine the variance accounted for by these characteristics. The full set of independent variables accounted for 43% of the variance in the referral rates, suggesting that one or more predictor variables might have been excluded from the model.

In light of the remaining variance to be explained and literature suggesting the importance of the supply factor a preliminary exploration of its possible contribution was conducted in Stage 3. For this, the two health regions with the highest and the lowest referral rates were compared with respect to the availability of doctors, specialists, x-ray and pathological services. Findings supported the importance of the supply factor. In the region with the highest referral rates, there was a considerable concentration of doctors, specialists and services compared to the region with the lowest referral rates.

While the design of the study does not allow one to determine whether the supply factors "drive" these different rates, the findings do raise important questions for further research. In particular, research should focus on access and health outcomes. Individual specialist services should be carefully studied as these too can have important cost and health implications.

DECLARATION

I certify that this Thesis contains no material which has been accepted for a degree or diploma by the University or any other institution, except by way of background information and is duly acknowledged in the Thesis, and to the best of my knowledge and belief no material previously published or written by another person except where due acknowledgement is made in the text of the Thesis.

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ACKNOWLEDGEMENTS

- My supervisor during the preparation of this thesis, Professor Wolfgang L. Grichting, for his help;
- My family, especially my husband, without whose support and encouragement this study would not have been possible.

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CHAPTER ONE

THE PROBLEM

1.1 Introduction

Variation in the rates of use of health care services, which includes initial contact with GPs (consultation) and being referred to other health services, have been widely and consistently documented for many years, not only among countries sharing the same body of scientific knowledge, but also among similar communities within a country (Renwick and Sax, 1991). Why should variations in modern medical practice be a challenge for all health care systems in the industrialised world? After all, variation is an intrinsic feature of most human practices. Most everyday activities in modern industrialised societies do not, in general, conform to homogeneous patterns across time and space (Anderson and Mooney, 1990). However, the image of modern health care, in contrast to most other social practices, is assumed to be based on a unified body of comprehensive scientific knowledge. As well, medical practice at large has been considered a coherent unified activity. As a result of various research activities, a new picture of modern medical practice has emerged. Highly significant variations in treatment methods seem to be the rule rather than the exception in modern medical care.

The implications of such variations for the quality and cost of medical care raise important questions about the process of clinical decision making for patients, physicians and health policy makers. Considerable

research has been carried out on variation rates on a variety of health care services, for example, variations in hospital admission, length of hospital stay and specific surgical procedures. In general, the physician's important decision-making role as an allocator of medical resources is well accepted in the literature. But an understanding of its effects on overall utilisation and continuity of services received is less well documented. Normally, in Australia, general practitioners, as gatekeepers to specialist health care, are the link between the patient and other health care services. However, there is only limited research related to referral rates by general practitioners to other health care services such as radiological and pathological investigations, physiotherapy and social welfare services in Australia. Therefore, this study attempts to explain the variation in consultation and referral rates by general practitioners as a function of socioeconomic background and health care characteristics within an Australian context.

1.2 Significance of the Study

Most of the research on health care utilisation grew out of two concerns: first, the awareness of the unequal distribution of the use of health care services by individuals in various social and economic groups, such as, the poor and the culturally and ethnically segregated; second, the dilemma over the consensus that all people should have relatively easy access to medical care despite the escalating cost of providing such access (Williams, 1980). In all countries, the increasing proportion of health care services paid for from public funds justifies according priority to equity of distribution and adequacy of coverage. To the extent that

efficacious care exists, it is important that all who can benefit should be provided with services that are not only effective, but are also distributed in an appropriate and adequate manner (White et al., 1977). Attempts to weigh the "costs" and "benefits" of health care services draw attention to a basic policy issue: what is equity in health care distribution and how can it be achieved? The evident unanimity about people's rights to health care and various health services research suggest that empirical research concerning methods of implementing health service equity have policy relevance (Andersen, 1975; Sax, 1990). Health services research studies have indicated the potential contribution of research to the equity issue. Flook and Sanazaro (1973) listed "equity of access" along with moderation of costs and assurance of quality as the three major goals of a health care system and have suggested that:

health services research is being challenged to produce a body of knowledge which will provide sufficient predictability in health services to support major policy and operating decisions at various levels of the health services structure.

One way of judging the level of equity achieved is by examining the relative importance of various determinants of health service utilisation (Andersen, 1975).

1.2.1 Determinants of Health Service Utilisation: Macro Consideration

International comparisons of patterns of utilisation in health care systems were conducted in the 1960s. It was evident from these studies that,

despite the fact that the health professionals in all the health care systems basically share the same body of scientific knowledge as a basis for their activities, huge differences in practice patterns were occurring. For instance, for a large number of diseases and treatments the population-based rates of admission were consistently very high in the United States compared with the United Kingdom (Pearson et al., 1968). For some diseases Sweden followed similar patterns of admission to those observed in the USA, whereas for some treatments the rates were even lower than those in the United Kingdom (Anderson and Mooney, 1990). Other comparisons of the USA, Canada and England and Wales found major differences between the patterns of utilisation of surgical procedures. The highest and lowest rates of surgeries differed by a factor of two (Bunker, 1970).

Seen in the light of the common scientific basis of clinical decision making in each of these countries, such differences in utilisation are striking. However, it is important to note that each health care system is adjusting its activities to a specific social, historical and cultural setting, in which many different factors may influence the performance and fundamental objectives of the health care systems (Anderson & Mooney, 1990). For example, Australia is one of the most ethnically diverse countries in the world. Of the three million immigrants in Australia, at the 1986 census, over 50 per cent were born in countries in which English is not used as the first language (Palmer and Short, 1989). In response to the health problems of the non-English-speaking Australians, The Better Health Commission (cited in Nadew and Achanfuo, 1994:49) acknowledges that "those whose native language is not English and

whose cultural norms are not Anglo-Saxon may suffer through a lack of sensitivity on the part of health care professionals, a shortage of bilingual and multicultural professionals and interpreters, and a shortage of information in their own languages. These are important barriers to early diagnosis and treatment, and even greater barriers to prevention and health promotion". A need therefore exists for health service providers to include cultural and linguistic issues in the planning and delivery of services.

1.2.2 Determinants of Health Service Utilisation: Meso Consideration

Turning from the macro level of cross-national comparisons to the meso level of small geographical areas within individual countries, the patterns of practice variation appear to be more obvious. For instance, the 1989/90 Australian Health Survey Data indicated variation in referral rates to various health care services, such as, specialist, physiotherapy, social welfare services by general practitioners in the forty-seven health regions in Australia. Inspection of the data indicates that there is approximately a one-and-half-fold difference between the Goulburn health region in Victoria and the South Coast health region of Queensland in the referral to specialist services. How can we account for the difference?

Is it due to the different disease characteristics of the two populations or to other non-medical factors? In relation to the disease characteristics of the population, Andersen's model (1975) found that illness levels such as

disability days, symptoms reported and worry about health to be important predictors of who will consult a physician over the course of a year. It might be expected that this model could also account for referrals by GPs to other health care services. However, the available evidence suggests that factors other than medical need are just as important. Shortell (1975) suggests the importance of provider variables in explaining differences in health care usage once contact has been made with the GP. Wennberg (1982) concluded that "for reasons that bear no obvious relation to differences in population need, neighbouring hospital markets often differ greatly in per capita rates of use" as well as in the availability of resources? This claim is supported by various other studies (Wennberg and Gittelsohn, 1982; Wennberg and Fowler, 1977 and Roos and Roos, 1982). Similarly, in Australia, a study between different regions of New South Wales found that health status did not account for the variation in surgery rates (McEwin, 1978). Therefore, we need to examine both these 'need/illness' factors as per Andersen's model of health care utilisation as well as non-medical factors to account for differences in usage rates.

Although many research studies have concluded that non-medical factors are as important as medical ones in determining utilisation rates, there is debate about the relative influence of the various non-medical factors that have been identified. Supply factors, such as the availability of hospital beds, staffing levels and methods of payment, in conjunction with physicians' practice styles, appear to influence utilisation rates and explain some of the variance. If this is so, access and equity are not the

only issues raised here. Because resources are limited, opportunity costs are also involved (i.e. the concept of what could have been done otherwise with the same resources). Vestergaard (1990) underscores this point when he states:

Unnecessary treatment of one person may well lead to another person's having to wait for his necessary treatment. The resources of the health sector are not unlimited. Thus, unnecessary or inappropriate treatment of one person may harm not only this person, but also others. Unnecessary treatment is a waste of resources.

But what is meant by unnecessary treatment? Evans (1990) states:

The dominant view of health care - and, by extension, of the health care system - remains an instrumental one. Patients seek care in order to be relieved of some actual or perceived, present or potential, 'dis-ease'. The care itself is not of direct value; it is generally inconvenient, often painful or frightening. It follows that patients want to receive 'effective' health care, that is, care which they 'need' in the sense that there is a reasonable expectation that such care will have a positive impact on their health. Ineffective, unnecessary care is of no or negative value to the patient, as well as a complete waste of the resources required to produce it.

1.2.3 Supply and Demand Factors in Health Care Utilisation

When attempting to seek causal interpretations of usage rates, Wennberg (1986:310) suggested that it is important to remember three possible explanations: (1) inappropriate uses in areas with high rates due to unnecessary care implying inefficient use of resources; (2) inappropriate use in areas with low rates due to insufficient care implying inequitable distribution of resources and (3) appropriate use in all areas with most of the differences explained by differences in illness rates implying efficient and equitable use of resources. Literature suggests that factors which contribute to health care utilisation follow the characteristics of the economic model of supply and demand. The supplier influence on utilisation of services by consumers may fall into the categories of inappropriate uses as suggested by Wennberg when it follows the simple hypothesis of supplier-induced demand i.e. providers will generate more demand for their services when the providers themselves are in plentiful supply and particularly when the reimbursement system is that of fee-for-service format.

However, 'taste variables' in the demand for health care services, such as, health status and medical need of the consumer may constitute a 'legitimate' variation rate in the utilisation of services. Practice variations, in this instance, may possibly reflect genuine differences in the 'needs' of different populations, resulting from differences in environment, lifestyle, genetic endowment - all the various factors which can be shown or hypothesised to affect human health.

According to Sax (1990) the special nature of health explains why effective health care should be available to all in a fair way and cannot be left entirely to the market. Firstly, for the most part the need for health care is uncertain and unpredictable and the purchase of health care can be costly. Secondly, patients (consumers) are not in a position to make informed choices about the level and type of health care required to meet their needs. There is also an imbalance of information between consumers and suppliers which casts doubt upon the reality of consumer sovereignty. Finally, the health of one person can be of concern to others. A person's ill health may impact adversely on others (either through infection or lost productivity). Pain, suffering and loss of future opportunity can occur as a result of a person's ill health (McClelland, 1991). But what is meant by equitable access? The President's Commission (1983) argued that this could not mean the assurance that everyone gets an equal quantity of health resources or even of health, or the same level of health care. If the standard were set too high, the cost would be unacceptable; if set too low, some useful services may be withheld, even from those willing to pay for them from their own resources. Whatever the definition, everyone requires access to some level of care: enough to facilitate a reasonably full and satisfying life. This level has been termed 'an adequate level of health care' which recognises that society's resources are not unlimited, acknowledges the need for setting priorities and takes into account the expectations about adequacy in any particular society at any particular phase of its development (Sax, 1990).

1.2.4 Health Care Interventions: Use and Misuse

An objective of equitable use also raises the problem about the perceived effectiveness of many health interventions in meeting health needs and in improving health status (see above). Since the introduction of Medicare in 1984, the number of medical services have escalated. A Health Department review of Medicare services in the second half of 1985 revealed a big jump in demand for Computerised Axial Tomography (CAT) scanning, radiology, pathology and miscellaneous procedures such as group therapy and ultrasound. Medical service use per person increased from 7.14 services in 1984-1985 to 8.8 services in 1989-90, a rise of 23.2 per cent. The largest rates of increase were in the diagnostic services, particularly in pathology and radiology (Deeble, 1991). In the more discriminating financial environment of recent times, the focus of debate has shifted from issues of access of care towards those of controlling its costs. Medical expenditures in particular have come under severe scrutiny (Sax, 1990). Evidence has been produced to suggest that the marginal cost of care is often greater than the resulting health benefits.

There is a growing worry about the quality of medical care. For example, while there is overwhelming evidence that radiological capabilities have played an important role in improved patient management and outcome in many situations, the scale of recent increases in diagnostic tests of all types appears disproportionate to their role. The Royal College of Radiologists estimates that in England about 400 radiological examinations are performed per 1000 persons per year, with about twice this number being performed in the United States and Germany. Up to

20 per cent of these radiological tests in the United Kingdom could be eliminated without detriment to patient management. In the United States 50 per cent have been said to be unnecessary (Sorby, 1992: 681). Since Australian radiological practice is an amalgam of United Kingdom and the United States patterns, it is likely that misuse of radiological tests is also in the above ranges (Royal College of Radiologists and The National Radiological Protection Board, 1990).

With new tests, altered use, and conflicting views how can diagnostic test use and misuse be defined? Cochrane (1972) addressed these issues. He suggested that a test is effective when "the effect of a particular medical action alters the natural history of the disease for the better" and is efficient when it employs "the optimum use of personnel and materials" noting that medical efficiency (do things right) is not possible unless effectiveness (do the right things) has first been achieved. In other words, we should do the minimum number of diagnostic examinations necessary for a diagnosis to be made; this diagnosis being the pre-requisite for the clinical management of the illness. For instance, the regulations on ionising radiation state that for any radiological examination there must be a net benefit and that all exposures must be kept as low as reasonably possible.

X-rays are potentially dangerous. They have been described as "pathogens causing cancer in this generation and defects in future ones" (Wright, 1988: 18). Over-exposure to x-rays can result in injuries to the health of the individual; some of which are minor but instantaneous, for example, blistering of skin of the exposed area (although rare today).

Serious injuries include chromosomal damage and cancers such as leukemias which can be fatal (Gofman, 1981). Six years after the discovery of radioactivity, Becquerel in 1901, found that a glass-tube of 200mg of radium carried in his vest pocket, caused red and blistered skin (Richardson, 1990). This is an observation of a somatic effect of radiation, which is expressed in the exposed individual; such a response is called an early effect of radiation exposure induced by one-off large doses of radiation. Today, such effects are not encountered due to smaller dose levels required to obtain a diagnostic examination. Other researchers noticed late effects among the early radiologists following low doses of x-rays delivered over a period. These effects included skin tumours and other cancers (Medical Research Council, 1956, Smith and Doll, 1981). This is not to say that late effects cannot be produced by high-dose, short-term exposure too; but in diagnostic radiography when one considers the exposure levels received by both patient and personnel, the late effects are of particular importance. The radiation exposures we experience in diagnostic radiography are low and can be chronic in nature when they are delivered intermittently over long periods of time. The principal late effects are radiation-induced malignancy and genetic effects. Lifespan shortening and effects on local tissues have also been reported as late effects.

A summary on radiation hazard by the International Committee on the biological effects of ionising radiation states:

Of the various types of biomedical effects that may result from irradiation of low doses and low dose rates, alterations of genes and chromosomes remain the best documented. The new data do not

contradict the hypothesis, at least with respect to cancer induction and hereditary genetic effects, that the frequency of such effects increases with low-level radiation as a linear, non-threshold function of the dose (Beir V. Report, 1990:2).

Concerned by the increasingly expensive and inefficient use of diagnostic facilities, the Royal College of Radiologists in the United Kingdom (1991) reports that doses received during diagnostic medical radiography made up almost nine-tenths of the total dose to the population from all man-made sources of radiation. Wright (1988:18) underscores this point when he states:

it [radiation] causes horror when it comes from atom bomb testing and nuclear power stations and irrational indifference when it comes from diagnostic radiology particularly because the bulk of ionising radiation received by patients and populations comes from this source.

A more recent illustration of this point is the consternation raised by the various environmentalist groups and governments, for example, of Europe, Australia and New Zealand over the French decision to resume nuclear testing in the Mururoa atoll in the South Pacific and China's detonation of two nuclear bombs. Presumably, the public indifference to the doses received from medical radiation is a result of x-rays being an imperceptible health hazard in the public's mind. The low level of media attention to this topic does nothing to alter perception. It seems it is a case of what one cannot see or know about one doesn't worry about.

X-rays are now a common feature of medical practice. Although various technical improvements in diagnostic radiology have been made to reduce the dose to patients, new x-ray tests and machinery contrary to what might be presumed actually increase radiation hazard to patients. For example, the CAT scanner and its rapid proliferation must have caused a quantum jump in radiation dose (Wright, 1988:20). Studies have shown, for example, that CAT scanning of the brain is widely misused for headache, dementia and psychiatric diseases (Hankey and Stewart-Wynne, 1987, Ashworth, 1986, Larson, Omenn and Lewis, 1980). It is interesting to note that the CAT scanner was in widespread use well before it was subjected to any evaluation, and it is used more to achieve better diagnoses than for better treatment (Banta, 1984). There exists a tyranny of technology. Each new technology creates a demand on practitioners to use them. Each technology, initially designed for "special" cases becomes more routinely used regardless of health outcomes or effectiveness adding to increased costs of health care (NHTAP, 1988). Bates and Lapsley (1985), while acknowledging the benefits of medical technologies, have written in length about their unintended adverse consequences. Sometimes they are used in addition to existing methods, especially for diagnostic purposes. Costs escalate as a consequence.

X-rays are but one example of the concern we should have over medical interventions. Pathology services, another often used medical diagnostic examination, were investigated by the Australian government for fraud and overservicing following recommendation from a joint parliamentary enquiry. Legislation was introduced to reduce the schedule fees and

benefits for eighteen common large-volume and highly profitable pathology tests (The National Times, May 30 - June 5, 1986: 8). Ashley et al. (1970) in a study to examine the rising costs of investigatory services, such as, radiology and pathology suggested that the growth of services has been uncoordinated; generated partly by the "scientific staff" themselves, and partly by "fashion" and has occurred unevenly over the country "in accordance with local interests". They concluded that any method adopted to lower costs or to prevent their rise cannot ignore clinical factors, for example, either the positive ill-effects of excessive radiation or the equally damaging consequences of inadequate investigation. Harvey (1991: 60) in a National Strategy Paper states:

The issue of appropriateness of care has been extensively researched mainly in North America, and to a lesser extent in Australia and the United Kingdom. It offers a possible "answer" to the current "question" - are health care systems producing value for money? It will not resolve the issue of how much health care should be bought. Nor will it resolve the issue of who gets or should get health care - but it will make a significant contribution to resolving the issue. If equity is to be the guiding principle of distribution, then the question about appropriateness must be answered.

In conclusion, assuming that the introduction of Medicare removes most financial burdens of access to medical care and assuming doctors are there to maximise health care and the quality of service to patients, how can one account for the difference in referral rates to other health services

by general practitioners in the 47 health regions in Australia (see above)? This study attempts to offer an explanation for the disparities.

Although numerous studies, mainly carried out in North America, have been made of the determinants of health care services utilisation, there is disagreement though as to the important factors in accounting for differences in utilisation of health services. However, it is important to separate out what is meant when one talks about utilisation rates so that proper estimates of the various factors can be determined. It may be that the factors important for consulting the GP are less relevant for what happens after the consultation, that is, GP referral practices. Most researchers concur that difference in physician practice patterns and in the availability of medical care resources are important determinants of the variation in health services utilisation. They disagree, however, on whether population characteristics, through their effect on demand, also account for differences in referral rates. Even though socioeconomic factors have been found to be significant determinants of health care usage by individuals (Bombardier et al., 1977; Hulka and Wheat, 1985), other researchers (Wennberg and Gittelsohn, 1982; Roos and Roos, 1982) maintain that population characteristics are not important determinants of the observed variation in usage rates. The lack of consensus stems, in part, from the difficulty in comparing results across studies that use different units and methods of analysis (McLaughlin et al., 1989). The present study used the best available National Health Survey 1989/90 data by the Australian Bureau of Statistics, two methods of analysis, and two units of analysis to test the importance of socioeconomic and behavioural characteristics as stipulated by Andersen's model of health care utilisation

in explaining the variation in referral rates in the health regions in Australia.

Therefore, this study was conducted in three stages. First, Stage 1 examined the factors that were thought to determine GP consultation and referral rates to other health care services at the individual level by testing a modified version of Andersen's model. Second, Stage 2 examined the contribution of these factors in explaining the variation in referral rates at the aggregate level for the forty-seven health regions in Australia. If the variance in referral rates is not fully explained, what else can account for it? Could supply-driven demand for health care services be the explanation? Popper (1972) proposed, in his theory of falsificationism, that scientific advance can only come through the testing and falsifying of hypotheses. By successive elimination of competing explanations we may arrive at the forces which determine health care services. The literature suggests that supply factors are an important contributor to variation in health service usage rate. A concept (ratios of health personnel and facilities to population) was dropped from Andersen's model in Stage 1 and 2 of the study due to difficulties in obtaining accurate information on GP distribution and resources available, such as radiological practices and other specialist services, in all the health regions. However, a preliminary study to examine the importance of the supply factor was conducted at Stage 3. The two health regions with the highest and lowest referral rates were compared with respect to numbers of GPs and selected specialist services.

This chapter presented an overview of the main issues thought important in relation to variation in health care services usage. The next chapter discusses in detail the empirical studies that attempted to account for some of the variation.

CHAPTER TWO

LITERATURE REVIEW : COMPETING MODELS

2.1 Introduction

Many researchers have documented large and significant geographic variations in the use of health care services, for example, variations in hospital admissions, lengths of hospital stay and specific surgical procedures (Chassin et al., 1987). Surgery as an intervention has been extensively studied. Glover (1938) found a tenfold variation in British tonsillectomy rates, ranging from 40-440 per thousand children. Vayda and his collaborators (1973) noted both the existence of rate variations across Canadian provinces in 1968 and their persistence over the subsequent ten-year period during which the National Health Insurance was introduced. Variations in surgical rates across the United States have been found to be large, if not larger than those reported in Canada (Roos, 1982). Australian studies of surgery rates between regions have been found to vary by a factor of one-and-a-half to five during the period 1973-1989 (Renwick and Sax, 1991). McEwin, in a paper presented to the Royal Australian College of Surgeons in 1978, reported remarkable variability of rates for several common surgical procedures (e.g. tonsillectomy, appendectomy) among different regions of New South Wales. There was then a five-fold difference between the highest and the lowest regional rates for tonsillectomy and hysterectomy. Uptake variation in medical diagnostic examinations would appear to be no exception.

Ashley et al. (1972) in the United Kingdom noted that there was considerable variation in the use of investigations between hospitals; for radiology the number of units used by patients varied from 28 per cent above the national average in some areas of the United Kingdom to 26 per cent below in others. Pathological investigations used for cases of hernia, for example, ranged from 2 to 53 units; the range for hyperplasia of the prostate from 78 to 215, and for coronary thrombosis from 48 to 116. In an unpublished study of a twelve-month follow-up of all cases of pulmonary tuberculosis admitted during one year (the type of cases admitted to three hospitals being reasonably comparable), there was disparity in the utilisation of radiographic examinations. In one hospital only a few per cent of the patients admitted had tomographic radiographic examinations of the chest, in another 52 per cent of the patients were recorded as having similar examinations, and in another 85 per cent (Cochrane, 1972). In a multicentre audit of hospital referral for radiological investigations in England and Wales, the range of inpatient and outpatient referral rates varied for many major categories of x-ray examinations in six study centres. Substantial differences among centres include a twelve-fold difference for skull examinations, six-fold for abdominal x-rays, four-fold for chest investigations and three-fold for limb and joint examinations (Royal College of Radiologists Working Party, 1991). In the United States, Halvorsen and Kunian (1989) in a study to look at variation in x-ray utilisation rates among five family practice clinics noted a two-fold difference in x-ray utilisation between the clinic with the highest utilisation rate and the one with the lowest. Strasser et al. (1987) in the United States, when comparing two teaching family medicine centres, found that the one with on-site radiology service

was more likely to conduct chest x-ray on patients than the centre without on-site radiological facilities.

Given the existence of substantial variation in utilisation, the critical task in research is to determine the sources of the variation. Many explanations for these differences have been proposed. Variation may be the result of differences in the health status of the individual and in the access to, and the availability of, health services - all matters of concern to governments that aim to redress inequities in the health system (Renwick and Sadkowsky, 1991). Another significant component of the variation may stem from differences in doctors' practice styles resulting in disparities in the way they, for instance, use x-rays and other health services for the care of their patients (Wennberg and Gittelsohn, 1982; Renwick and Sax, 1991; Vayda, 1973).

2.1.1 Health Care Service Uptake and Health Status

Health services are demanded because of their expected effect on the health status of those who consume them. In practice, however, it is very difficult to assess the impact of the provision of the various health services, technologies, and facilities, or the total health care system, on the health and well-being of the community precisely. An important reason for this is that the concept of health or health status is not easy to define and is impossible to measure directly. The South Australian Health Commission (SAHC) refers to health status as, "the level of health experienced by an individual or a community by placing it along a continuum through distress, disease and disability to death" (SAHC,

1990: 65). In other words in the absence of appropriate direct indicators we measure health status by mortality (death) rates, morbidity (sickness) rates, and the levels of disability. We may also think of health status as a factor associated with social class or one's occupational status. As Sigirist (1962:241) stated: "We understand only imperfectly the social causes of ill-health, but in every country in the world the rich are healthier than the poor". Recent studies have demonstrated the presence of substantial differentials in mortality and morbidity experienced among socioeconomic status groups. The Australian Institute of Health (AIH) report, *Australia's Health 1990*, points to an association between poor health status and a range of measures of socioeconomic disadvantage. It suggests that regardless of whether income, education, occupation or employment status is used as a measure of socioeconomic disadvantage, "the disadvantaged have higher death rates than the socioeconomically advantaged for all major causes of death" (AIH,1990: 37).

Various studies have examined the association between socioeconomic disadvantage and health status according to a number of indicators. These included social class, aboriginality, economic resources in terms of income, wealth and poverty status, gender and age (Mechanic, 1968; Smith, Bartley and Blane, 1990; Byth, McIntosh and Piper, 1992; Siskind, Najman and Veitch, 1992; Lawson and Black, 1993).

Social class has a broad and substantial influence on health status and risk of disease. For example, a study by Broadhead (1985) in Australia demonstrated that men in lower status occupations tended to suffer

from higher rates of self-reported illness, chronic conditions and days of reduced activity than men in more prestigious occupations. Manual occupations carry a higher risk of injury, and some types of factory work expose employees to toxic hazards (Taylor, 1979). However, direct hazards at the work place are only one of many factors determining the differing mortality pattern in the various social classes. The more likely reason for the health gradients across social classes may be found in the behavioural patterns and lifestyle, an integral part of the makeup of the social status groups. Examples are unfavourable diet, cigarette smoking, excessive alcohol use, insufficient care on the road, analgesic abuse, inadequate child care, industrial injuries and disease, insufficient exercise linked to complex interaction of personal, social, and economic factors such as low esteem, alienation, unemployment, low income, inadequate education, demoralisation, poverty, frustration and lack of power to control one's life (Taylor, 1979).

Early effects of behaviours such as smoking, diet, and lack of exercise, for example, are reflected in risk factors such as cholesterol level, obesity, and blood pressure; longer term-effects can be seen in disease and premature mortality. Both the behaviours and the risk factors show a linear relationship with socioeconomic status. Clear socioeconomic status differences are shown in rates of smoking. In the Whitehall studies of the British Civil Service, smoking rates in both sexes increased as one went down the employment grade hierarchy. According to Marmot, Smith and Stansfield (1991), a significant linear trend by employment grade was also found in prevalence of exercise (the lower the employment grade, the higher the percentage reporting getting no exercise) and diet

(the lower the employment grade, the lower the percentage of individuals consuming skimmed milk, wholemeal bread, and fresh fruits and vegetables). In the United States, similar patterns have been found. For example, in a study by Matthews et al. (1989) the prevalence of smoking ranged from 45 per cent of those with less than a high school education to 19 per cent of those with advanced education. Educational attainment was also significantly associated with cholesterol level, systolic blood pressure, glucose tolerance, and body mass index. All these risk factors were more adverse the less education the respondent had. Although, the relationship between health risk behaviours and socioeconomic status has not always been thus. Earlier in this century the well-off considered many of these factors as luxuries and during this time rates of coronary artery disease were greater in the higher socioeconomic groups. Generally though, today, upper socioeconomic groups have been quicker to acquire and act on information regarding health risks (Adler et al., 1993). However, health behaviours represent only one pathway by which socioeconomic status may influence health and they do not account for all of the variation. Other factors play a part too.

Aboriginal people have not shared in the recent marked improvements in mortality in Australia. Their health status remains substantially worse than that of other Australians. Many reports have commented that the causes of the poor health of the aboriginal people are inextricably linked with their social and economic disadvantage (McClelland, 1991). In the mid-1980s the unemployment rate for aboriginal people was about four times the national rate; they earned two-thirds the income of non-aboriginal people; and the imprisonment rate for aborigines was about

twenty times that for the total population (Palmer and Short, 1989: 233). These disadvantages have been linked to a history of cultural dislocation and undervaluing; a history of political oppression and an experience of substantial discrimination (McClelland, 1991).

The association between gender and health status is less straight forward. Women have a lower socioeconomic status than men when measured according to paid labour force participation rates, lower wage rates and vulnerability to poverty (Commonwealth Department of Community Services and Health, 1989). The Health Targets and Implementation Committee (HTIC) report concluded that while women die later than men, with major differences occurring in deaths due to causes such as accidents, suicide, heart disease and cancer, women have higher rates of reported morbidity, mental health problems, chronic symptoms, and disability (HTIC, 1988). A survey in Sydney of 36,678 adults attending the Medichack Referral Centre found that: 60 per cent of women (twice the number of men) reported one or more symptoms of stress; 33 per cent of women compared with 25 per cent of men reported emotional problems; 16 per cent of women compared with seven per cent of men reported depression as a health problem; two or three times more women than men used analgesics on a regular basis (NSW Health Commission, 1979).

Because the amount of serious illness increases steadily with age, differences in the age composition of various populations could produce substantial differences in medical consultation rates. For example, death

rates for the 55 to 64 year age group are over ten times greater than those for the 25 to 34 year age group, a larger differential than any of those between the sociodemographic sub-groups. Similarly, the prevalence of disability and serious chronic illness increases steeply at older ages. In 1988, one or more disabilities were reported by 64 per cent of the 686,000 people aged 75 years or more, compared with 6.8 per cent of the 4.05 million people aged 15 to 29 years (AIH, 1990).

Whereas the inequalities in health of social class groups and of men and women have been considered separately, the various subgroups in the population which differ in their experience of health and illness necessarily overlap. According to Morgan, Calnan and Manning (1985), for example, the mortality rates of both men and women vary by marital group, with married people of both sexes having lower mortality rates than single and widowed people. Research studies indicate that married persons, by and large, enjoy better health than persons without immediate lifeline. The emotional support that the nuclear family is able to extend to its members suggests that fewer visits in search of sharing and caring with the health care personnel are necessary (Grichting, 1979; Najman, 1993).

The above explanation, namely, that the socioeconomically disadvantaged have poorer health status, might explain variation in uptake of health services - sicker people need and use more services, whereas people in good health do not need and use services to the same extent. If this direct relation between health status and the use of health services operates, then areas with high consumption are those where there is a high proportion of

socioeconomically disadvantaged people (Renwick and Sadkowsky, 1991).

To assess the relationship between socioeconomic status and the use of medical services, McClelland (1991) combined the data available through Medicare (which includes postcode of residence of patient) with the index of relative socioeconomic disadvantage developed by ABS from information collected in the 1989 census of population and housing. This analysis revealed a trend to higher overall per capita service use for patients living in areas of greatest socioeconomic disadvantage (AIH, 1992). So it would appear services are going to areas where they are needed. Although, in a study of surgical rates between different regions of New South Wales, McEwin (1978) suggested that health status did not account for the variation in rates. Rather, "those who reside in areas with low rates do not seem to suffer in any obvious way, there is a possibility that much unnecessary surgery is performed". Wennberg and Fowler (1977) have also examined the relationship between surgical rates and population characteristics. They identified six geographically contiguous areas in Vermont known for their variations in surgical rates and conducted 300 household interviews in each area. Differences in populations across these areas did not explain their different use of health care. Illness rates and the extent of insurance coverage varied little; existing income differences were not related to variation in the consumption of health care. While Wennberg and Fowler concluded that consumers probably do not determine variations in rates of health care, their study is

handicapped by the few areas studied (six) as well as by the limited indicators of surgery used - only overall surgical rates are discussed.

Also, in relation to specific aspects of ill health, services appear not to be related to morbidity in Canada. For instance, a tonsillectomy study in Manitoba by Roos and Roos (1982) attempted to correlate surgical rates with morbidity rates. No relationship was found between the tonsillectomy rate in an area and the prevalence of respiratory morbidity in the relevant population. The researchers suggested that their conclusions from the study were necessarily tentative; only nine regions were examined, morbidity data were obtained from claims rather than from patient self-reports and only one surgical rate was studied. The study, however, found a strong correlation between surgical rates and the independent variables of education and ethnicity using Pearson's correlation. The study conducted by Roos and Roos (1982) estimated only zero-order correlations between socioeconomic characteristics and utilisation rates. There were no tests of spurious association concerning the relationship between socioeconomic characteristics and utilisation rates. In contrast, other studies using multiple regression techniques to examine the relation between socioeconomic factors and usage rates, holding all else constant, were statistically significant. As Folland and Stano (1990: 428) put it:

We know, in principle, that utilisation is determined by the simultaneous confluence of many factors. It may well be that the role of morbidity will not be revealed until we go to a truly multivariate context. Each bivariate study could be seen as a special case of multivariate correlation with one or two variables

omitted. These omissions may bias the effect of included variables and they may disguise the importance of the single variable.

For example, in other multivariate studies, illness rates and socioeconomic factors are found to be significantly correlated. In regressions employing variables developed from factor analysis, Pasley et al. (1987) found that a morbidity variable was significantly related to the usage rates of three of the surgical procedures examined. Wilson, Griffith and Tedeschi (1985) examined white and black age-adjusted patient-day rates across 23 Michigan communities and found the standardised mortality rates to be consistently significant explanatory variables. Brewer and Freedman (1982) found that socioeconomic factors taken together explain more than half of the variation in utilisation in their study. McLaughlin et al. (1989), in a study of variation in hospital discharge rates, found socioeconomic factors to be statistically significant determinants of the variation in both medical and surgical discharge rates. Regardless of the method of analysis, whether simple correlations or multiple regressions, and whether the unit of analysis is the country or a well-designed hospital service area it is far from conclusive that one's health has a direct effect on uptake of services. There are complex interactions to be considered (see below).

2.1.2 Health Care Service Uptake and Access

Roemer (1961) suggested that under conditions of widespread economic support for hospitalisation (such as insurance), the supply theory such as bed supply is the greatest and most consistent determinant of hospital

utilisation rates through its influence on the practice of doctors. In a nutshell, they contend that consumption of services follows supply of resources. Under this model, geographic abundance of health resources - general and specialist medical practitioners, well-staffed and equipped hospitals - will have very high usage rates. With that scenario, remote rural areas would yield much lower usage rates than white collar well-to-do suburbs (Renwick and Sadkowsky, 1991). Studies have shown "a strong positive correlation between an area's physician-population ratio and the per capita utilisation of health services over time" (Roos, 1982: 946). Lewis (1969: 884) in an early study of this relationship, concluded that his results "might be interpreted as supporting a medical variation of Parkinson's Law; patient admissions for surgery expand to fill beds, operating suites and surgeons' time". It would appear that as long as there is a surplus of surgeons and hospital beds available to a population, more surgery will be performed.

Vayda (1973) compared intervention rates for 28 procedures in Canada and England and Wales. After standardising for age and sex of the two study areas, Vayda concluded that the diverse elective and discretionary surgical rates between the countries were probably due to sources other than the incidence and prevalence of disease. Among the contributing factors are divergent styles of treatment and indications for surgery, but the main determinants may be the differences in organisation and payment of health services, in functional "limited licensure" and in the numbers of surgeons and hospital beds. In Canada, the number of surgeons, which is not externally controlled or restricted, is 1.4 times higher than that in England and Wales, which is limited by the authorised

amount of hospital-based positions. With more hospital beds available in Canada, the tendency to do surgery may also be increased. The 30 per cent fewer acute-care beds in England and Wales limit the number of hospital admissions and, thereby, the rate of surgery (Vayda, 1973).

Bunker (1970) demonstrated that the US population was subjected to twice as many surgical procedures per capita as the population of England and Wales. He also found that the USA had twice as many surgeons per capita population as Britain. He suggested a relationship between these two findings. Australia has twice the hysterectomy rates of England and Wales and has more than four times the number of specialist obstetrician/gynaecologists per unit population than Britain. Thus the concept of "supplier-induced-demand" has to be evoked in order to fully explain the variation in surgical rates (Taylor, 1986).

It could be argued that countries with fewer medical professionals do not get all the services that are required. However, Wennberg and Gittelsohn (1982) in their study to look at medical care among small areas recorded that residents differed little in the factors affecting the consumption of medical services. The average numbers of episodes of acute and chronic illness in each area were similar, as were the proportion of people with an income below the poverty level, the proportion with various kinds of health insurance and the proportion with access to a physician. Indeed, approximately equal proportions of the people in the areas visited the physician each year, as would be expected in populations of similar wealth and health. The large difference in surgical rates and the amount spent on hospital care must therefore be traced to factors that come into

play after patients have contact with physicians. The above researchers suggested that the total rate of surgery and the likelihood of being admitted to a hospital for treatment must thus depend on the supply of physicians and hospital beds in the area.

In 1989, New South Wales had the highest per capita supply of full-time private medical practitioners (general practitioners and specialists), with 133 per 100,000 population, followed by South Australia (125) and Victoria (116). The use of medical services was highest in New South Wales, followed by Queensland and South Australia (AIH, 1992). Overall, there appears to be a consistent relationship between the number of full-time medical practitioners per 100,000 population and the per capita use of out-of-hospital medical services. An electorate-by-electorate breakdown of Medicare claims in 1993/94 showed a disparity in medical payouts between country and city seats. For example, Melbourne and Sydney received up to double the benefits handed out to country people. Victorians averaged \$297 per head a year, ranking the state second to New South Wales, at \$330, in the national illness stakes; while Kargoorlie, in Western Australia, breeds a more robust population having the least benefits paid at \$138 per head. The Health Department suggested that people in warmer climates were generally healthier and received less in Medicare benefits. But the figures did show that the greater the supply of doctors in an area, the more likely the higher Medicare payouts (The Age, 6 April, 1995:1). Roos and Roos (1982), in a Canadian study of surgical rate variations among elderly people found that areas with high surgical uptake were not characterised by an unduly morbid population. Rather, high-rate areas contained a more educated

population, as well as more elderly people whose origins were Canadian, British or American. This study did not support a needs model, i.e. lower socioeconomic status groups use more services, for explaining variation in surgical rates.

The cost of health care can be a substantial factor affecting equity of access in a number of ways: cost can deter people from obtaining the health care they need; and the costs people bear in obtaining needed care may leave them in a difficult financial position and threaten "income insufficiency" (McClelland, 1991). These two aspects of cost have been recognised. In 1984 the universal system of health insurance - Medicare - came into operation to allow for more equitable financing arrangements by extending benefits to people not previously covered, creating a greater measure of influence over the fees charged by doctors and an improved information system for the monitoring of medical service provisions. Extension of the direct billing option by doctors to eligible pensioners and others defined by the government as being in the special need category removed almost all financial barriers to the use of medical services by the lower socioeconomic groups of the population. With the removal of financial barriers to health care services how can one account for the variation in uptake in services in different health regions?

Even when people have the capacity to pay, they may be unable to obtain services because they are not available in all geographical localities. Because of Australia's large geographical size and uneven distribution of its relatively sparse population, the provision of adequate services in any non-metropolitan area poses logistical and economic problems for any

health authority. The more specialised secondary and tertiary health services are overwhelmingly concentrated in the state capital cities. Health care consumers living in cities and large metropolitan centres, where large hospitals are located, have greater access to medical technologies such as CAT (Computerised Axial Tomography) scanners and coronary bypass surgery than their rural counterparts. For example, Taylor and Goldstein (1981) pointed to the gross maldistribution of CAT scanners in the states of New South Wales and Victoria. In Sydney, there are 3.2 scanners per million population compared to New South Wales non-metropolitan areas with only 0.1 scanners per million population; and in Melbourne there are 2.3 scanners per million population compared to only 0.9 per million in Victorian non-metropolitan areas.

However, service uptake cannot be explained simply in terms of availability of services. Other burdens suffered in order to obtain care must be taken into consideration. These include both direct and indirect factors, such as, any additional cost that the doctor may charge over and above the scheduled fee (increasingly, fewer doctors are now bulkbilling), waiting and travel times, and the cost of transport. Patient-level studies conducted in the RAND Health Insurance Experiment in North America demonstrated that utilisation of medical care drops substantially when insurance coverage is reduced and that the physician's price is an important determinant of the number of episodes of care incurred by a patient. Other studies have found education and income as well as the patient's opportunity cost of time to play a role (Benham and Benham, 1975; Phelps, 1975; Bombardier et al., 1977). There are also cultural considerations, patients without adequate command of English may be

more reluctant to visit their GP if there are no interpretation services available (Palmer and Short, 1989). For example, Roos and Roos (1982) found that education and ethnicity were strongly correlated with surgical rates. Also, different patients have different desires and expectations related to their symptoms (Mechanic, 1972). At the most basic, some hesitate before consulting medical opinion, while others see a doctor with the slightest symptom. Given a particular condition, some patients prefer an interventionist approach, while others expect the opposite. Balancing perceived benefits and risks against each other is accomplished in totally different ways by different people. These factors may determine the rate of any medical intervention, given a known incidence of morbidity of a community.

2.1.3 Health Care Service Uptake and Doctors' Practice Patterns

The wide variations in the rates of individual procedures, however, are not caused by differences in the supply of resources alone (Wennberg and Gittelsohn, 1982). Various studies suggest that the doctors' practice patterns are the principal underlying cause for variation in the provision of medical and surgical services. In an international comparison on variation rates in the use of common surgical procedures McPherson et al. (1982) concluded that differences among the physicians in either their diagnostic styles or their beliefs in the efficacy of specific treatments contribute essentially to the observed variation in the rates of services. Ashley et al. (1972) looked at regional variation in radiology and pathology consumption rates in the United Kingdom and concluded that variation in practice was due to lack of consensus about use of diagnostic

facilities among the profession. A study in the United Kingdom examined the impact of introducing radiological guidelines for effective use of x-ray services to General Practitioners in the Plymouth Health District. It was demonstrated that only those investigations targeted in the guidelines showed a significant reduction of 28 per cent in referral rate (De Vos Meiring and Wells, 1990).

Why do different doctors hold different beliefs about the management of similar medical problems? For many conditions substantial uncertainty exists for a practicing physician on both the diagnostic stage and the effectiveness of treatment. Regardless of whether patient preferences rule in such cases or whether physicians act as imperfect agents, the uncertainty represents an enabling factor for variations to occur. This uncertainty may be due to general limits of knowledge, or to particular doctors not being fully informed. In either event, the decision-maker may not be fully aware of the possible outcomes of different approaches to treatment or of the probability of their occurrence. After all, much of medical practice remains a legacy of an era that saw clinical interventions being introduced and disseminated without adequate evaluation (Renwick and Sax, 1991). For example, many surgical procedures, drug therapies, psychotherapy and patient counselling, and rehabilitative manoeuvres have never been satisfactorily evaluated. Some procedures of dubious benefit, such as, the more heroic approaches to the management of cancer, became entrenched in professional mythology long ago, when the knowledge of the underlying biology was, by today's standards, primitive; yet they remained unchallenged despite their appalling cost in terms of human sufferings (Leeder, 1985). Similar uncertainties exist when it

comes to recommending medical management, angiography, coronary bypass surgery, or angioplasty for coronary artery disease (Wennberg, 1987). Because formal assessments have not been completed, some well-qualified physicians reasonably hold (to the theory) that the medical treatment is better; others reasonably prefer the surgical alternative. The implications of these observations are that there are differences in the quality and cost of medical care. Equity is diminished as a consequence. For example, patients presenting in different parts of the country receive care for reasons that do not appear to be rational. Governments aim to equalise opportunities of access to medical and hospital care, but individuals with similar problems should have not only equal access to care but also equal opportunity to have their problems managed in accordance with "best practice" principles. The inference to be drawn from variations in practice patterns is that either (in some regions) things are being done that are inappropriate, or (in others) things that should have been done are being left undone. Evidence of persisting variations suggests that the health care system is failing to meet fully the objective of providing effective care whenever possible (Renwick and Sax, 1991).

One major problem with the idea that service uptake is a result of doctors' practice patterns is that one would expect these patterns to be randomly spread among the regions; therefore, can this be seen as a reasonable suggestion for variation in the use of services? Of course, if the unit of analysis is a small geographical area one might expect that some areas have doctors favouring one mode of treatment over another. When the unit of analysis is large, say a health region, one would expect that with respect to doctors' varying practice patterns one region to be comparable

with another - under the hypothesis of random variation of practice patterns.

McPherson et al. (1981), in a study to compare regional variations in the use of common surgical procedures, suggest a positive correlation between numbers of surgeons and operations performed although this relationship was stronger in America than in Britain. Why should "Parkinson's Law" apply with such unequal force? One plausible answer lies in the different professional, economic and organisational structures which embody North American surgery as compared with surgery in England and Wales. In particular, the North American surgeon is in some crucial aspects an entrepreneur, his British counterpart is rather closer to a salaried official (McPherson et al., 1981). As George Bernard Shaw (1906) has eloquently pointed out, "to give clinicians a financial reward for one decision and none for another should give rise to an expectation of as much impartiality as from judges who might be paid according to the quantity of their innocent (or guilty) verdicts"!

Many studies have found that medical care systems based on fee-for-service payment have higher rates of surgical interventions than schemes which have salaried sessional, prepaid or capitation methods of remuneration (Taylor, 1986). In a study to look at physicians' responses to financial incentives, Hemenway et al. (1990), compared the practice patterns of 15 doctors, each employed full time at a different Health Stop centre in the Boston area in Massachusetts. Physicians were offered bonuses the size of which depended on the gross income they generated

individually. During the periods compared (before and after the start of the new financial arrangement) physicians increased the number of laboratory tests performed per patient visit by 23 per cent and the number of x-ray films per visit by 16 per cent. Hillman et al. (1992), in their study of physicians' utilisation and charges for outpatient diagnostic imaging in a Medicare population, reported that nonradiological physicians who operate diagnostic imaging equipment in their offices performed medical examinations more frequently. One phenomenon promoting greater intensity of care is physicians increasingly adopting more and more complex technologies into their office practices. Physicians can then "self-refer" their patients to these technologies. Self-referral endangers both payers and patients with the possibility of unnecessary or poor-quality care. In the United States, many physicians are investing as entrepreneurs in a burgeoning health care market. As researchers they may even own stock in the same company that sponsors their investigations; and as clinicians they may invest in such health care enterprises as freestanding diagnostic imaging facilities, minor emergency centres, and home health care agencies. While some of these arrangements literally constitute 'kickbacks', in which the physician is paid solely for the referral and not for any professional service, all can tempt the physician to consider his/her own income above the patient's medical interests and to tap payers for excessive outlays (Morreim, 1989).

In Australia, in a study designed to look at general practitioner services under Medicare, Roseman and Mackinnon (1992: 424) suggested that "bulkbilling was a dominant predictor of level of service and this effect

was significantly larger in metropolitan than in rural areas". Implied in the above study is that bulkbilling allows the doctor to prescribe any number of services, which includes x-rays, for patients. The authors also suggested that the combined effects of general practitioner numbers and bulkbilling could imply that, in many metropolitan areas where doctor numbers exceed demand, providers compete for and provide the maximum number of services for individual patients. In this situation, the number of services is determined by factors other than simple medical need. The researchers concluded that:

the findings are consistent with general practitioners adjusting the number of services to maintain income where supply of services is growing faster than demand. The increased maldistribution of practitioners seen at the same time as the lopsided growth of bulk-billed services in the city areas suggests that the distribution and practices of general practitioners have been influenced by the payment system (Roseman and Mackinnon, 1992: 426).

However, while financial incentives may contribute to medical intervention rate variation, research by Bunker and Brown (1974) has confused the issue. Elective surgical rates for physicians and their spouses were found to be as high as or higher than such rates in other professional groups. These results suggest that doctors, as informed consumers of medical care, place a high value on surgical treatment or it might reflect their easier access to such treatments.

According to McLaughlin et al. (1989), it is necessary to understand why utilisation rates vary in order to decide what kind of policies should be pursued to lower high rates or to raise low rates:

if physician practice patterns are the primary determining factor, a likely interpretation of an area's high rates is that physicians in that area may be prescribing medically unnecessary care. This may suggest that some form of review of the appropriateness of care followed by physician education or utilisation review programs may be warranted. Different policy interventions would, however, be formulated if high rates were due to higher level of needs. In this case, programs aimed at reducing the need for medical care would be pursued. Conversely, if the availability of medical care resources rather than socioeconomic factors is the determining factor, low rates may be interpreted not as indications of a healthier population but as indications of access problems that need to be remedied.

Despite the uncertainty about the causes of variation in medical intervention rates, the simple existence of these variations suggests to some that unnecessary medical intervention must exist. The proposition that the variations reflect inappropriate use is a controversial one. Does a "right" rate exist or are all observed rates right? Roos, Roos and Henteleff (1977) examined cases of tonsillectomy in high and low usage rate areas in Manitoba on the basis of their conformity to accepted standards. The researchers found no evidence of lower standards in high use areas. Chassin et al. (1987) studied three surgical procedures in three areas including high and low use areas and found no significant differences in

the appropriateness associated with the rate of usage for the procedures. Goran (1979) argued that the lowest use of medical or surgical procedures across regions represented the target level that all areas should strive to achieve. Others take exception to this position. Some have expressed concern that the low British surgical rates may be attributed to a failure to meet the existing needs of the population (Pearson et al., 1968). The issue involved in assessing inappropriate use is problematic. Pauly (1979) argued that we know little of the degree of unnecessary surgery that takes place. He noted that for surgery to be unnecessary, the costs must exceed the benefits. The appropriate costs are the opportunity costs incurred by society and the appropriate benefits are those determined by the fully informed patient.

Determining the important factors in utilisation rates is complex. This literature review identified the following factors, some more than others, as contributing to the variation rate in medical interventions - the health status of the individual which is related to his/her socioeconomic status; access to, or the availability of, health resources; and the variation in doctors' practice patterns. Given the stated purpose and role of health care, that is, to ensure equity in the provision of health services, the above factors affecting variation rates need to be viewed carefully. Some of them can be regarded as legitimate, while others are illegitimate (McPherson, 1990). Poor health status and demand constitute legitimate causes of variation. On the other hand, if variation in health care use is directly caused by variation in supply, method of payment and/or clinical uncertainty, then those responsible for the rational provision of limited

health resources will increasingly find it hard to justify the more expensive options.

2.2 Proposed Theoretical Model

Because of the unusual characteristics of the medical marketplace, the independent variables used to estimate the demand for health services including initial GP consultation, referral to specialist services, hospital treatment and so forth, differ in a number of ways from those used in demand studies in other sectors. Particularly important factors are access such as health insurance or availability of services, provider influence over demand, and medical 'need' or health status of the consumer (Sorkin, 1992). Access to services such as health insurance influences demand by reducing the price the consumer pays at the time services are purchased below that charged by the provider. The introduction of Medicare in Australia removes most financial barriers to health care services especially the extension of the bulk-billing option by doctors to the lower socioeconomic groups of the population.

Studies that attempt to incorporate provider influence into a theoretical formulation have relied on the simple hypothesis that providers will generate more demand for their services when the providers themselves are in more plentiful supply (Sorkin, 1992). To test this hypothesis, availability variables such as the number of physicians per capita and the number of hospital beds per capita have been included in empirical demand functions. In general these availability variables appear to be related to the quantity of services consumed (see pages 26-29).

Neoclassical theory argues that the market for physician services acts like any normally functioning market. When the supply of physicians' services increases, individual workloads fall, as a fixed patient load is spread among more physicians. Physicians' incomes consequently decline. Physicians respond to this increased competition by reducing their fees so that the demand for physicians' services increases at this new lower price. An increase in the number of physicians will also increase utilisation by lowering the opportunity cost. Greater access to physicians presumably reduces travel distances as well as waiting time in the physician's office (Sorkin, 1992).

Under the inducement hypothesis, however, market equilibrium can be obtained not only by adjustments in price, but also by influencing the consumer's perception of need. Faced with a declining caseload, physicians may simply recommend and perform additional services for his or her remaining patients (Sorkin, 1992).

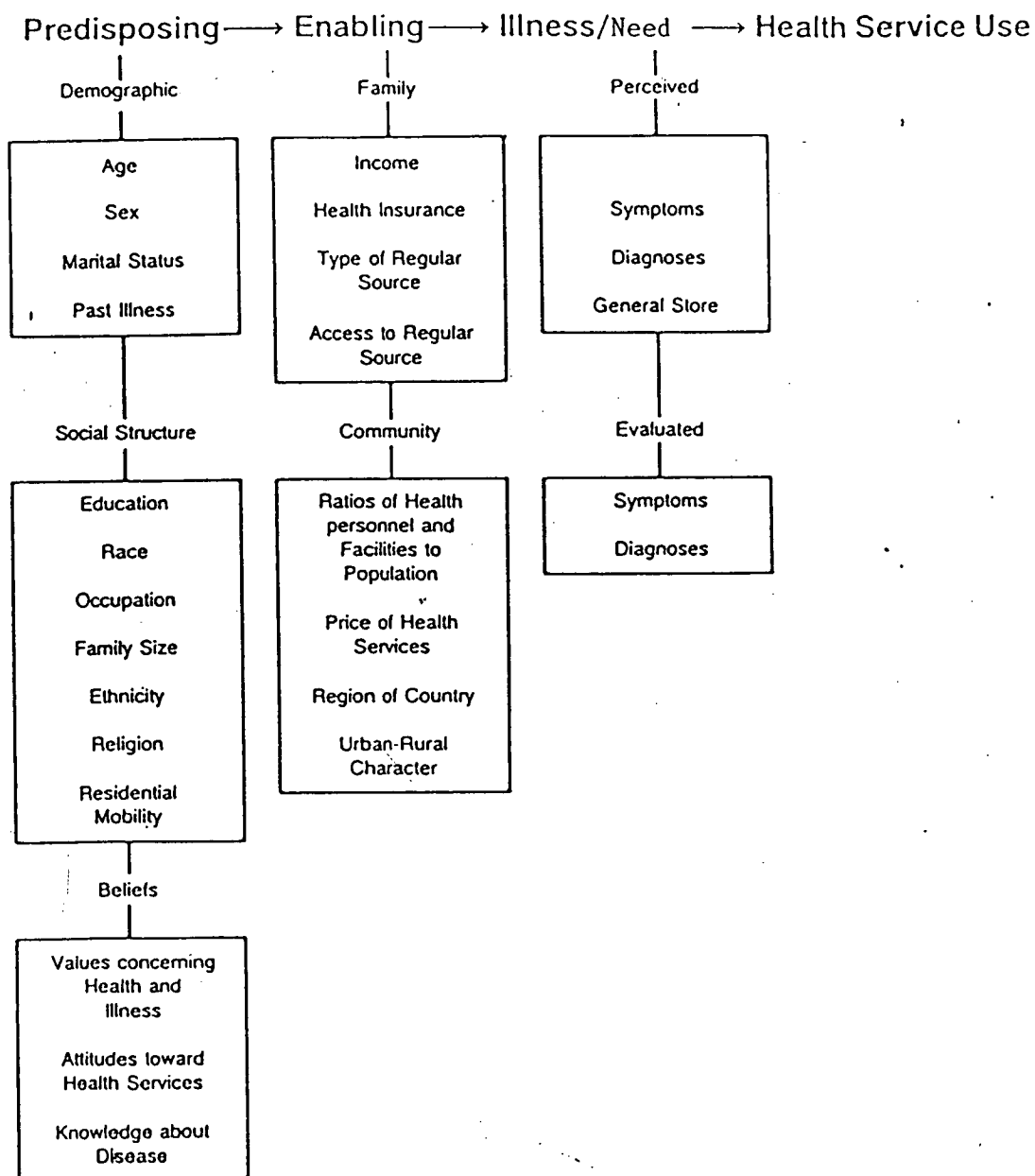
In studying the demand for medical services, a variable of importance is the health status or medical need of the consumer. Since this factor is related to the quantity of services demanded and because it is also correlated with other independent variables such as income, age, etc, the inclusion of health status variables in an empirical demand equation is necessary to avoid substantial biases in results (Sorkin, 1992). Health status is a latent construct. It can be indicated for example by: (1) external measures such as number of visits to the GP and (2) internal measures such as self-assessed health status by the individual.

Ronald M. Andersen (1975), in his model for health services utilisation, listed certain characteristics that influence an individual's demand for health services. This framework of health care utilisation takes into account both individual and societal factors. According to this model, an individual's decision to utilise medical services depends on a sequence of conditions grouped under three components: predisposing, enabling and need/illness level (see Figure 2.1).

As indicated by Andersen's behavioural model, the availability and accessibility of health care represent enabling variables that influence utilisation. For example, the bed-population and physician-population ratios have been shown to be positively associated with the likelihood of visiting a provider and with the amount of care consumed (Sorkin, 1992). Literature has suggested availability of resources as one factor affecting usage rates (see above). Preliminary enquires to obtain data on the availability of resources in the health regions, such as GP distribution and radiological practices, proved impossible to obtain in some states. For example, the Radiation Boards differed with respect to the information that they were willing to disclose regarding the number of radiological practices or the radiological equipment available in each state. Where information was available, for example, the GP distribution in the health regions, it would have been beyond the resources available to the researcher. Also, a confounding factor was that the above information required would need to be compatible with the National Health Survey 1989/90 (NHS89/90) dataset to be analysed in this study.

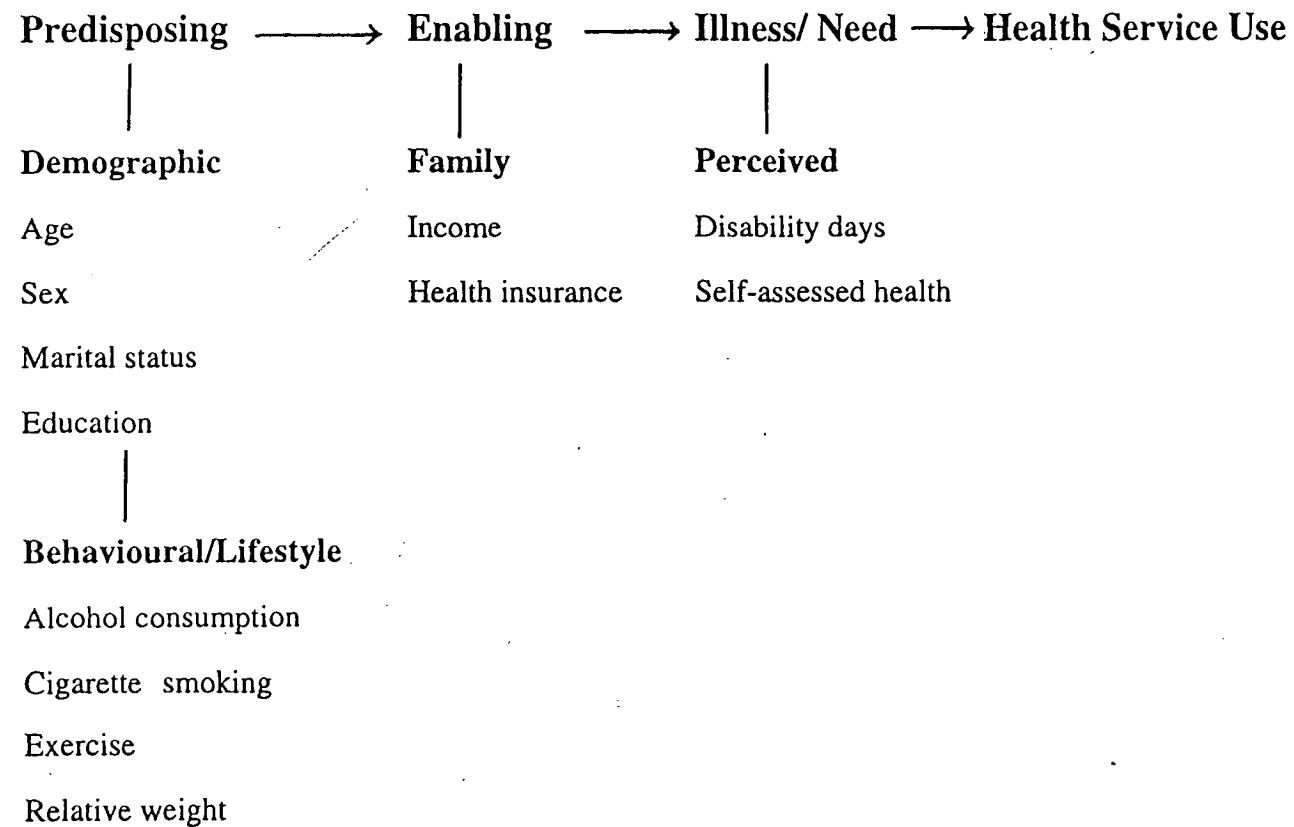
Again a difficulty beyond the author's means. Hence a modified version of Andersen's model was examined (see Figure 2.2 below).

Figure 2.1 Andersen's Behavioural Model of Health Services Utilisation



Source: Sorkin, 1992: 32

**Figure 2.2 Modified Version of Andersen's Behavioural Model of Health
Services Use (For Stage 1 and Stage 2 of Analysis)**



This study is therefore mainly focussing on the examination of socioeconomic background and health care behavioural characteristics as stipulated by Andersen's model. If the model is better at predicting consultation rates than referral rates - Shortell (1975) states that "the initial decision whether to make contact with the medical system may be primarily a function of individual predisposing, enabling and illness/need variables, but once individuals have visited the doctor, presumably other factors are important" - we then need to consider factors other than individual characteristics in accounting for the unexplained variance in referral rates.

Following Popper's theory of falsification (Popper, 1972), to eliminate supply factors and trying to test the impact of such a hypothesis requires the elimination of competitive explanations. The falsificationist sees science as a set of hypotheses that are tentatively proposed with the aim of accurately describing or accounting for the behaviour of some aspect of the world or universe. However, if it is to form a part of science, the hypothesis must be falsifiable. Theories that fail to stand up following observational and experimental tests must be eliminated and replaced by further speculative conjectures. As Popper (1972) himself put it: "in finding that our conjecture was false we shall have learned much about the truth, and shall have got nearer to the truth". In the present context, if the above modified version of Andersen's model does not fully explain the variation in referral rates, what else can account for it? Supply factors?

There are, however, limitations to Popper's theory. For example, Chalmers (1976) argued that theories cannot be conclusively falsified because the observation statements that form the basis of the falsification may themselves prove to be false in the light of later developments; and a difficulty for falsification may arise in a complex realistic test situation in that a theory cannot be conclusively falsified because of the possibility that some part of the test situation, other than the theory under test, that is responsible for the erroneous prediction, cannot be ruled out.

The following sections describe each of the three components of Andersen's model and identify variables used in this study to operationalise the latent constructs (predisposing, enabling and illness/need). The variables were chosen because of their correspondence with the model. Previous research has related them to health service use and has shown that they can be operationalised in social survey research.

Predisposing component: Some individuals have a propensity to use more services than others, where propensity toward use can be predicted by individual characteristics which exist prior to the onset of a specific episode of illness. Such characteristics include demographic, social structural, and attitudinal-belief variables. Demographic variables, such as, age, sex and marital status for example, are closely associated with health service usage. Age is physiologically based - younger persons have a lower physiological need for medical care than older people. For example, the prevalence of disability and serious chronic illness increases steeply with age (refer page 24). Studies suggest that females consume more health services than males. Although differences are attributable in

part to obstetrical needs, women use more services relative to men even when both groups have similar health status (refer page 24). Research studies indicate that married persons, by and large, enjoy better health than persons without immediate lifeline. The emotional support that the nuclear family is able to extend to its members suggests that fewer visits in search of sharing and caring with the health care personnel are necessary (refer page 25).

Education is a social status variable which denotes a person's position in a social system. As such, this variable reflects the differences in lifestyle and values which influence behaviour which may be related to the use of health services. Generally speaking, better education should lead to a better understanding of one's environment, including disease and the processes related to it. Educated persons should perceive morbidity and the benefits of health care differently from those with little formal education, all other things being equal.

In this study, four major habits are examined to 'stand in' for a general concept of healthy or unhealthy lifestyle. The assumption is that an individual who smokes and drinks heavily, and is careless of the health implications of exercise and diet, is leading a generally unhealthy life. It has been amply documented that cigarette smoking is related to several types of chronic morbidity (Royal College of Physicians cited in Kohn and White, 1976). There is a well-documented relationship between a country's per capita alcohol consumption and both mortality and morbidity. Deaths from cirrhosis, hospital admissions due to alcoholism and alcoholic psychosis, and convictions for various forms of unlawful

behaviour are all positively associated with national alcohol consumption (Smith, 1981). However, some studies have shown that not all levels of alcohol consumption are detrimental to health (Gordon and Doyle, 1987). It has been demonstrated that mortality is higher for both coronary heart disease and non-coronary deaths among non-drinkers and heavy drinkers compared with mild drinkers. It is generally agreed that exercise is relevant to health. Studies have shown that physical exercise benefits both the quality of life and the incidence of coronary heart disease (Morris et al., 1953). The investigation of the health effects of diet is more complex. The health effects of diet relate to both deficiencies and excesses of food, as well as to its composition. During this century, the role of diet has taken on a new dimension. The dietary deficiencies of the past have been replaced by over-eating and health problems associated with affluence (Harper, Holman and Dawes, 1994). One specific consequence of dietary excess is obesity. Studies have shown a relationship between body weight and mortality. The lowest death rate occurred at a body weight slightly below the average for the population. As body weight increased, so did mortality. At 5-15 per cent overweight the mortality increased by 25 per cent and by 25 per cent overweight the death rate was five times the expected level. Mortality also increased at very low body weight (Harper, Holman and Dawes, 1994:127).

Enabling component: Even though individuals may be predisposed to the use of health service, means must be available for them to do so. A condition which permits a family to act on a value or satisfy a need

regarding health service use is defined as enabling (Andersen and Newman, 1973). Enabling conditions can be measured by family resources such as income and level of health insurance cover. Family income, for example, can be ascertained by classifying total combined family earnings from such sources as wages, salaries, pensions and allowances. According to Kohn and White (1976), social security for both individuals and families has many dimensions. Several of these were considered on the basis of their possible relationships with health service usage; that is, availability of health insurance, and the type and amount of cash sickness benefits. The lack of either form of coverage may act as a deterrent to seeking services or to absence from work for reasons of ill health because it adversely affects available financial resources (Kohn and White, 1976).

Illness/Need component: Given the existence of both predisposing and enabling conditions, the individual's utilisation of health services also depends on medical need which can be disaggregated into perceived need as measured by self-assessed health status or sick days and evaluated need as estimated by clinical diagnosis. Some studies have reviewed the conceptual problems associated with developing an index of health and have suggested that disability on a specific day is probably the best description of perceived morbidity. Disability, according to Sullivan (1971), can be scaled according to the degree of restriction of usual activities on the day in question. The World Health Organisation (WHO) originally defined health as "a state of complete physical, mental and social well-being, and not merely the absence of disease and infirmity". In seeking to describe the health status of the

Australian population, the National Health Survey 1989/90 (NHS89/90) directly approached the concept of health as "well-being" through the collection of information on an individual's self-perceived general state of health (measured as excellent, good, fair or poor). In empirical assessments of Andersen's model, need variables, for example, the number of disability days and self-assessed health status, have generally been found to be the strong predictors of utilisation (Sorkin, 1992).

It is a consideration of these three components that guides the research focus for this study. Clearly, if this model does not account for a very substantial amount of the variance, what else can account for it? Supply factors?

2.3 Research Focus

This study attempts to offer an explanation for the variation in consultation and referral rates to other health care services by the general practitioners in the forty-seven health regions in Australia. It examines to what extent these variations can be attributed to Andersen's behavioural model of health service utilisation. Andersen's model in health services utilisation has been used in research studies in North America (Andersen, Kravits and Anderson, 1975 and Kohn and White, 1976). However, this model appears not to have been tested within the Australian context.

The study will be conducted in three stages. In Stage 1, individual characteristics will be assessed for their influence on the probability of consulting a GP. These same characteristics will then be assessed to see

if they can equally well predict the probability of referral by general practitioners to other health care services. If these characteristics do not predict referral rates as well as consultation rates, a second analysis (Stage 2) will be required at the aggregate level for the 47 health regions in order to get an estimate of the variance accounted in referral rates using these same characteristics. If a substantial amount of variance is not accounted for in this model then a consideration of the influence of supply factors (eg, number of doctors, beds, facilities, etc) on referral rates must be considered (Stage 3).

Stage 1:

Research Question:

Do age; sex; marital status; education level; income; health insurance coverage; self-perceived health status; number of short-term disability days; alcohol consumption; cigarette smoking; exercise level; and relative weight of the individual following Andersen's Model of Health Care Services Utilisation predict the probability of consulting a GP and the probability of referral by the general practitioner to other health care services?

Stage 2:

Research Question:

Is variation in referral rates in the forty-seven health regions a function of: age profile; sex ratio; marital status; education level; income distribution; health insurance coverage; self-perceived health status; number of short-

term disability days; alcohol consumption; cigarette smoking; exercise level; and relative weight of the regional population as per Andersen's Model of Health Care Utilisation?

Stage 3:

Research Question

To what extent does the region with the highest referral rate (South Coast Queensland health region) have more GPs, specialists and radiological and pathological facilities compared to the region with the lowest referral rate (Goulburn health region)?

This chapter reviewed the literature which identified factors that determined variation in health care services usage and proposed a theoretical model to guide the research focus for this study. The next chapter presents the methodology to be used in the study.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

The data source for this study is the National Health Survey for 1989 to 1990 (NHS 89/90) conducted by the Australian Bureau of Statistics (ABS, 1992). Secondary analysis was conducted using this data set because the NHS89/90 is still the most recent and best available data. It not only represents an enormous resource in terms of human effort and funding but also offers information on health care use, health status, health behaviours, and demographic characteristics of the population suitable for testing the model proposed in this study. The sample design and selection used ensured the ability to generalise to the wider population and therefore the justification for significance testing, as discussed below under sample design and selection (Castles, 1992:4). Bombardier et al. (1977) in a study to examine differentials in surgical utilisation among socioeconomic groups in 1970 in Canada adopted a similar approach by using data from the Health Interview Survey 1970 conducted by the National Centre for Health Statistics on a probability sample of households in that country.

3.2 Secondary Analysis

Secondary analyses of national surveys and other quantitative social data sets available in archives have now become an important research

method. Secondary analysis, as defined by Hakim (1982:1), is "any further analysis of an existing data set which presents interpretations, conclusions or knowledge additional to, or different from, those presented in the first report on the inquiry as a whole and its main results." Secondary information offers some distinctive advantages over primary collection efforts. The advantages are those related to economies of time, money and personnel - advantages that are particularly attractive at times when funds for new research are scarce. But, the single most important advantage of secondary analysis is the benefit of the years of expertise that have gone into establishing research organisations such as the ABS in Australia, the National Opinion Research Centre in the USA and the UK Office of Population Censuses and Surveys which is now available to the secondary analyst. As Hyman (1972) quotes Newton as saying "If I have seen further, it is by standing on the shoulders of giants". Most national surveys represent high quality data with careful questionnaire design, fieldwork and methodological development. Because of their relative consistency over time, their large sample size and national representativeness, surveys such as the National Health Survey and the General Household Survey in Australia, for example, have been widely used. Secondary data may also provide a useful comparative tool. New data may be compared to existing data for the purpose of examining differences or trends (Stewart and Kamins, 1993).

The fact that data were collected originally for particular purposes may produce problems in a secondary analysis. For example, category definitions such as measures or treatment effects may not be appropriate

for the purpose at hand (Stewart and Kamins, 1993). Secondary data are, by definition, old data and may therefore not be particularly timely for some purposes. An example is the census data which may not be published in their entirety for at least two years after the collection process.

In order to use secondary data sensitively and with validity, the analyst needs to confront a few issues. First, (s)he needs to examine the purpose of her/his study. Does the secondary information cover the issues the researcher is interested in? Second, the credentials and quality of the data need to be established. Third, information on the sampling frame is important so that an indication of the extent to which the population sampled is likely to correspond to the "true" population. In other words, is the survey nationally representative to support generalisations about the population? Finally, it is important to check the collection date of the data to establish relevancy. Substantial changes may have occurred since the collection of the data and therefore the data may not be relevant for the study in hand. In the context of the present study, such concerns were taken into consideration and informed the analysis and interpretation of the data throughout this study. Nevertheless, the data used in the present study were perhaps not ideal for the purpose at hand but still the best currently available for secondary analysis.

3.3 National Health Survey 1989/90 Data (NHS89/90)

The NHS89/90 survey was the first in a new series of regular five-yearly population surveys conducted by the Australian Bureau of Statistics

(ABS) in order to obtain national benchmark information on a range of health-related issues for the monitoring of trends in health over time. Information collected included the health status of Australians, their use of health services and facilities and health-related aspects of their lifestyle. The survey also provided information about household structure, income from selected sources, and a range of demographic characteristics such as occupation, employment status and age. The survey was carried out over a twelve-month period from October 1989 to September 1990 in order to eliminate the influence of seasonal effects on the data. Two pilot tests were conducted, the first in Adelaide in September 1988 and the second in Sydney in February 1989 to investigate respondents' reaction to the survey; and to ensure that the survey was accurately and effectively addressing the issues intended.

3.3.1 Sample Design and Selection

The sampling technique chosen by the ABS was guided by the aims of the survey, the topics it contained, the level of disaggregation, the accuracy required of survey estimates, the ability to generalise to the wider population, and finally the costs and operational constraints of conducting the survey (Castles, 1991).

The survey covered rural and urban areas of all States and Territories of Australia, and included residents of both private and selected non-private dwellings. About 22,200 households were randomly selected. This presented an approximate number of 57,000 persons (or about one in three hundred of the population, although an individual's chance of

selection in the survey varied depending on the state/territory and region in which they lived; but note over/under sampling and weighting which is inversely proportional to it, for example, Tasmania) throughout Australia to be included in the survey. The sample was considered to be sufficient to provide:

- detailed information for each State and Territory;
- relatively detailed data for each capital city/rest of state areas within each state;
- broad level estimates for regions within the more populous states;
- estimates for those characteristics which were relatively common; and
- estimates for sub-populations which were relatively large and spread fairly evenly geographically.

The data collected had to be at an acceptable level of accuracy and reliability after allowing for sample loss through factors such as vacant dwellings inadvertently selected in the sample, non-contacts, etc. To enhance reliability of regional estimates in general, and the level of disaggregation of data which could be provided at the regional level, the base sample was increased in New South Wales, Victoria and Tasmania.

The sampling frame used by the ABS is as follows:

A multi-stage area sample of private dwellings (houses, flats, etc) and non-private dwellings (hotels, motels, etc) was used. This ensured that all segments of the population were represented. Each State and Territory was divided into areas or strata consisting of a Local Government Area (LGA) or group of LGAs determined to be relatively homogeneous in respect of socioeconomic characteristics of the households within the

area. Within each stratum are a number of Collector's Districts (CDs) with approximately 250 dwellings. The sample was selected to ensure that each dwelling had the same probability of selection.

In cities, major urban and high density population areas the sample was selected in three stages:

- each stratum contained a sample of CDs with probability proportional to the number of dwellings in each CD;
- each selected CD was divided into blocks of dwellings of similar size, and one block was selected from each CD, with probability proportional to the number of dwellings in the block;
- within each selected block, all private dwellings were listed and a systematic random sample of dwellings were selected. Dwellings selected were not contiguous, with 8 to 16 dwellings between each one selected.

In strata with low population density each stratum was divided into units, corresponding to towns or LGAs or combinations of both, and one or two units were selected from each stratum with probability of selection proportional to the number of dwellings in each unit. Within selected units, the sample of dwellings was arrived at in the same way as for high-density population areas. The effect of this approach is that a sample was not necessarily selected from each LGA, rather those selected represented neighbouring LGAs of similar characteristics.

The sample of non-private dwellings was selected separately from the sample of private dwellings to ensure they were adequately represented in the sample. The non-private dwelling strata were formed by combining

private dwelling strata to a level corresponding to Statistical Subdivisions, Divisions or combinations of these. The sample of non-private dwellings was then selected in two stages:

- a sample was selected from each stratum with probability proportional to the average occupancy of the non-private dwelling;
- a list of units (rooms, beds, etc) was prepared for each selected non-private dwelling and a systematic random sample of units was selected.

The above selection method ensured a known and equal chance of selection of each person within each stratum, and, with the exception of Victoria which had a proportionately higher sample of dwellings in the metropolitan area of Melbourne, an equal chance of selection within each State (Castles, 1991:4). This allows one to make generalisations to the populations based on statistical probabilities. To justify the use of the sampling distributions for inferential purposes, it is necessary to know both the population from which the sample is drawn and the probability with which the sample is selected (Grichting, 1989).

To take account of possible seasonal effects, the sample was allocated equally to each quarter of the twelve-month-collection period. CDs were randomly allocated to months in such a way as to ensure an acceptable spread of sample units throughout the year.

3.3.2 Data Collection

Selected households were initially approached by mail to inform them of their selection in the survey and to advise them that an interviewer would

call to arrange a suitable time to conduct the survey interview. A brochure, providing some background to the survey, information concerning the interview process and a guarantee of confidentiality were included with the initial approach letter. Trained ABS interviewers personally interviewed each member of the selected households aged 18 years or more, and with the consent of parents/guardians, children aged 15 to 17 years. Parents/guardians were asked to answer questions in respect of their younger children. All phases in the training of the interviewers emphasised understanding of the survey concepts, definitions and procedures in order to ensure that a standard approach was employed by all interviewers concerned.

Three questionnaires developed and used in the survey were the :

1. Household Form used to collect basic demographic data (e.g. sex, age, birthplace) and details of the relationship between individuals in the household;

2. Personal Interview Questionnaire used to collect information from individuals about health-related actions they had taken, recent and long-term illness conditions experienced, selected lifestyle behaviours, etc.

This questionnaire was designed to be administered using standard ABS procedures for conducting population interview surveys, having regard to the particular aims of the survey and of the individual topics within it, and to the methodological issues associated with these topics. Other factors considered in designing the questionnaire included the length of the individual questions, the use of easily understood words and concepts, the number of subjects and overall length of the questionnaire, sensitivity of topics, etc. The questionnaire was fully field tested to ensure:

- that the data requirements from the survey were adequately addressed in order to obtain the required data in the most effective and efficient way;
- there was minimum respondent concern about the sensitivity or privacy aspects of the information sought, effective respondent/interviewer interaction, acceptable levels of respondent load;
- the operational aspects of the survey were satisfactory, for example, arrangement of topics, sequencing of questions, adequacy and relevance of coding frames, etc.

3. Women's Health Questionnaire (optional) for female respondents aged 18 to 64 years was completed at the end of their interview.

3.3.3 Response Rates

In any sample survey, responses should ideally be obtained from all selected units. However, in practice, there will be some non-response, refusal to cooperate by some people, and situations where some people cannot be contacted. It is important that response be maximised in order to reduce sampling variability and avoid biases. Sampling variability is increased when the sample size decreases and biases can arise if the people failing to respond to the survey have different characteristics from those who respond. Measures taken by the ABS to encourage respondent cooperation and maximise the response rate included:

- public awareness activities, aimed at informing the community in general;
- advising selected households by letter of their selection, the purpose of the survey, its official nature and the confidentiality of the information

collected. An information brochure was included with the letter plus advance notice that an ABS interviewer would call;

- stressing the importance of participation in the survey of selected households to ensure proper representation in the survey;
- stressing the importance of the survey to the planning and provision of health services and facilities to meet Australia's health needs;
- making every effort to contact the occupants of each selected dwelling through at least three call-backs in rural areas and at least five in urban areas, and
- following-up respondents who refused to participate with letters and visits by office supervisors.

A total of 26,470 private and special dwelling households were selected. This number was reduced to a sample of 22,202 households after sample loss. Sample loss was due to no questionnaires being obtained for reasons other than non-response. For example, the dwelling was vacant, under construction or converted to non-dwelling use. From the effective sample of households, there were 56,803 persons in scope/coverage of the survey. Fully completed questionnaires were obtained from 96 per cent of these persons (see Table 3.1 below).

Table 3.1 Response Rates for NHS 1989/90 Survey

	Number	Per cent
Fully completed questionnaire obtained	54,576	96.1
Refusal	1,247	2.2
Non-contact	940	1.7
Other non-response	40	..
Total	56,803	100.0

(NHS 1989/90 User's Guide Cat.No.4363.0: page 8)

3.3.4 Samples Selected for the Study

Stage 1: Individual Level Analysis

In an attempt to explain the probability of GP consultation and GP referral to other health care services at the individual level the following three samples were selected from the NHS89/90 sample:

1. respondents who saw the doctor in the two weeks before the interview and were referred for other services (n=1215);
2. respondents who saw the doctor in the two weeks before the interview and were not referred for other services (n=1215); and
3. respondents who did not consult/visit the doctor in the two weeks before the interview (n=1215).

The reasons for selecting the three samples are as follow: 10,745 respondents (19.8%) reported consulting the General Practitioner in the two weeks before interview. Out of this number 1215 respondents were referred for other health care services (sample 1). To see how well Andersen's model predicts utilisation of services, a comparable sample of respondents were randomly selected from those that did not visit the doctor (sample 3). This selection of two random samples, one for which the event occurred and one for which the event did not occur, enabled the data to be used to estimate the logistic regression equation which is the analysis used in the first stage of the study to examine the probability of GP consultation. This method has the advantage of being able to specify the number of individuals with or without the event.

In order to see if Andersen's model could equally well predict referral rates to specialists and other health care services following respondents' visit with their GPs, a third sample was selected from the respondents who consulted the GPs and were not referred (sample 2). This third sample (sample 2) was merged with the sample of respondents who were referred to other health care services (sample 1) and used in the analysis to examine the probability of GP referral to other health care services.

Stage 2: Aggregate Level Analysis

In an attempt to explain variation in referral rates at the national level, that is, all 47 health regions collectively, the NHS 1989/90 sample (n=54,241) was used for the study. Means for each of the 47 health regions were computed on selected variables following Andersen's model. As the dependent and independent variables are interval data, ordinary least squares regressions were used for the analysis.

Stage 3: Case Study to Compare Goulburn Health Region (Lowest Referral Rates 9%) and South Coast Queensland Health Region (Highest Referral Rates 14.8%).

An attempt was made to explore the possible contribution of the supply factors in explaining variation in referral rates. The GP referral rates to other health care services in the 47 health regions were compared. The two health regions with the highest and lowest referral rates were examined and compared with respect to their socioeconomic and health behavioural characteristics and the distribution of services such as the

number of GPs, specialists, radiological and pathological services. Means for the two health regions were computed on selected variables following Andersen's model. Information on the distribution of GPs, specialists, radiological and pathological services were obtained from telephone directories.

3.3.5 Survey Content

Topics included in the NHS 89/90 are grouped under four headings:

- Health Status: In seeking to describe the health status of the Australian population, the survey focused on two measures of health: (i) ill-health such as the number and types of medical conditions recently experienced and the number and types of long-term medical conditions experienced. Recent illness is defined as medical conditions, for example, illness, injury or disability, experienced in the two weeks prior to interview. It is a key indicator of the health status of the population, and a major factor in the usage of health services and facilities; (ii) health as "well-being", through the collection of information on self-assessed health and happiness. Self-assessed health status is defined as the respondents' perception of their general health status. Health could be defined simply as the absence of disease but for most people it was more than that. They tended to agree, it would seem, with the World Health Organisation's definition of health as a "state of complete physical, social and mental well-being and not merely the absence of disease and infirmity" (Kohn and White, 1976).

Andersen's behavioural model of health service utilisation (refer page 52) suggests that individuals must perceive illness or the probability of its occurrence before they seek medical care. According to that model, perceived need (for health services) is the stimulus for health service use. Respondents were asked whether, during the two weeks prior to interview, they took certain actions in relation to their health. One of these actions included days away from school or work. Respondents were also asked directly how they rated their health in general (from excellent to poor). The two measures of health of reported number of short-term disability days and self-assessed health status were used as independent variables in the present analysis. Various studies had utilised one or both of these measures as indicators for use of health services (Newman, 1973; Kohn and White, 1976; Kalimo and Bice, 1973).

- Health-related actions covered by the survey involved the use of health services such as consultations with doctors and other health professionals. Doctor consultations referred to any occasion in the two weeks prior to the interview on which a respondent discussed his/her own health with, or received treatment from, a doctor. It was during this period of consultation that the respondents may or may not be referred for other health services. The present study attempts to explain the variation in both consultation and referral rates in the health regions in Australia as a function of socioeconomic background and health care characteristics as per a modified version of Andersen's behavioural model of health services utilisation (refer page 47). Consultation and referral rates were used in the study as dependent variables.

- Health Risk Factors: A variety of social, economic and environmental, as well as aetiological, factors are recognised as increasing the risk of ill-health. The NHS89/90 focussed on selected health risk factors which were determined following consultations with health professionals, policy makers, administrators, etc. The health risk factors selected as independent variables for the present study were smoking, alcohol consumption, exercise and body mass index (relative weight).

Smoking: smoking is implicated in over 20 per cent of all deaths - and over 30 per cent of all cancer deaths are attributed to it (AIH, 1990). Since knowledge of this relationship may affect individual behaviour, cigarette smoking is used in this study to facilitate assessment of its effect on health services use in the populations under study. Smoking status was measured in the survey by ascertaining the approximate number of cigarettes smoked per day by the respondent. For persons whose smoking patterns vary from day to day, the average daily consumption over a week was recorded. Respondents were also asked the number of years they had been smoking. A new variable was generated from these two measures for the analysis (see Appendix A: I). Studies have shown that the increased incidence of cancer of the lung is in direct proportion to the number of cigarettes smoked per day and the lowered incidence of lung cancer is in direct proportion to the number of years since the habit of smoking has been dropped (Doll and Hill, 1964:1339). Some under-reporting of smoking, both in terms of persons identified as current smokers and in the reported quantity smoked, is expected to have occurred (Castles, 1991:31). The reasons for this may be due to guilt/embarrassment, social pressures and probably

this may be due to guilt/embarrassment, social pressures and probably recall problems especially regarding the duration of smoking habit.

Alcohol: it is well-known that there are health problems associated with excessive intake of alcohol such as ulcers, heart and liver diseases. In addition there are also indirect implications for the alcohol user, such as, the association with violence, road and other accidents. Respondents were asked about the types and quantities of alcoholic drinks consumed on each of the seven days prior to interview. Reported quantities of drinks consumed in a week were converted by the ABS to millilitres of alcohol present in those drinks (absolute alcohol per day was converted to millilitre equivalents using the ratio: 1ml = 0.70 gm). A new composite index was computed for the amount of alcohol consumed daily (see Appendix A: II). This is the best available measure used for the analysis. It is accepted that extensive and prolonged alcohol consumption has a deleterious effect on health but the information on, for example, years of alcohol consumption has, unfortunately, not been collected by the ABS. Some under-reporting of consumption in terms of persons identifying as having consumed alcohol in the reference week, and in the amount drunk, is expected to have occurred (Castles, 1991:33). A comparison with the 1977 Survey of Alcohol and Tobacco Consumption Patterns, according to the ABS, indicated that reported consumption accounted for around half of apparent consumption. It was also noted by ABS that the National and Medical Research Council grouped respondents into relative health risk categories by the amount consumed not just on a daily basis but on a regular basis, whereas the indicators derived from the NHS 1989/90 related to consumption during the reference week and took no account of

whether or not consumption in that week was more, less or similar to usual consumption level. As a result, the predictive power of this variable will probably be reduced (Berk, 1983).

Exercise: exercise is defined as leisure-time physical activity. It is generally agreed that this is also relevant to health, especially for protection against coronary heart disease, and activity which is undertaken as part of work is a matter which has to be considered separately (unless of course it is very strenuous work). Respondents were asked about the different types of activities which they had done in the "last fortnight", and also about the amount of time spent on such activities. A new variable was computed from these data for the purpose of the study (see Appendix A: III) so that a total measure of the amount of exercise performed in the fortnight prior to interview was used for the analysis. In general, the use of a fortnight as reference period was not considered to pose significant recall problems for respondents. For most people, participation in exercise was regular and for a set period each session (Castles, 1991:35).

Relative weight (i.e. weight in relation to height) is regarded as an indicator of possible health risk, such as, heart disease and diabetes, particularly when linked with other lifestyle factors such as smoking and lack of exercise (Castles, 1991:40). Respondents were asked to report their height and weight. Relative weight was derived using Quetelet's body mass index which is calculated as weight (in kg) divided by the square of height (in metres). This measure was used in the data analysis but has to be recoded for the following reason. The acceptable body mass

index for an individual is between 20 - 25 kg/m²; therefore, body mass indices below and above this range may be unacceptable for various reasons. Underweight may be due to conditions such as malnutrition, anorexia, bulimia or cancer, whereas, overweight or obesity creates health problems such as heart conditions and diabetes as stated above. The variable is therefore recoded to indicate acceptable for body mass index 20-25kg/m² and unacceptable for body mass index outside this range.

- Demographic characteristics: In addition to specific health information collected, the survey also obtained a range of information describing the demographic and socioeconomic characteristics of the sample. Andersen's model suggests that some individuals have a propensity to use services more than other individuals. This propensity can be predicted by individual characteristics which exist prior to the onset of illness. Such characteristics include demographic and social-structural variables, such as race, age, sex, marital status, education, income and insurance coverage. In order to account for this influence, the six variables, age, sex, marital status, education, income and insurance coverage, have been included as independent variables in the analysis. Racial differences in health care service usage have been recognised in various studies (Newman, 1975; Andersen and Newman, 1973). The health status of the aboriginal people in Australia is substantially worse than that of other Australians with the causes of poor health inextricably linked with their social and economic disadvantage (refer page 24). While this is very much so, the NHS89/90 data used for this study do not allow for the identification of aboriginality.

This chapter looked at the methodology used for the study. The following chapter discusses the analysis of the data and presents the results of the study.

CHAPTER FOUR

DATA ANALYSIS AND RESULTS

4.1 Introduction

This chapter presents the methods and the results of the data analysis. Data analysis was carried out using the Statistical Package for the Social Science (SPSS for Windows + Release 6.0).

4.2 Characteristics of the Samples

Recall that three samples were selected for Stage 1 of the study, which looked at individual levels of consultation and referral rates. Sample 1 (n=1215) consisted of the respondents who saw the doctor and were referred for other health care services. Sample 2 (n=1215) was a random sample drawn from the rest of the respondents who saw the doctor and were not referred. Sample 3 (n=1215) was a random sample from the NHS 1989/90 sample of respondents who did not visit the doctor in the fortnight preceding the interview.

To see whether there were any significant differences between the respondents who visited the doctor (samples 1 and 2) and the respondents who did not visit the doctor (sample 3), all three samples drawn from the NHS 1989/90 sample were used for Stage 1 of the analysis. Independent t-tests were performed to compare the samples. This was done to

ascertain to what extent (if any) they varied on variables thought significant for the study. Table 4.1 presents the results of the tests.

The respondents from the sample who had visited the doctor (samples 1 and 2) were of an older age group (mean of 43 years versus 35 years), of lower income and education level than those who did not visit the doctor (sample 3). The average amount of alcohol consumed and cigarettes smoked were of a slightly higher level for samples 1 and 2 as against sample 3. Samples 1 and 2 were also characterised by more females: 59% compared to 48% of those who did not see the doctor. There is a higher percentage of respondents in samples 1 and 2 with poor self-assessed health status and a greater amount of disability days. The respondents who visited the doctor exercised less in the two weeks prior to interview. Respondents who saw the doctor had a slightly higher percentage of unacceptable body mass index than those who did not visit the doctor. A higher percentage of respondents from the sample who visited the doctor have no insurance cover compared to the other group; although this difference is small and could be due to sampling variation. According to the literature (refer pages 51-52), insurance coverage is a factor which enables a person to seek health care. On further examination of the data, it was found that the percentage of insurance coverage decreases with the lower income and less educated groups. Since the people with the lower income and the less educated visited the doctor more, this result could be expected. Moreover, the extension of the bulkbilling facility under the Medicare system by GPs to the lower income groups might have helped overcome the enabling effect to seek

Table 4.1 Comparison of Samples on Variables Used in the Analysis

	Visited GP and Referral n = 2430		No visit to GP n = 1215		Probability
	Mean	SD	Mean	SD	
Age (years)	42.5	4.7	35.0	4.2	<.01
Income (\$)	15,107.0	2.9	16,194.0	3.3	.64
Amount of alcohol consumed daily (mls)	4.8	12.8	4.5	10.9	.09
Number of cigarettes smoked (*365)	87.0	258	85.8	251	.89
Number Short-term disability days	2.8	4.9	0.5	2.2	<.01
Exercise level (daily)	785.0	2449.0	904.0	3022	.20
Relative weight Accept=0 Unaccept=1	.65	.48	.63	.48	.39
Sex Male=0 Female=1	.59	.49	.48	.50	<.01
Education High=0 Low=1	.90	.31	.86	.34	.01
Self-assessed health Good=0 Poor=1	.40	.49	.16	.37	<.01
Insurance No=0 Yes=1	.50	.50	.55	.50	.03
Partnered Yes=0 No=1	.47	.50	.53	.50	<.01

care that can only be provided either through sufficient income or insurance coverage. It would be interesting to note, however, whether insurance coverage makes a greater difference when it comes to referral rates to other health care services. Would the respondents who were referred have a higher percentage of insurance cover? This will be discussed in the logistic regression findings between sample 1 (who visited the doctor and were referred) and sample 2 (who visited the doctor and were not referred). Insurance coverage would be important as an enabling factor in referral to other health care services due to the 'topping-up' necessary for charges for referred services above the schedule fees under Medicare.

Contrary to what has been suggested in the literature the results showed that un-partnered people were less likely to visit the doctor than partnered ones although the percentage difference is small (47% visited the doctor compared to 53% who did not visit the doctor). Further examination of the data revealed that samples 1 and 2 had a higher percentage of female respondents who were also in the age group of 25 - 45 years. This might account for the fact that more married people visited the doctor and in the case of the female married respondent these might have been referred to gynaecological and obstetrical services (Sorkin, 1992).

There were significant differences between the samples on some of the variables. The major difference was with regard to the number of short-term disability days, that is, the more disability days the respondent experienced in the fortnight prior to the interview the greater the likelihood of consulting the GP. This would appear to support Andersen's

model that certain characteristics of the population determined utilisation of health services. For example, Newman (cited in Andersen, Kravits and Anderson, 1975), in a study of health status and the utilisation of physician services in the United States using Andersen's model, found disability days to be an important predictor.

Note, where there are significant differences, the magnitude of differences between samples was small. Since the samples were large, even a small difference constitutes a significant difference.

4.3 Representativeness of the Sample

All three samples from above were merged and compared with the 1991 Census in order to examine whether or not the sample accurately represents the population of Australia. The NHS (1989/90) was not a census. The sample design of the survey was a multi-stage area sample of private and non-private dwellings in Australia, unlike that of a census where all the households are included. Hence indices of dissimilarity were computed in order to examine whether or not the sample selected for analysis accurately represented, on selected demographic and socioeconomic variables, the population of Australia. Table 4.2 shows the results of the distributions of selected demographic and socioeconomic variables of the samples and the 1991 Census of the Australian population along with the respective indices of dissimilarity.

Table 4.2 Distributions of Selected Demographic and Socioeconomic Variables of the Selected Sample (NHS89/90) and the Australian Population (1991 Census) with Their Respective Indices of Dissimilarity (I_d)

	Selected Sample		Australian Population		I_d
	N	%	N	%	
Age					
< 35 years	1793	49.2	9146055	54.3	
35 - 64 yrs	1274	34.9	5797691	34.5	
> 65 years	578	15.9	1906676	11.2	
Total	3645	100.0	6850422	100.0	5.1
Gender					
Males	1632	44.8	8362818	49.6	
Females	2013	55.2	8487604	50.4	
Total	3645	100.0	16850422	100.0	4.8
Marital Status					
Married	1860	51.0	7344438	56.1	
Un-partnered	1785	49.0	123514394	43.9	
Total	3645	100.0	130858832	100.0	5.1
Country of Birth					
Australia	2814	77.2	2725163	75.5	
Other	831	22.8	4125370	24.5	
Total	3645	100.0	16850533	100.0	1.7
Income (15+ years)					
< \$20,000	1690	58.1	7303142	58.1	
\$20 - 40,000	729	24.9	3384065	25.9	
> \$40,000	262	17.0	2098164	16.0	
Total	2681	100.0	12785371	100.0	1.0
Employment Status (Labour Force only)					
Employed	1496	91.6	7109336	88.5	
Unemployed	138	8.4	931926	11.5	
Total	1634	100.0	8041262	100.0	3.1

Note: The Index of Dissimilarity (I_d) is computed as follows:

$$I_d = \frac{1}{2} \sum | \text{dist}_1 - \text{dist}_2 |$$

where dist_1 and dist_2 are the category percentages of the individual variable in the sample and Australian population respectively. In the gender variable, for example, the Index of Dissimilarity is computed by halving the sum of the percentage differences in the male and female categories giving an Index of Dissimilarity of 4.8. This means 4.8% would have to be shifted from one distribution to the other in order to have identical distributions.

Among the 3645 respondents there was considerable bias towards the female respondents. There were 2013 (55.2%) women compared to 1632 (44.8%) men. The bias probably comes from the fact that there were more women in samples 1 and 2 (respondents who saw doctor). However, when compared with the Census population, one also finds a small bias towards the female population. For gender, the computed index of dissimilarity is 4.8% ; that is, 4.8% would have to be shifted from one distribution to the other in order to have identical distributions.

There were 1793 respondents (49.2%) who were less than 35 years of age, 1274 (34.9%) respondents in the 35 to 64 age group and 578 (15.9%) respondents who fitted into the category of 65 years and over. In comparing the distribution with the national figures, the sample had 5.1% fewer respondents below the age of 35, 0.4% more in the 35 to 64 age group and 4.7% more respondents over 65 years. The index of dissimilarity for age is 5.1%.

The number of respondents reported being involved in a relationship was 1860 (51.0%), while 1785 (49%) were either single, separated, divorced or widowed. The figures for marital status approximate the national figures with the survey having 5.1% fewer respondents who are married. In order to have identical distributions, 5.1% would have to be shifted from one distribution to the other.

With regard to the country of birth, most respondents were born in Australia, 77.2% compared to 22.8% of respondents of other origin. This

figure is very similar to the national figure with an index of dissimilarity of only 1.7%.

The majority of the respondents above 15 years of age (58.1% or n=1690) earned less than \$20,000, similar to that of the national distribution. However, respondents earning over \$40,000 were slightly more than in the Australian population (17.0% versus 16.0%). In order to have identical distributions, 1% would have to be shifted from one distribution to the other.

In the labour force, 91.6% of the respondents from the sample were employed compared to 88.5% in the nation. The computed index of dissimilarity is 3.1%.

The probability sample can be described as having the following characteristics. The majority of the sample consisted of females and were above the 35 years age group. Fifty-one per cent of the respondents reported being married. Most respondents were Australian-born and earned less than \$20,000 per annum with the majority of respondents in the labour force.

Comparison with the Census on the selected demographic and socioeconomic characteristics would seem to suggest that the sample is representative of the nation. The results were reassuring as they showed no major discrepancies, and it is thus reasonable to assume that any inference from the data could also apply to Australia as a whole.

4.4 Stage 1: Individual Level Analysis

4.4.1 Predicting Consultation Rates

Sample 1 (n=1215 who saw the doctor and were referred to other health care services) and sample 3 (n=1215 who did not visit the doctor) were merged and used for this stage of the analysis. Logistic regression was used to investigate the relationship between the dependent variable, GP consultation, and the independent variables following Andersen's model. Logistic regression is used because the dependent/outcome variable is binary or dichotomous (0=No; 1=Yes). The predicted values can be interpreted as probabilities falling in the interval between 0 and 1. When the dependent variable has only two values, the assumptions required for hypothesis testing in regression analysis are violated. The errors are not normally distributed, rather they form a binomial distribution. Some assumptions, however, are still needed for this statistical analysis: a random sample, correct knowledge of group membership, and data that are free of measurement errors and outliers. The model also assumes that the predicted values are linearly related to the independent variables. This latter assumption was tested by examining the residual scatterplots (see Appendix B: Figures I - VI). According to Tabachnick and Fidell (1989: 131) residual scatterplots may be examined in lieu of initial screening runs. The assumptions were met, further screening of variables were unnecessary and the analysis continued.

In logistic regression the probability of an event occurring can be estimated using the following equation for a single independent variable:

$$\text{Probability (event)} = \frac{1}{1 + e^{-(B_0 + BX)}}$$

where B_0 and B = coefficients estimated from the data
 X = value of independent variable
 e = base of natural logarithms.

For more than one independent variable, the model can be written as

$$\text{Probability (event)} = \frac{1}{1 + e^{-z}}$$

where z is the linear combination

$$z = B_0 + B_1X_1 + B_2X_2 + \dots + B_PX_P$$

Prior to undertaking a logistic regression analysis to investigate the relationship between the dependent variable, GP Consultation (Yes=1/No=0) and the selected independent variables following Andersen's model, it is necessary to perform certain recoding procedures.

Age, income, daily amount of alcohol consumed, number of cigarettes smoked during lifetime, exercise levels, total number of short-term disability days were kept as quantitative variables. Relative weight and education were recoded into categorical variables and together with sex, marital status, self-assessed health status and insurance coverage were subsequently recoded as dummy/indicator variables and represented as follows:

Sex: Male=0, Female=1
 Self-assessed health status: Good=0, Poor=1
 Marital status: Partnered=0, Not partnered=1
 Insurance coverage: No=0, Yes=1

Relative weight: Acceptable=0, Unacceptable=1
Education: High=0, Low=1

The reason why the male was chosen as a reference class (i.e., the class for which the indicator variable is coded 0) is that it is expected that males would have less uptake of services than females according to the literature review. By making the male the reference class, the odds ratio associated with the regression coefficient will be greater than 1, facilitating its interpretation. Similarly, good self-assessed health status, high education, no insurance coverage, acceptable relative weight and married status are chosen as the reference classes because these categories are expected to have less uptake of services as discussed under the proposed theoretical model (pages 49-53).

Another step in the procedure before logistic regression is carried out, is to perform a correlational analysis of all the independent variables. This was to check for multicollinearity or intercorrelation among independent variables. Multicollinearity may create unreliability in the parameter estimates. To reduce the standard errors of the estimated regression coefficients of the variables, correlated variables may need to be dropped from the model. Although the correlational analysis indicated several weak to moderate significant associations between some of the independent variables, the correlations between them are not sufficiently large to be a problem. Lewis-Beck (1980: 60) suggested that a correlation coefficient of less than 0.8 should not pose a problem. All variables were kept in the model for the study. Table 4.3 shows the results of the correlational analysis undertaken to check for existence of multicollinearity.

Table 4.3 Correlational Matrix of Independent Variables to be Used in the Analysis of Stage 1

	1	2	3	4	5	6	7	8	9	10	11	12
1 Age												
2 Alcohol intake	.15*											
3 Education	.18*	.01										
4 Exercise	.21*	.05	-.00									
5 Sex	.05	-.07	.07*	-.02								
6 Self-assessed health	.34*	-.02	.09*	-.08*	-.02							
7 Income	.30*	.19*	-.13*	.18*	-.20*	-.20*						
8 Insurance coverage	-.04	.04	-.07*	-.00	.04	-.19*	.25*					
9 Marital status	-.16*	-.06*	-.02	.08*	.08*	.07*	-.18*	-.19*				
10 Cigarettes consumption	.18*	.11*	.06*	-.03	-.08*	.08*	.09*	-.09*	-.05			
11 Disability days	.17*	-.02	.05	-.06*	.01	.30*	.01	-.07*	.03	.06*		
12 Relative weight	-.20*	-.10*	.02	-.18*	-.03	-.17*	-.22*	-.01	-.02	-.04	.03	

* $p < 0.05$

Table 4.4 contains the estimated coefficients (under column B) and related statistics from the logistic regression model that predicts whether a respondent consulted his/her GP or not. The prediction is based on age, sex, income, self-assessed health status, number of short-term disability days, education levels, marital status, insurance coverage, alcohol consumption, number of cigarettes smoked, exercise levels, relative weight of the respondent and a constant.

4.4.1.1 Interpretation of the coefficients

To understand the interpretation of the logistic coefficients, a rearrangement of the equation for the logistic model has to be considered. The logistic model can be rewritten in terms of the odds of an event occurring. Written in terms of the log of the odds, the equation for the logistic model is

$$\log \frac{\text{Prob (event)}}{\text{Prob (no event)}} = B_0 + B_1X_1 + B_2X_2 \dots\dots\dots + B_pX_p$$

The logistic coefficient can be interpreted as the change in the log odds associated with a one-unit change in the independent variables. However, since it is easier to think of odds rather than of log odds, the equation can be written in terms of odds as

$$\frac{\text{Prob (event)}}{\text{prob (no event)}} = e^{B_0+B_1X_1 \dots\dots\dots + B_pX_p} = e^{B_0} e^{B_1X_1} \dots\dots e^{B_pX_p}$$

Table 4.4: Logistic Regression Consultation (Yes/No) with Selected Variables as per Andersen's Model

Variable	B	S.E.	Sig.	Exp(B)
Age	.0347	.0161	.0315	1.0353
Education	.0280	.1625	.8632	1.0284
Exercise (units)	.0167	.0120	.1627	1.0168
Gender	.6765	.1130	.0001	1.9669
Self-assessed Health	1.0469	.1314	.0001	2.8487
Income	-.0236	.0195	.2267	.9767
Insurance	.0574	.1106	.6038	1.0591
Cigarettes Consumption	-.0003	.0002	.0845	.9997
Alcohol Consumption	.0011	.0006	.0835	1.0011
Disability Days	.1819	.0178	.0001	1.1995
Partnered	-.2380	.1154	.0391	.7882
Relative Weight	.0417	.1049	.6907	1.0426
Constant	-1.0943	.2607	.0001	

Number of selected cases: 2430

Number rejected because of missing data: 568. These respondents were mainly under 15 years of age, ie, they would not have an income, be partnered and so on.

Number in analysis: 1862

Note: Consult GP: No=0, Yes=1
Relative weight: Acceptable=0, Unacceptable=1
Sex: Male=0, Female=1
Education: High=0, Low=1
Self-assessed health: Good=0, Poor=1
Insurance cover: No=0, Yes=1
Partnered: Yes=0, No=1
Age: 1-17 (in units of 5 years)
Income: 1-12 (in units of \$5,000)

then e^{B_i} raised to the power B_i is the factor by which the odds change when the i th independent variable increases by one unit. If B_i is positive this factor will be greater than 1 which means the odds are increased; if B_i is negative the factor will be less than 1, which means that the odds are decreased. When B_i is 0, the factor equals 1, which means that the odds are unchanged (Norusis, 1990: B-43). For instance, the education coefficient, discussed below, is 0.028 which gives an odds ratio of 1.0284 (Column 5 in Table 4.4), implying that a respondent with lower education has approximately 3% higher chances of visiting the doctor. In other words, one's education level contributes relatively little to explaining the variation in the dependent variable, the odds are almost unchanged in either category of education.

The coefficients for education, gender, self-assessed health status, marital status, insurance coverage and relative weight status are log odds ratios, since these variables are dummy variables. The coefficient of relative weight, similar to education, implies an insignificant relationship with the dependent variable. Respondents with an unacceptable body mass index have only 4% higher chances of visiting the doctor. On the other hand, the gender coefficient implies that women's log odds of seeing a doctor are 0.68 higher than men's indicating an odds ratios of 1.97. In other words, women have almost twice the chance of men of consulting their GPs, controlling for all the other independent variables. Individuals of poor self-assessed health status have a higher log odds of consulting a GP. The odds ratio implied by the coefficient is 2.85. Respondents who had health insurance coverage had 5% higher chances of visiting the doctor. Unmarried people, contrary to what is implied by Andersen's

model, have decreased log odds of consulting a GP. The coefficient implies an odds ratio of 0.78 which means that unmarried people have about three quarters chances of married people of visiting a doctor.

The coefficients on the continuous variables indicate the net change in the logit for one unit change in the relevant independent variable. The odds of consulting a doctor increases with age and the number of short-term disability days. Older people and more disabled individuals have higher log odds of seeing a doctor than younger people, and people with fewer short-term disability days. Every category of age (5-year interval between categories) increases the odds of seeing a doctor 1.04 times and each day of disability increases the odds of GP consultation 1.2 times. The exercise coefficient, contrary to what might be expected, increases the odds of seeing a doctor by 2%. On the other hand, people with higher income, are less likely to see a doctor although the odds are only .97 times for every category increase in income (\$5000 interval between categories). In other words, income of the respondent made relatively little difference to the consultation rates. The odds of consulting a GP is unchanged with alcohol consumption. The negative coefficient for cigarette smoking implies a diminished but minimal odds ratio of consulting a doctor contrary to what the literature suggested. According to Berk (1983), this may be due to sample selection bias. People who smoke more are more likely to have fatal illnesses and dead people won't visit the GP!

4.4.1.2. Goodness of Fit of the Model

There are various ways to assess whether or not the model fits the data. One way is to compare the predictions to the observed outcomes as shown in Table 4.5.

Table 4.5 Classification Table for GP Consultation (Yes/No)

		Predicted		% Correct
		Not consulted	Consulted	
		0	1	
Observed				
Not consulted	0	588	257	69.6%
Consulted	1	343	674	66.3%
		Overall		67.8%

From table 4.5, 588 respondents who did not see the doctor were correctly predicted by the model not to have consulted the doctor. Similarly, 674 respondents who consulted the doctor were correctly predicted to have seen the doctor. The off-diagonal entries of the table showed how many respondents were incorrectly classified. A total of 600 respondents were misclassified - 257 who have not seen the doctor and 343 who had. Of the respondents who had not seen the doctor in the last fortnight, 69.6 per cent were correctly classified. Of those who had seen the doctor, 66.3 per cent were correctly classified. Overall, 67.8 per cent of 1862 respondents

were correctly classified (fifty per cent would have been predicted correctly by chance).

Homer and Lemenshow (1989: 146-147) indicate that a logistic regression model that fits the data may not necessarily predict group membership accurately, and they caution against using the classification table on its own as a measure of fit. It is also the case that by somewhat arbitrarily assigning individuals to either of the categories of the response we lose a fair bit of information contained in the predicted probabilities. For instance, the model would treat two individuals with predicted probabilities of 0.49 and 0.51 as being in different categories of the response if the classification is requested.

Another way of assessing the goodness of fit of the model is to actually examine how likely the sample results are, given the parameter estimates. This utilises the likelihood function which expresses the probability of observing the data in terms of the statistical model that is being estimated. The maximum likelihood estimation attempts to maximise the value of the likelihood function, or more precisely the logarithm of the likelihood because this is mathematically straightforward. When the log-likelihood has been maximised, values of the parameters in the statistical model are chosen that make the probability of observing a specified outcome as high as it can be. In the analysis, the log-likelihood for the null model, that is a model containing the intercept only, and the log-likelihood for the model estimated are printed. In this analysis, the log-likelihood for the model containing only the intercept is 2565.369 while for the model with the covariates it is 2178.187. The difference is 387.182 with 12 degrees of

freedom (df). A chisquare statistic of 387.2 with 12 df is highly significant, thus implying that the independent variables do contribute to explaining the variation in the dependent variable. In light of this and given that the classification table is a crude measure of the probability of consultation rates, the results of the logistic regression analysis can be used to calculate the probability of visiting the doctor as a function of the selected characteristics in Andersen's model. The two extremes understood as Weberian ideal types were used in conjunction with the equation to examine the probability of consulting and not consulting a doctor.

4.4.1.3 Weberian Ideal Type

Weber (1968) suggested that an "ideal type" is a hypothetical construction formed from real phenomena which has an explanatory value and which can be used as a testable model of the real world. Characteristics of the ideal type are made up of certain aspects of behaviour or institutions observable in the real world and exaggerated to form a coherent intellectual construction.

Given the coefficients as in Table 4.4 above, the logistic regression equation for the probability of consulting a GP can be written as

$$\text{Probability (consultation)} = \frac{1}{1 + e^{-z}}$$

where

$$z = 0.0347 (\text{Age}) + 0.0280 (\text{Education}) + 0.0167 (\text{Exercise}) + 0.6765 (\text{Gender}) + 1.0469 (\text{Self-assessed Health}) - 0.0236 (\text{Income}) + 0.0574 (\text{Insurance coverage}) - 0.0003 (\text{Cigarette consumption}) + 0.0011 (\text{Alcohol Consumption}) + 0.1819 (\text{Disability Days}) - 0.2380 (\text{Partnership}) - 0.0417 (\text{Relative Weight}) - 1.0943 (\text{Constant})$$

Values were selected from the frequency tables (these have not been reproduced as some frequencies stretch over a large range of values, taking up several pages) to indicate the extremes of each variable that will most likely predict the probability of consultation. For an individual who is female (value 1), partnered (value 0), in the oldest age group (value 14), with low income (value 1), poor assessed health status (value 1), low education (value 1), maximum of short-term disability days (value 14), over/underweight (value 1), does not exercise (1), drinks alcohol in excess (value 60) and smokes (value 40) and is covered by insurance (value 1),

$$\begin{aligned} z &= 0.0347 (14) + 0.0280 (1) + 0.0167 (1) + 0.6765 (1) + 1.0469 (1) - 0.0236 (1) + 0.0574 (1) - 0.0003 (40) + 0.0011 (60) + 0.1819 (14) - 0.2380 (0) + 0.0417 (1) - 1.0943 \\ &= 3.8357 \end{aligned}$$

The probability of consulting a GP is estimated to be

$$\text{Prob (Consultation)} = \frac{1}{1 + e^{-z}} = \frac{1}{1 + e^{-(3.8357)}} = 0.98$$

Based on this estimate one could predict that an individual with the above characteristics is almost certain to consult the doctor - the estimated probability of the event occurring is greater than 0.5, in fact, 98 per cent of the time would such an individual consult a doctor.

To look at the other extreme situation where the individual is male (value 0), married (value 1) and of a younger age group (value 4) with medium income (value 7), good perceived self-health (value 0), education (value 0), no disability days (value 0), acceptable weight (value 0), regular exercises (value 8), and consumes moderate amount of alcohol (value 20) and does not smoke (value 0), and is not insured (value 0)

$$\begin{aligned} z &= 0.0347 (4) + 0.0280 (0) + 0.0167 (8) + 0.6765 (0) + 1.0469 (0) - \\ &0.0236 (7) + 0.0574 (0) + 0.0003(0) + 0.0011 (20) + 0.1819 (0) \\ &-0.2380 (1) + 0.0417 (0) - 1.0943 \\ &= -1.2031 \end{aligned}$$

$$\text{Prob (consultation)} = \frac{1}{1 + e^{-z}} = \frac{1}{1 + e^{-(-1.2031)}} = 0.23$$

Based on this estimate one could predict that for an individual with the above characteristics there is only 23 per cent chance of consulting a doctor.

4.4.1.4. Adequacy of Statistical Model

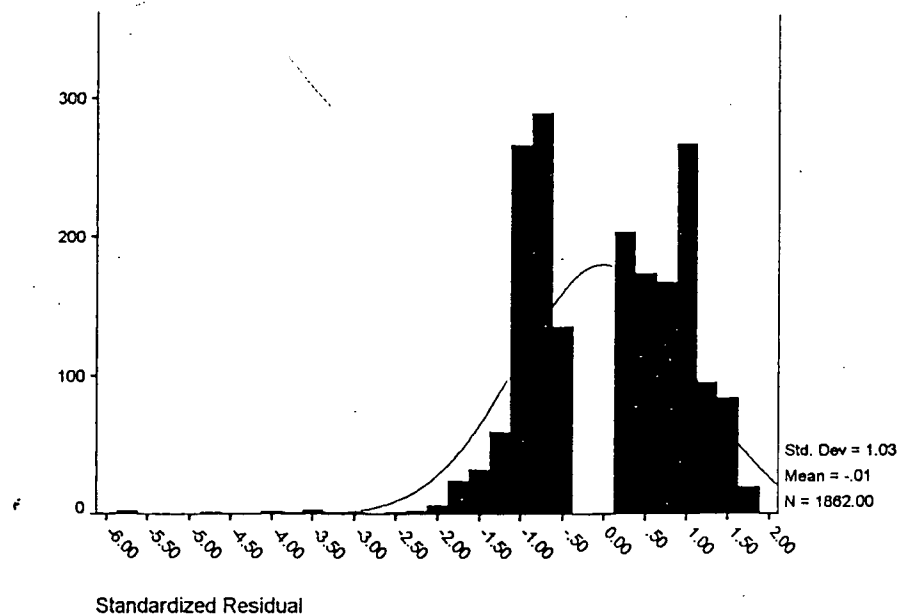
Finally, whenever a statistical model is built, it is important to examine the adequacy of the resulting model. In logistic regression, a diagnostic

procedure that can be used to examine the adequacy of the statistical model is to look at the standardised residual. The residual is the difference between the observed probability of the event and the predicted probability of the event based on the model. The standardised residual (Z_i) is the residual divided by an estimate of its standard deviation where

$$Z_i = \frac{\text{Residual}}{(\text{Pred.Prob.i}) (1 - \text{Pred.Prob.i})}$$

For each case the standardised residual can also be considered a component of the chi-square goodness-of-fit statistic. With a large sample size, the standardised residuals should be approximately normally distributed with a mean of 0 and a standard deviation of 1. Figure 4.1 shows a distribution of the standardised residuals with results of mean and standard deviation that indicate that the model is adequate ($\bar{x} = .01$; $SD = 1.03$).

Figure 4.1. Histogram of Standardised Residual : Predicting Consultation Rates



4.4.2 Predicting Referral Rates

A sample of respondents which consisted of sample 1 (n=1215 who saw the doctor and were referred to other health care services) and sample 2 (n=1215 who saw the GP and were not referred) was used for this stage of the analysis. Logistic regression analysis was carried out to examine whether Andersen's model could equally well predict the probability of being referred to specialists and other health care services or not *following* respondents' visit with their GPs.

Relevant variables as in the previous analysis were selected, recomputed and recoded as before. Table 4.6 contains the estimated coefficients and related statistics from the logistic model that predicts whether a respondent was referred or not from a constant and the relevant selected variables.

4.4.2.1 Interpretation of the Coefficients

The coefficients for the dummy variables are examined first. Less educated people have a greater chance of being referred to other health care services. The odds ratio is 1.14. The gender coefficient implies that women are more likely to be referred with an odds ratio of 1.15. One's perception of poor health has the most impact on being referred. The coefficient of self-assessed health is .26 implying an odds ratio of 1.29. Similarly, people that are insured have a likelihood of being referred to other health care services. The odds ratio is 1.14. Contrary to what might be expected, unpartnered people are less likely to be referred with an odds

Table 4.6: Logistic Regression Referral (Yes/No) with Selected Variables as per Andersen's Model

Variables	B	S.E.	Sig.	Exp(B)
Age	-.0211	.0134	.1166	.9791
Education	.1331	.1543	.3885	1.1424
Exercise(units)	.0091	.0107	.3980	1.0091
Gender	.1416	.1010	.1612	1.1521
Self-health	.2551	.1039	.0141	1.2906
Income	.0117	.0181	.5161	1.0118
Insurance	.1321	.0996	.1849	1.1412
Cigarettes intake	.0013	.0033	.6964	1.0013
Alcohol consumption(mls)	.0007	.0005	.1832	1.0007
Disability days	.0460	.0094	.0001	1.0470
Partnered	-.1738	.0992	.0797	.8405
Relative weight	-.0197	.0950	.8357	1.0013
Constant	-.1777	.2427	.4642	

Number of selected cases: 2430

Number rejected because of missing data: 498. These respondents were mainly below 15 years of age and therefore would not have an income, be partnered and so on.

Number in analysis: 1932

Note: Referred: No=0, Yes=1
Relative weight: Acceptable=0, Unacceptable=1
Sex: Male=0, Female=1
Education: High=0, Low=1
Self-assessed health: Good=0, Poor=1
Insurance cover: No=0, Yes=1
Partnered: Yes=0, No=1
Income: 1-12 (in units of \$5,000)
Age: 1-17 (in units of 5 years)

ratio of 0.84. Further discussion of this unusual finding will be carried out in Chapter Five. The odds for people in the two relative weight categories is unchanged - no contribution is made by the weight category to explaining the variance in the dependent variable.

The negative coefficient of age implies that as one gets older the odds of referral to other health care services are diminished, although the odds are minimal. On the other hand, the more disabled days a respondent experienced, the more likely the odds of referral. In other words, each day of disability increases the odds of referral 1.05 times. The odds of being referred are unchanged for income, exercise level, number of cigarettes smoked and alcohol consumption.

4.4.2.2 Goodness of Fit of the Model

Table 4.7 shows the classification which compares the predicted and the observed outcomes. From the table, 444 respondents who were not referred to other health care services were correctly predicted by the model not to have been referred. Similarly, 622 respondents who were referred were correctly predicted to have been referred. The off-diagonal entries of the table showed how many respondents were incorrectly classified. A total of 866 respondents were misclassified - 471 who had not been referred and 395 who had. Of the respondents who were not referred to other health care services in the last fortnight, 48.5 per cent were correctly classified. Of those who had been referred, 61.2 per cent were correctly classified. Overall, 55.2 per cent of 1932 respondents were correctly classified - 5.2% better than chance.

Table 4.7: Classification Table for Referral to Other Health Care Services (Yes/No)

		Predicted		% Correct
		Not Referred 0	Referred 1	
Observed	Not Referred 0	444	471	48.5%
	Referred 1	395	622	61.2%
Overall				55.2%

It is evident from the classification table that Andersen's model is not as good for predicting the probability of referral services as for predicting the probability of consulting a GP. In other words the initial decision whether to make contact with the medical care system may be primarily a function of individual predisposing, enabling and need variables, but once individuals have visited the doctor, presumably other factors are relevant. What is it that takes effect after a patient sees a doctor to increase the patient's chance of being referred to other health care services? Could provider variables be more important in explaining differences in utilisation after contact has been made (Shortell in Andersen, Kravits and Anderson, 1975)? The next chapter will attend to this issue in greater detail.

For the present, in comparing the log-likelihood for the null model, containing the intercept only (2672.933) with the log-likelihood for the

model with the covariates (2630.45), the difference of 42.49 with 12 degrees of freedom is significant, thus implying that the independent variables do contribute to explaining the variation in the dependent variable. However, sample size affects the chi-square value. Hence the impact may be minimal.

4.4.2.3 Weberian Ideal Type

Again, given that the independent variables are significant in contributing to explaining the variation in referral rates and the classification table above is a crude measure of the probability of being referred, the two extremes understood as Weberian ideal types were used in the equation to calculate the probability of referral as a function of the selected characteristics following Andersen's model.

Given the coefficients as in Table 4.6, the logistic regression equation for the probability of having been referred to other health care services can be written as

$$\text{Prob(referred)} = \frac{1}{1 + e^{-Z}}$$

where

$$\begin{aligned} z = & .0211(\text{Age}) + .1331(\text{Education}) + .0091(\text{Exercise}) + .1416(\text{Sex}) + \\ & .2551(\text{Self-assessed Health}) - .0117(\text{Income}) + .1321(\text{Insurance coverage}) \\ & - .0013(\text{Cigarettes consumption}) + .0007(\text{Alcohol Consumption}) + \\ & .0460(\text{Disability Days}) - .1738(\text{Partnership}) - .0197(\text{Relative Weight}) - \\ & .1777(\text{Constant}) \end{aligned}$$

Substituting the corresponding numerical values, we find:

For an individual who is female (value 1), partnered (value 1), in the older age group (value 14), with low income (value 1), poor assessed health status (value 1), low education (value 1), maximum of short-term disability days, over/underweight (value 1), does not exercise (1), drinks alcohol in excess (value 60) and smokes (value 40) and is covered by insurance (value 1),

$$z = .0211(14) + .1331(1) + .0091(1) + .1416(1) + .2551(1) - .0117(1) + .1321(1) + .0013(40) + .0007(60) + .0460(14) - .1738(1) - .0197(1) - .1777$$

$$= 0.9045$$

The probability of having been referred to other health care services is estimated to be

$$\text{Prob (Referral)} = \frac{1}{1 + e^{-z}} = \frac{1}{1 + e^{-(.9045)}} = 0.71$$

Based on this estimate one could predict that an individual with the above characteristics is likely to be referred - the estimated probability of the event occurring is greater than 0.5, in fact, 71 per cent of the time would such an individual be referred to other health care services.

To look at the other extreme situation where the individual is male (value 0), partnered (value 1) and of a younger age group (value 4) with medium income (value 7), good perceived self-health (value 0), education (value 0), no disability days (0), acceptable weight (value 0), regular exercises (value 8), and consumes moderate amount of alcohol and does not smoke, and not insured (0)

$$z = .0211(4) + .1331(0) + .0091(8) + .1416(0) + .2551(0) - .0117(7) + .1321(0) - .0013(0) + .0007(20) + .0460(0) - .1738(1) - .0197(0) - .1777$$

$$= -0.4310$$

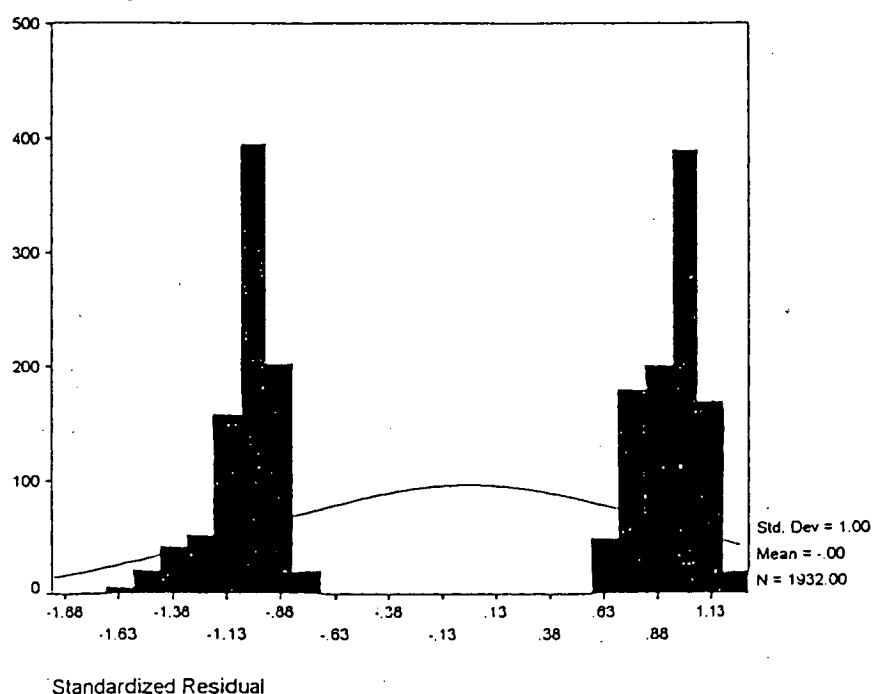
$$\text{Prob (Referral)} = \frac{1}{1 + e^{-z}} = \frac{1}{1 + e^{-(-0.4310)}} = 0.39$$

Based on this estimate one could predict that for an individual with the above characteristics there is only 39 per cent chance of being referred to other health care services.

4.4.2.4. Adequacy of Statistical Model

The adequacy of the resulting model was determined by examining the standardised residuals. Figure 4.2 presents a distribution of the standardised residuals with the results of the mean and standard deviation which indicate that the model is adequate ($\bar{x} = .00$; $SD = 1.00$).

Figure 4.2 Histogram of Standardised Residual: Predicting Referral Rates



4.5 Stage 2: Aggregate Level Explaining Variation in Referral Rates between Health Regions: Path Analysis

Path analysis was used to explain the variation in referral rates between the forty-seven health regions. Recall, Andersen's model for health care utilisation proposed that the sequence of conditions that contributes to the amount of health services a person uses can be grouped under three components: 1) the predisposition of the individual to use services; 2) his/her ability to secure services; 3) his/her perceived illness level. Path analysis evaluates the relative importance of various direct and indirect links between variables and as such helps to understand the causal

mechanisms between variables. A pictorial flowgraph specifies the nature of the proposed model, according to which the subsequent analysis is to be made (see Figure 4.3). Grichting (1979) employed path analysis in a study to explain rates of ambulatory health care use in a tropical city and offered the following review regarding the basic principles of path analysis:

Path analysis is not a new statistical technique but rather a theory-oriented interpretation of readily available statistical techniques used to interpret partial correlation coefficients. Path analysis does not prove causality but assesses the compatibility of a theoretical model with the actual data. The main advantage of path analysis are two-fold: first, it enables one to measure direct and indirect effects that one variable has upon another variable. Secondly, it permits the decomposition of the overall correlation between two variables of interest into a sum of simple and compound paths. To the degree that the sum of the simple and compound paths between any two variables equals the zero-order correlation between these variables the compatibility between the theoretical model and the actual data holds. In working out the legitimate compound paths, it is important to observe three rules:

- no path may pass through the same variable more than once;
- no path may go backward on an arrow after the path has gone forward on a different arrow;
- no path may pass through a double-headed curve (representing an unanalysed correlation between exogenous variables) more than once in any single path.

The whole sample from the NHS89/90 survey (n=54,241) was used for this analysis. Means for each health region were computed on selected variables as stipulated by Andersen's model and entered into a new dataset with the forty-seven health regions as the units of analysis. According to Robinson (1951), there are dangers in inferring individual association or characteristic in aggregate data as there may be no correspondence between the individual and the ecological correlation. For instance, the individual correlation depends upon the internal frequencies of the within-areas individual correlations, while the ecological correlation depends upon the marginal frequencies of the within-areas individual correlations. However, the ABS collected data on health regions precisely because it was felt that valid inferences could be drawn from the sample to the population. Smith (1991) does not subscribe to the notion that all level of explanation must be at the micro level (in this case at the individual level) because it preempts other legitimate ways to understand. Understanding of social phenomena requires all useful approaches. In the present context, a concern with individual explanation only may hide complex outcomes of aggregation and distort "higher level" social reality.

Table 4.8 shows the means and standard deviations (SD) for these 47 health regions. For example, the sex ratio varies from 1.45 to 1.54. A mean for sex ratio of 1.5 indicates that number of men = number of women in a given region; 1.2 means 80% men and 20 % women, given that the codes are 1 for men and 2 for women.

Table 4.8 Means and Standard Deviations (SD) for the 47 Health Regions

Variable	Mean	SD	Minimum	Maximum	N
Total disability days	.82	.13	.48	1.14	47
Selfhealth ratio	1.21	.04	1.12	1.32	47
Sex Ratio	1.51	.02	1.45	1.54	47
Insurance coverage	1.51	.08	1.34	1.67	47
Partnered	1.52	.03	1.45	1.61	47
Education	1.88	.06	1.72	1.96	47
Income distribution (\$)	3.08	.37	2.46	4.11	47
Alcohol consumption(mls)	4.41	1.23	2.23	6.82	47
Age profile(years)	7.28	.46	5.94	8.25	47
Relative weight	0.638	.031	.56	.70	47
Cigarettes smoked (*365)	80.43	14.07	52.00	121.00	47
Exercise level	8334.23	1978.27	4903.00	14988.00	47

Note: Total disability days, income distribution, alcohol consumption, age profile, cigarettes smoked and exercise level are interval data. The other six variables are coded as such:
Selfhealth ratio Poor = 2, Good = 1; Sex ratio female = 2, Male = 1;
Partnered No=2, Yes=1; Education Low = 2, High = 1;
Insurance cover Yes=1, No= 0; Relative weight Unacceptable = 1; Acceptable = 0;
Income distribution: 1-12 (units of \$5,000); Age profile: 1-17 (units of 5 years).

Path analysis makes use of the beta weights or standardised regression coefficients, providing an index of the impact of each independent variable when the effects of other independent variables are held constant. Because the regression coefficients are standardised, we can compare the magnitudes from variable to variable. When used in a path analysis, they are called path coefficients. Since regression weights are used as path estimates in a path analytic model, the requirements necessary for multiple regression analysis must be met. One prerequisite for multiple regression is that variables are either dichotomies or at least of interval nature. The selected variables satisfy the level of measurement requirement. Another requirement of multiple regression is that a linear relationship exist between dependent and independent variables. Scattergrams carried out revealed no identifiable non-linear relationships. Multiple regression analysis also requires an absence of multicollinearity. Table 4.9 shows the results of the correlational analysis undertaken to

check for multicollinearity. Lewis-Beck (1980:60) proposed that a correlation coefficient of less than .8 should not pose a problem. Pearson's correlation coefficients computed for all independent variables indicated that most variables were not correlated sufficiently high as to warrant deletion from the model. Only two variables, lack of education and income distribution, had a correlation of -.76. (Note the negative correlation because education was coded from high=1 to low=2). Collinearity diagnostics were carried out. When one of these two variables was dropped from the equation, there was little change in the regression coefficients, suggesting that multicollinearity is not a problem (Lewis-Beck, 1980:60). The measures of collinearity - eigenvalues and condition indexes - also showed that none of the variables had high proportions of variance for the same eigenvalue indicating that they were not highly dependent (Norusis, 1993:357).

Multiple regression equations were carried out. First, the relationship between referral rate (dependent variable) and all the independent variables of self-assessed health status, number of short-term disability days, relative weight, cigarette consumption, alcohol intake, amount of exercise, insurance coverage, income, education levels, partnership, sex ratio and age was examined. Table 4.10 shows the results of the analysis examining the effects of these variables. It presents the raw (B) and standardised (Beta) regression coefficients of the independent variables and their accompanying t-values. Only four t-values are statistically significant at $p < .10$. The beta weights provide an indication of the relative contribution of the variables to the prediction of referral percentage when all the other variables are controlled.

Table 4.9 Correlational Matrix of Independent Variables to be Used in the Analysis of Stage 2

	1	2	3	4	5	6	7	8	9	10	11	12
1 Age profile												
2 Sex ratio	.25*											
3 Partnership	-.19	.04										
4 Education	.02	-.12	-.58*									
5 Income distribution	.05	-.02	.56*	-.76*								
6 Insurance cover	.00	.05	.02	-.17	.31*							
7 Exercise level	.13	-.19	.33*	-.48*	.47*	-.18						
8 Alcohol consumption	.15	-.10	.11	-.35*	.62*	.22*	.42*					
9 Cigarettes smoked	.29*	-.15	-.04	.01	-.03	-.42*	.21*	.10				
10 Relative weight	-.59*	-.16	-.08	.45*	-.48*	-.07	-.30*	-.48*	-.04			
11 Disability days	.22*	-.16	.15	.01	.06	-.02	.11	.04	.09	-.15		
12 Self-health ratio	.45*	.14	-.04	.18	-.32*	-.30*	-.12	-.34*	.54*	.08	.30*	

* $p < 0.10$

Table 4.10 Multiple Regression of Referral Percentage on Selected Variables

Independent Variable	B	Beta	t
Self-health ratio	11.54	.57	2.39*
Disability days	-0.01	-.00	-0.02
Relative weight	-2.01	-.09	-0.34
Cigarettes smoked	-0.01	-.23	-1.17
Alcohol consumption	0.22	.37	1.82*
Exercise level	0.14	.37	2.01*
Insurance coverage	-1.53	-.17	-0.96
Income distribution	-0.05	-.03	-0.09
Education	0.01	.00	0.00
Partnership	-0.47	-.02	-0.11
Sex ratio	14.01	.29	1.90*
Age profile	-0.28	-.18	-0.70
Constant	-27.45		-1.80*

$R^2 = .43$, $F = 2.18^*$

* $p < .10$

Variable codes:

Self-assessed health ratio: Good=1, Poor=2

Mean disability days: 0.48 - 1.14

Relative weight: Acceptable=0, Unacceptable=1

Mean cigarettes smoked (*365 days): 52 - 121

Mean alcohol consumption (mls): 2.23 - 6.815

Mean exercise level (units): 4903 - 14988

Insurance cover ratio: Yes=1, No=2

Mean income distribution (\$): 12,300 - 20,550

Education: High=1, Low=2

Partnership: Yes=1, No=2

Sex ratio: Male=1, Female=2

Mean age profile: 29.7 - 41.25

Self-assessed health status ratio of the population has the greatest influence on referral rate, followed by exercise levels, sex ratio and alcohol intake. The R^2 indicates that 43% of the variance in the referral rate to other health care services can be explained by the combined influence of all the independent variables.

Because multiple regression analysis by itself would only tell us the relationships between the independent variables and the dependent variable, the model was worked through with a series of multiple regressions to see not only direct effects of the independent variables on the dependent variable, but also the indirect effects and the patterns of interrelationships among all variables in the model (Johnson, 1977). Appendix C: Tables I-X shows the results of the standardised and unstandardised regression coefficients and their accompanying t-values of the rest of the multiple regression analyses.

The standardised regression coefficients from the multiple regression analyses performed are presented together with the zero order correlations of the variables in an overall display in Table 4.11. A path diagram is drawn using Andersen's model. Because of the complexity of the model, a restricted path diagram displays the major findings with non-significant paths removed (Figure 4.3).

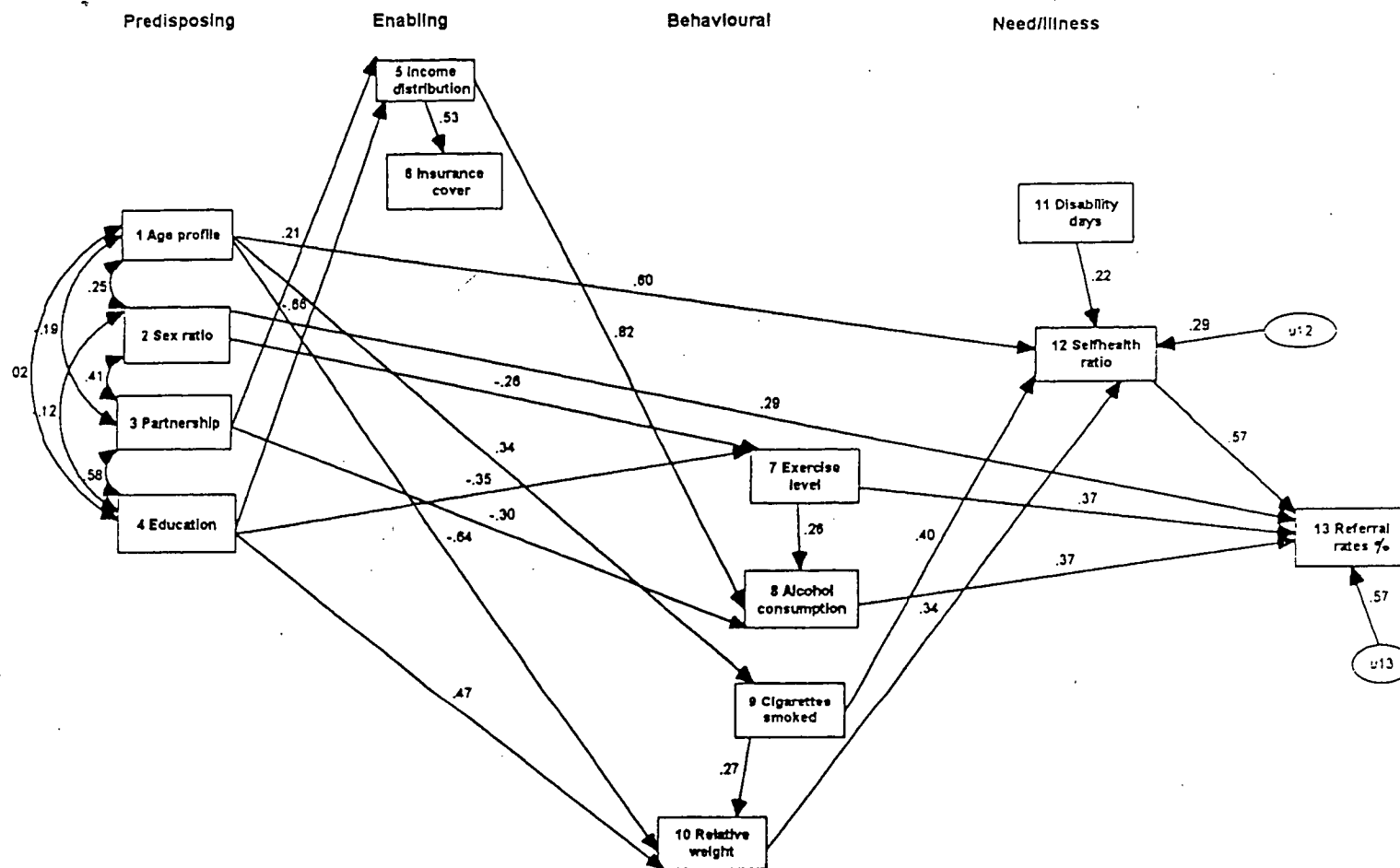
When the referral scores were regressed on the explanatory variables, self-assessed health status ratio ($p_{13,12} = .57$), exercise level ($p_{13,7} = .37$), sex ratio ($p_{13,2} = .29$) and alcohol intake ($p_{13,8} = .37$) exerted significant direct effects ($p < .10$) on the referral score. The higher the sex ratio and

Table 4.11 Zero Order Correlation Coefficients (Lower Triangle) and Standardised Path Coefficients (Upper Triangle)

	1	2	3	4	5	6	7	8	9	10	11	12	13	\bar{X}	SD	R ²
1 Age profile					.14	-.10	.19	.01	.34*	-.64*	.28	.60*	-.18	7.28	.464	—
2 Sex ratio	.25*				-.14	.10	-.26*	-.00	-.23	.07	-.25	.05	.29*	1.51	.015	—
3 Partnership	-.19	.41			.21*	-.24	.03	-.30*	.02	.14	.35	.16	-.02	1.52	.033	—
4 Education	.02	-.12	-.58*		-.66*	.11	-.35*	.24	-.15	.47*	.16	-.26	.00	1.88	.061	—
5 Income distribution	.05	-.02	.56*	-.76*		.53*	.26	.82*	-.10	-.12	-.09	-.27	-.03	3.08	.368	.63
6 Insurance cover	.00	.05	.02	-.17	.31*		-.31*	.06	-.45*	.26*	.04	-.08	-.17	1.51	.082	.15
7 Exercise level	.13	-.19	.33*	-.48*	.46*	-.18		.26*	-.06	.14	.01	-.17	.37*	8.33	1.978	.43
8 Alcohol consumption	.15	-.10	.11	-.35*	.62*	.22	.42*		.16	-.30*	-.03	-.15	.37*	4.41	1.225	.52
9 Cigarettes smoked	.29*	-.15	-.04	.01	-.03	-.42*	.21*	.10		.27*	-.01	.40*	-.23	80.43	14.069	.33
10 Relative weight	-.59*	-.16	-.08	.45*	-.48*	-.07	-.30*	-.48*	-.04		-.13	.34*	-.09	0.64	.031	.70
11 Disability days	.22*	-.16	.15	.01	.06	-.02	.11	.04	.09	-.05		.22*	-.00	0.82	.1345	.17
12 Self-health ratio	.45*	.14	-.04	.18	-.32*	-.30*	-.12	-.34*	.54*	.08	.30*		.57*	1.21	.036	.71
13 Referral rates	.24*	.26*	.16	-.22*	.16	-.23*	.37*	.24*	.18	-.24*	.13	.29*		2.27	.734	.43

* $p < .10$

Figure 4.3 Path Diagram linking Selected Independent Variables as per Andersen's Model and Referral Rates



Note: Insignificant path coefficients of less than .1 have been omitted to simplify diagram

the higher the alcohol consumption in a health region the higher the referral rate. Exercise, contrary to the idea that increased exercise levels produced more health and therefore less need of health services, showed a positive path coefficient with referral services. Poor perception of one's health as stipulated by Andersen's model had a direct effect on referral rate.

Three other variables showed weaker direct effects on the dependent variable. These are age ($p_{13.1} = -.18$), cigarette smoking ($p_{13.9} = -.23$) and insurance coverage ($p_{13.6} = -.17$) which exerted negative effects on the dependent variable. It is interesting to note that the higher the mean age of the population in a health region and the greater the number of cigarettes smoked, the lower the probability that doctors will refer patients to specialist services. These findings will be discussed further in Chapter 5. However, age also has an indirect effect on referral rates via the other variables: disability days, $(.28)(.22)(.57)$; self-perception of health, $(.60)(.57)$; cigarette smoking, $(.34)(-.23)$ and $(.34)(.40)(.57)$; relative weight, $(-.64)(-.09)$ and $(-.64)(-.34)(.57)$; income, $(.14)(-.27)(.57)$; insurance coverage, $(-.10)(-.17)$; and exercise level, $(.19)(.37)$. The sum of these compound paths is 0.23 which equals the zero-order correlation between referral rates and age (0.24), indicating that the compatibility between the theoretical model and the actual data holds.

Table 4.12 presents the results of the path analytic decomposition table for the referral rates for the total sample.

Table 4.12 Path Analytic Decomposition Table: Referral Rates for Total Sample

Dependent Variable	Total	Causal		Total Effects (D=B+C)	Spurious (A - D)
Independent Variable	Cov(r) (A)	Direct (B)	Indirect (C)		
R ²					
Residual					
Referral rates					
Selfhealth	.29	.57	-	.57	-.28
Disability days	.13	-.00	.13	.13	-
Relative weight	-.24	-.09	.17	.08	-.16
Cigarettes smoked	.18	-.23	.26	.03	.15
Alcohol consumption	.24	.37	-.11	.26	.02
Exercise	.37	.37	-	.37	-
Insurance	-.23	-.17	-.05	-.22	-.01
Income	.16	-.03	.19	.16	-
Education	-.22	.00	-.22	-.22	-
Partnership	.16	-.02	.10	.08	.08
Sex	.26	.29	-.08	.21	.05
Age	.24	-.18	.41	.23	.01

R² = .43

Residual = .75

Selfhealth

Disability days	.30	.22	-	.22	.08
Relative weight	.08	.34	-.03	.31	-.23
Cigarettes smoked	.54	.40	.08	.48	.06
Alcohol consumption	-.34	-.15	-.04	-.19	-.15
Exercise level	-.12	-.17	-.01	-.18	-.06
Insurance	-.30	-.08	-.04	-.12	-.18
Income	-.32	-.27	-.22	-.49	-.17
Education	.18	-.26	.33	.07	.11
Partnership	-.04	.16	.14	.30	-.26
Sex	.14	.05	-.06	-.01	.13
Age	.45	.60	-.09	.51	.06

R² = .71

Residual = .54

Disability days

Relative weight	-.15	-.13	-	-.13	-.02
Cigarettes smoked	.09	-.01	-.04	-.05	.04
Alcohol consumption	.04	-.03	-.04	-.07	-.03
Exercise level	.11	.01	-.03	-.02	.09
Insurance	-.02	.04	-.03	.01	-.01
Income	.06	-.09	.02	-.07	-.01
Education	.01	.16	-.01	.15	-.14
Partnership	.15	.35	-.04	.29	-.14
Sex	-.16	-.25	-	-.25	-.09
Age	.22	.28	.09	.37	-.15

$R^2 = .17$

Residual = .91

Relative weight

Cigarettes smoked	-.04	.27	-	.27	-.23
Alcohol consumption	-.48	-.30	.04	-.26	-.22
Exercise level	-.30	.14	-.10	.04	-.26
Insurance	-.07	.26	-.34	-.08	-.01
Income	-.48	-.12	-.10	-.22	-.26
Education	.45	.47	-.21	-.26	.19
Partnership	-.08	.14	.01	.15	-.07
Sex	.14	.07	-.05	.02	.08
Age	-.59	-.64	.07	-.57	-.02

$R^2 = .70$

Residual = .55

Cigarettes smoked

Alcohol consumption	.10	.16	-	.16	-.06
Exercise level	.21	-.06	.04	-.02	.19
Insurance	-.42	-.45	.03	-.42	-
Income	-.03	-.10	-.13	-.23	-.20
Education	.01	-.15	.08	-.07	-.06
Partnership	-.04	.02	.14	.16	-.12
Sex	-.15	-.23	-.02	-.25	-.10
Age	.29	.34	.03	.37	-.08

$R^2 = .33$

Residual = .82

Alcohol consumption

Exercise level	.42	.26	-	.26	.16
Insurance	.22	.06	-.08	-.02	.20
Income	.62	.82	.10	.72	-.10
Education	-.35	.24	-.26	-.38	-.03
Partnership	.22	-.30	.17	-.13	-.02
Sex	-.10	-.00	-.17	-.17	-.07
Age	.15	.01	.16	.17	-.02

$R^2 = .52$

Residual = .69

Exercise level

Insurance	-.18	-.31	-	-.31	-.13
Income	.47	.26	-.16	.10	.37
Education	-.48	-.35	-.20	-.55	-.07
Partnership	.33	.03	.12	.15	.18
Sex	-.19	-.26	-.07	-.33	-.14
Age	.13	.19	.07	.26	-.13

$R^2 = .43$

Residual = .75

Insurance

Income	.31	.53	-	.53	-.22
Education	-.17	.11	-.35	-.24	-.07
Partnership	.02	-.24	.11	-.13	-.09
Sex	.05	.10	-.07	.03	.02
Age	.00	-.10	.07	-.03	-.03

$R^2 = .15$

Residual = .92

Income

Education	-.76	-.66	-	.66	-.10
Partnership	.56	.21	-	.21	.35
Sex	-.02	-.14	-	-.14	-.12
Age	.05	.14	-	.14	-.09

$R^2 = .63$

Residual = .61

For the relationship between the dependent variable, referral rates, and the independent variable, disability days, path analysis is no more than a restatement of the assumptions i.e all the covariation between the two is taken as 'causal' or genuine. Similarly, all the covariation between referral rates and age is also taken as 'causal', but this covariation is decomposed into that which is mediated by other intervening variables, disability days, selfhealth ratio, cigarettes smoked, relative weight, income, insurance coverage and exercise level; and that which is not. For this relationship, path analysis enables us to determine how much of the 'causal' relationship between referral rates and age is "interpreted" by the intervening variables. The relationship between referral rates and selfhealth ratio is decomposed into 'causal' and spurious components. Path analysis thus provided at least a partial test of the causal closure of the bivariate relationship between referral rates and selfhealth ratio. It is found that, given the assumptions, half of the original association (.28) is spurious.

Cigarette smoking has an indirect influence on the dependent variable via self-assessed health status and relative weight. Insurance coverage also influences referral rate indirectly via self-assessed health status, exercise, smoking, alcohol intake and relative weight.

The remaining independent variables have weak or hardly any direct effects on the referral score. They are disability days, relative weight, income, education and marital status. However, disability days and the level of acceptability of relative weight of the population have an indirect

effect on referral via self-assessed health status. Income has an impact on referral indirectly via self-assessed health status, insurance coverage, alcohol consumption, cigarette smoking, relative weight and exercise. The indirect effects of education on referral are negative via income, exercise, cigarettes consumed, insurance coverage, relative weight, self-assessed health status and positive via alcohol consumption. Marital status has indirect effects on referral via income, insurance coverage, exercise levels, alcohol consumption, relative weight, and self-assessed health status.

Finally, it is customary to assess the completeness of each relevant subsystem by examining the path coefficients from latent variables. Path coefficients from latent variables (that is, all residual causes) associated with X_i are estimated by $\sqrt{1 - R^2}$, where the multiple R is that part of the regression equation in which X_i is the dependent variable and all causally prior variables are used as predictors. For example, the examination of latent influences (u) on referral rates (u_{13}) and self-assessed health status (u_{12}) showed that $(.75)^2 = 57$ per cent of the variation in the former and $(.53)^2 = 29$ per cent of the variation in the latter remained unexplained by the causal relations postulated by the model (see Figure 4.3). It should be noted that the full set of independent variables accounted for 43% of the variance in the referral scores. This suggested that one or more variables might have been excluded from the model, indicating the need for a broader searching effort. There is a possibility that the omitted variable(s) may be correlated with both the dependent variable and one or more of the independent variables in the present model. In such a case

the regression coefficients in the model might be substantially affected even to the extent of reducing to zero some of the now non-zero coefficients, and of reasserting causal linkages estimated as zero in the present model (Blalock, 1971: 47). Or again, might supply factors be the culprit? Recall, a central concept (ratios of health personnel and facilities to population) from Andersen's model was not included in the study. However, various studies suggest that supply factors could be an important contributor to the variation in service use. A case study of the two health regions with highest and lowest health service usage rates was therefore carried out to explore the supply hypothesis.

4.6 Stage 3: Case Study to Compare Goulburn Health Region (9% Referral Rates) and South Coast Queensland Health Region (14.8% Referral Rates)

In the two weeks prior to their interview, 651 and 860 respondents visited the doctor in the Goulburn health region and the South Coast of Queensland, respectively. This represents, in effect, a 64.4% difference considering the relative populations in each region $[(9 - 14.8)/9 = 64.4\%]$. In other words, the South Coast Queensland health regions uses 1.64 times as many services as Goulburn. Could this difference be due to differences in socioeconomic background and health care characteristics of the two populations as stipulated by Andersen's model?

The first task was to examine the characteristics of the respondents to see if there were any significant differences between the two health regions. Table 4.13 presents the results of this analysis. Few differences in the

Table 4.13 Comparison of the Means for the Two Health Regions on Selected Variables as per Andersen's Model

	Goulburn Health Region	South Coast Queensland Health Region
	Mean	Mean
Age (years)	36 years	37 years
Daily alcohol intake (mls)	4.07	5.23
Education high=1 low=2	1.90	1.93
Exercise level	9530	12526
Income (\$)	\$15,100	\$14,750
Insurance coverage yes=1 no=2	1.45	1.35
Partnership yes=1 no=2	1.49	1.49
Relative weight acceptable=0 unacceptable=1	0.63	0.62
Self-assessed health poor=2 good=1	1.21	1.21
Cigarettes smoked (*365)	77.00	96.00
Number of disability days	1.09	0.85

Note: Sex ratio varies from 1.49 to 1.50. A mean for sex ratio of 1.5 means number of men = number of women; 1.49 means there are 51% men and 49% women. Similarly, for ratio of insurance coverage, 1.45 means 45% of the population has no insurance coverage compares to 55% with insurance.

characteristics of the two health regions were noted. The respondents in the South Coast Queensland health region had higher rates for smoking and drinking, two factors which according to the literature may contribute to poorer health status and therefore lead to a greater need for health care. However, they also exercised more and had fewer disability days, indicating less demand for health services. Because of these countervailing tendencies the overall effect on health service usage on account of respondent characteristics might be expected to cancel each other out. However, the extent of supply factors in each region has not been included for comparison. When these are included (Table 4.14) we find considerable differences between these two regions.

Table 4.14 Approximate Numbers of GPs, Radiological Practices, Pathology Services and Specialists in the Two Health Regions of Goulburn and South Coast, Queensland.

	GPs	Radiology	Pathology	Specialists
Goulburn	262	10	4	41
South Coast Queensland	335	19	7	59
Ratio	1.28	1.9	1.75	1.43

Note: Average of above ratios = 1.59; almost identical to referral ratio of 1.64

Recall, preliminary enquiries to obtain accurate data on the availability of resources in the health regions, such as availability of GPs and radiological practices, proved impossible in some states. However, for the purpose of this case study, information on number of GPs, radiological practices and specialists in the two health regions were obtained from telephone directories (1993) and confirmed through personal contact (Table 4.14).

The information obtained showed a marked difference in the number of GPs, radiological and pathology services and specialists between the two health regions in spite of the fact both regions have a similar number of comparable residents. The census of the Australian population and dwellings (ABS, 1991) showed that Goulburn has a population of 150,242 and the South Coast of Queensland 157,857. Given this similarity in the two populations, both in terms of numbers and characteristics, it is clear that there is a maldistribution of health care services between the two health regions - the South Coast of Queensland is more generously endowed with health care services than the Goulburn health region. Hence one may infer that the more doctors and specialist services the greater the usage. In other words, consumption of services follows supply of resources.

4.7 Limitations of the Study

The following limitations should be considered when examining the results of this study:

1. Some of the behavioural characteristics may have been perceived by respondents as socially unacceptable, hence they may have under-reported information on these variables, for example, the number of cigarettes smoked and amount of alcohol consumed. Recall problems such as number of years of smoking and the amount of alcohol consumed in the week before interview may have affected the accuracy of some estimates too.

2. One cannot be always certain that the indicators selected for analysis are the "best" available. When dealing with latent constructs it is difficult to know for certain that one has captured all the relevant indicators for a particular concept. While surveys can gather a lot of information relatively quickly they nevertheless provide generally crude measures of more abstract concepts. For instance, perception of self-health is of a subjective nature and may be unrelated to health, and possibly reflecting momentary feelings or short-term circumstances (Castles, 1991).

3. The 47 health regions were not examined in relation to supply factors due to the inability to obtain data compatible with the NHS89/90 data set. Only two health regions were looked at using information from the 1993 telephone directories (The 1993 telephone directories were used due to inaccessibility to the 1989 or 1990 telephone directories). The resulting data on the distribution of GPs, specialists, radiological and pathological services may not be totally accurate and should therefore be interpreted with caution.

4. Without an experimental design it is difficult to demonstrate cause and effect relationships. For instance, are supply factors a cause or a consequence of increased demand.

This chapter gave an account of the analysis of the data and presented the results. A discussion of the findings will be carried out in the next chapter.

CHAPTER FIVE

DISCUSSION

5.1 Introduction

This study attempted to explain the variation in referral rates by general practitioners in the 47 health regions in Australia. Variation in the rates of use of health care services, including for example, variations in hospital admission, length of hospital stay and specific surgical procedures have been widely and consistently documented for many years. Such variation raises important implications for the quality and cost of medical care. The process of clinical decision making for patients, physicians and health policy makers is also affected. However, in Australia, there is limited research related to referral rates by general practitioners to other health care services such as radiological and pathological investigations, physiotherapy and social welfare services.

Most of the research on health care utilisation grew out of two concerns: first, the awareness of the unequal distribution of the use of health care services by individuals in various social and economic groups; and second, the dilemma over the consensus that all people should have relatively easy access to medical care despite the escalating cost of providing such access. Recall, Flook and Sanazaro (1973) listed three major goals of an equitable health care system: equity of access, moderation of costs and assurance of quality. One way of judging the level of equity achieved is by examining the relative importance of

various determinants of health service utilisation including GP consultation and GP referrals. According to Andersen (1975), equitable access is achieved when demographic and need/illness variables account for most of the variance in utilisation. Inequitable access occurs when social structure such as enabling factors of income and physical access to services determine who gets medical care.

Fair access, according to Sax (1984:187), is consistent with a widely held humanitarian view that individuals should not be denied health care because of their lack of income and wealth. An excerpt from the Preamble to the Constitution of the World Health Organisation (Deeble, 1984:17) also typifies both the political and popular attitudes to health care distribution that "attainment of the highest achievable standard of health is a fundamental right of every human being, regardless of race, colour, religious and political convictions and economic circumstances". If this is correct, then health services have many of the characteristics of 'merit goods'. Deeble (1984:17) suggested that since society has made the value judgement that health services are 'merit goods' then the market place is not an applicable model because the policy aim is social, the ethic is service not profit, and the distribution is based on need and not on the ability to pay. Social justice should thus be the primary goal of all health programs.

According to McClelland (1991), there are other special characteristics of health care which mean that the delivery of health care cannot be left

entirely to the market. The need for health care is unpredictable and costly. Consumers are often not in the position to make informed choices about the level and type of health care required to meet their needs. There is also an imbalance of information between consumers and suppliers which casts doubt upon the reality of consumer sovereignty (Richardson, 1980). These characteristics mean that the market may not operate efficiently. Maximum benefits may not be obtained from health care expenditures and health care costs may escalate due to spending where there are few if any benefits.

5.1.1 Overall Findings

The theoretical model proposed for study was Andersen's behavioural model of health services utilisation. This model implies a sequence of conditions that determines usage of medical services. It postulates that health services utilisation is affected by the need for care, influenced by enabling and predisposing factors.

This study was conducted in three stages. First, the variables/factors, including age, sex, marital status, education, income, insurance coverage, exercise, alcohol consumption, cigarettes smoking, relative weight, number of disability days, self-assessed health status, that were thought to determine GP consultation and referral rates at the individual level were examined, using logistic regression. For this analysis a subset of the NHS89/90 data was used. Findings indicated that Andersen's behavioural model did well at explaining consultation rates but not so well at

accounting for referral rates - indicating that there are "missing" factors to explain referral rates. To account for differences in referral rates at the regional level these same variables were used in a path analysis. The variance in referral rates accounted for by these independent variables in the 47 health regions was 43 per cent. As the set of independent variables only partly explained the variation in referral rates for health regions a third stage was carried out. This latter stage was a preliminary study which examined the ratios of health personnel and facilities to population (supply factors - a variable not included in the first two stages due to the difficulty of obtaining adequate data) in relation to the two health regions with the highest and the lowest referral rates. Findings indicate that the region with highest referral rates had considerably more doctors and specialist services even though the demographic and need/illness factors were comparable.

This study was conducted bearing in mind Popper's falsification theory, ie, by successive elimination of competing explanations we may arrive at the forces which determine health care services. The sections to follow discuss the findings in detail. Section 5.2 discusses the factors that *predicted* consultation and referral rates, whereas Section 5.3 attempts to *explain* the direct and indirect effects of these factors on referral rates. Section 5.4 examines the impact of supply factors on referral rates. Finally Section 5.5 discusses the implications of the findings and suggestions for further research.

5.2 Stage 1: Predicting Consultation and Referral Rates

5.2.1 Consultation Rates

Logistic regression analyses indicated that the selected variables as per Andersen's model were better at explaining the probability of consulting the GP than the probability of being referred to other health care services. The model correctly predicted 68 % of those respondents who consulted or did not consult a doctor. This compares to predicting 55 % of those respondents who were referred or not referred to other health care services. The relationships between the dependent and selected independent variables as per Andersen's model are discussed below.

Findings indicate that an older individual who is female with poor health status and more disability days is likely to see her GP. This supports the findings in other studies (Kohn and White, 1976, Wan and Soifer, 1974, Andersen, 1975). Also, married people visited the doctor more than unmarried people - a result contrary to that implied by Andersen's model and other studies (Grichting, 1975, Najman, 1993), where un-partnered people visited the doctor more. However, further examination of the data revealed that a greater proportion of the respondents were in the 25 - 45 age group and were female. Sorkin (1992) suggests that females in this age group may consult the doctor for gynaecological and obstetrical reasons. Perhaps this accounts for the finding in this present study. Also, Hetzel (1980) proposed that the reality of married and family life for the majority of Australians today is very different from the romantic ideal that is consistently set before young people by the mass media.

Marriage involves facing a number of problems; it entails breaking ties with parents, the question of housing, hire purchase commitments, administration and finance, quite apart from the tasks of sexual adjustment. For the modern urban man, increased mobility, deadlines to be met, more competition and more pressure for achievement, all resulting in less time for wife and family, have become common experiences. The increased tension is often associated with heavier food and alcohol intake, more cigarettes smoked and less exercise. Work for women too is problematic. About 50% of all married women are in the paid labour force. Studies found that married women with independent children reported higher levels of illness if working full-time. It would appear that full-time work for young mothers can be detrimental to their health unless there were adequate financial resources to help with the burden of maintaining the multiple roles of housewife, mother and employee, or until the gender imbalances in the division of housework changed (HTIC, 1988). Therefore, the importance of marriage and one's health status is still open to debate. It may well be that one's network (for example, marriage and other social ties) have different effects for different kinds of illnesses and for different genders and cultures.

However, inspection of the characteristics of the minority of respondents who were separated, divorced and widowed revealed that a large proportion of these respondents visited the doctor. This would support Andersen's model and findings in other studies (Grichting, 1979, Najman, 1993). Recall, the respondents in the below-15

age group were not included in the logistic regression analysis (pages 78) which might have influenced the results.

The other variables of education, income, insurance coverage, alcohol consumption, cigarette smoking, exercise level and relative weight made relatively little difference to the odds of consulting a doctor. Their impact on consultation rates failed to reach significance at the .05 level. This could be due to sampling variability, to insensitive tests or to the fact that the variables may not be as important as originally thought.

The less educated had only 3% higher chances of visiting the doctor. Perhaps Grichting (1979) might be correct when he suggested that the less educated with their less healthy lifestyle and more illnesses, are more likely to visit a hospital casualty department. Feldstein (1988) supported this view too. According to Feldstein, the less educated may not visit the doctor until they are seriously ill. If this is so, then they would most probably be hospitalised instead of visiting a doctor.

With regard to income and insurance coverage, perhaps these effects are not as important in Australia as overseas given the availability of Medicare. Medicare normally takes care of the financial costs incurred in visiting the doctor (although it is becoming difficult to be bulk-billed in many practices). A survey carried out to assess the reasons for people seeking insurance cover gave the following answers: "mainly for extras/dental cover" and "choice of doctor in hospital" (Wilcox, 1991).

Perhaps, this explains the insignificant association between insurance and doctor visits.

The fact that the lower income did not visit the doctor could be that low income people do not necessarily take advantage of public assistance by increasing their overall volume of physician visits (Palmore and Jeffers, 1971; Loewenstein, 1971; Richardson, 1971) or the poor do not change their behaviour patterns even when financial barriers to health services are removed (Olendzki, 1972). According to Kaplan and Bolaria (1971), certain social psychological mechanisms or "blockage variables" may impede utilisation among the poor. For example, they may feel that a stigma is attached to public assistance in the form of Medicare. More importantly, the impact of external or "accessibility" factors such as waiting time and distance to a doctor, waiting days for an appointment, and doctor-population ratio on physician utilisation need to be considered.

Alcohol consumption contributed relatively little to explaining the probability of visiting the doctor. According to Grichting (1979), extensive and prolonged alcohol consumption not only has a deleterious effect on health but also results in a general disability to recognise warning signals of health deterioration and to act accordingly. It may be that by the time the adverse effects of high levels of alcohol consumption are acted upon the individual is too ill to be seen by the GP and instead is hospitalised. There is also increasing evidence that moderate amounts of alcohol consumption may be beneficial to health - non-drinkers and heavy

drinkers have a higher total of cardiovascular disease mortality than light or moderate drinkers (Gordon and Doyle, 1987). Also, the distribution of alcohol consumption in communities is uneven - 50% of alcohol consumed in a community is accounted for by the heaviest drinking 10% of the population, with 70% being consumed by the heaviest drinking 20% (Wodak, 1991). The risk to health (and the likelihood of adverse social consequences) for individual drinkers in general is directly proportional to the quantity of alcohol consumed. Therefore, it would appear that there are larger number of moderate drinkers who are exposed to low relative risk from alcohol.

Although smoking is a major contributory factor to lung cancer, symptoms due to cigarette consumption do not generally appear till late in life. Similar to drinking, it may be that visits to the GP will not generally affect the results as individuals with smoking complaints will not visit their doctor until late in life, and relative to the rest of the elderly respondent participants make up a small percentage of the sample. There is also a close association between heavy smoking and heavy drinking and, as discussed above, early warning signs may not be acted upon (Grichting, 1979).

Exercise has a negative but negligible impact on GP consultation rates. It increases the odds of seeing the doctor by 2%. Perhaps Solomon (1984) is right when he suggested that exercise levels may occasionally cause muscular injuries or fractures, which necessitate the visit to the GP.

Unacceptable relative weight of the respondent had a very small impact (4%) on GP consultation rates. Population surveys in Melbourne and Adelaide (Hetzl, 1989) found that 35% of overweight men and 20% overweight women do not wish to reduce their weight to within normal, non-overweight range. Among the obese, most wished to reduce weight but only 30% wanted to attain normal range. It would appear that the condition of over- and under-weight did not present a problem to many of the individuals concerned. Also, diet alone is not a sufficient explanation for disease occurrence. A number of other factors together with diet may lead to illness, for example, smoking, lack of exercise and high fat diet together increases the risks of ischaemic heart disease (Waddell and Petersen, 1994:3).

5.2.2 Referral Rates

Factors determining referral rates were slightly different to the ones that influenced consultation rates. An individual with poor self-health and more disability days is likely to be referred. However, age did not seem to make a difference to referral rates. Perhaps, age per se is not that important. It could be as Grichting (1979) suggested that the elderly have more leisure time to visit the doctor which accounts for the effect on consultation rates and that only the more disabled with poorer health status will be referred. Although females were more likely to be referred compared to males this result failed to reach significance at the .05 level.

Lower education and insurance coverage increased the odds of an individual being referred to other services. These results failed to reach

significance although they are in keeping with the suggestion by Kohn and White (1976) that better education should lead to a better understanding of one's environment, including disease and the processes related to it and therefore a better lifestyle and health. Also, people with greater education attainment have more avenues to meet their needs - such as information, counselling, self-examination, etc - which may necessitate referrals of the less well educated by the GP to other health care services. Health education of the general populace may well result in less frequent but more appropriate access to the medical profession (Grichting, 1979).

Health insurance cover provides a "top-up" to costs incurred in visits to specialists (Grossman, 1972; Phelps, 1975). This would not be necessary when an individual consults a doctor as Medicare provides the necessary resources. Even when an individual is poor, bulkbilling extended by most practitioners to the lower income groups takes care of most of the financial burden of visiting the doctor (Roseman and McKinnon, 1992). Further support for this contention is evident as income made no difference to the odds of being referred.

In relation to un-partnered people Andersen's model predicts that they will utilise more services than partnered people. However, findings from the present study indicate that those without partners are referred less ($p = .08$). This supports Sorkin's (1992) suggestion that a sizeable number of visits to specialists are incurred by married women to obstetricians and gynaecologists in conjunction with pregnancy and childbirth. Recall, the

respondents in the below-15 age group were not included in the logistic regression analysis (page 88) which might have influenced the results.

Again, similar to GP consultation rates, the behavioural variables including exercise level, alcohol consumption, cigarette smoking and relative weight, made relatively little difference to the odds of being referred. The result failed to reach the significance level of .05.

5.3 Stage 2: Explaining Variation in Referral Rates Among the 47 Health Regions

The differential impact of the selected variables on the pattern of referral rates in the 47 health regions is discussed below. Recall, path analysis was used in an attempt to account for the variance in referral rates. The sample size for this stage was only 47 because the units of analysis were the health regions of Australia; hence the acceptable significance level was increased to .1.

5.3.1 Need/Illness Component

Similar to the findings in Stage 1, the 'need' variables, ie, self-health status and disability days had an impact on the referral score. Perception of poor health status bore a strong direct influence on the referral rates. According to Grichting (1979), inasmuch as people go to the doctor when they feel ill rather than when they fall ill, perception of one's health is an important concept in understanding the frequency with which medical services are required. Doctors also typically inquire about the subjectively

perceived health of a client and to some degree modify their intervention on the basis of that information (Grichting, 1994).

Disability days also exerted a significant influence indirectly via perception of poor health. It would appear that as people become aware of their ill health and its disabling consequences, they tend to seek medical attention (Wan and Soifer, 1974). Various studies also found that self-assessment of poor health status and total number of disability days to be strong predictors of health services usage (Andersen and Newman, 1973; Kohn and White, 1976; Wan and Soifer, 1974).

While the need component may be an important predictor of usage rates some studies have focussed on the interaction between need and predisposing and enabling factors. Treating the need for care as an intermediate factor convincingly related the enabling and predisposing factors to the appropriate courses of action (Wan and Soifer, 1974).

5.3.2 Behavioural Component

Among the four behavioural variables, exercise level, alcohol consumption, cigarettes smoked, and relative weight, two of them - exercise and alcohol consumption directly impacted on referral rates. Number of cigarettes smoked and relative weight had no direct significant influence on referral rates.

Taking each variable in turn, the greater the amount of exercise undertaken the higher the referral rates. This is contrary to studies which

advocate the benefits of physical exercise in relation to health, an example being the reduction of coronary heart disease (Morris et al. 1953). However, according to Solomon (1984), excess exercise levels sometimes cause muscular injuries which may in turn necessitate the visit to the GP and referral for specialist services such as an x-ray examination, physiotherapy treatment or even surgery. Physical running injuries are common; for example, injuries of the knees, lower legs and feet due to jogging are frequent (Hetzel, 1989). There is also evidence that prolonged vigorous exercise in women may actually increase osteoporosis because of the effect of exercise-induced reduction of sex hormone levels upon decalcification of bones. Path analysis revealed the indirect effect of exercise on referral rates via self-assessment of health: the more exercise undertaken the better the perception of health. It may be that present results reflect the fact that people who exercise feel healthy yet have frequent referrals to specialist services as a result of 'minor' injuries following exercise. As well, it was noted that more exercise is undertaken by males who are well educated and who are more aware of the benefits of exercise in relation to health. Similar findings have been reported by Caspersen (1986) and Bauman et al. (1990).

The more alcohol consumed the greater the referral rates. However, the more one drinks (alcohol) the better one's perception of health. Nevertheless, feeling good about one's health was not enough to negate the increase in referrals as a result of high levels of alcohol consumption. Findings in Stage 1 indicated that alcohol consumption did not contribute

significantly to explaining consultation rates. Grichting (1979) suggested that extensive and prolonged alcohol consumption not only has a deleterious effect on health but also results in a general reluctance to recognise warning signals of health deterioration and to act accordingly. However, it would appear that once the GP threshold is crossed, the higher alcohol consumption rates result in increased referral rates. If this is true, then education programs may need to be implemented that stress the importance of seeking help early. Although it should be realised that such programs may have an uphill battle convincing people of the dangers of alcohol when a) people report feeling good about their health (as these results indicate); b) any deleterious effects of excess alcohol consumption may not occur for many years; and c) people are likely to under report their consumption to what they perceive as a socially acceptable level of alcohol consumption (Najman, 1993).

Few doubt that smoking is a major contributory factor to lung cancer. There was no direct effect on referral rates owing to the number of cigarettes smoked. However, it had an indirect effect via perceived poor health leading to higher referral rates. The number of cigarettes smoked increased with age. However, the path between age and smoking would be misleading inasmuch as smoking over one's lifetime is automatically increasing with age. Like the discussion above surrounding alcohol, the effects of smoking are generally longterm and therefore may not affect referral rates to the extent of the other variables. Also, heavy drinkers tend to be heavy smokers (Blaxter, 1990).

Surprising perhaps, the variable of relative weight did not have a direct effect on referral rates even though people who were underweight/overweight perceived their health as poor. Problems associated with weight can be considered as behavioural/emotional issues for the individual and generally are not amenable for treatment by specialist services as per the 'normal' types of illness and disease that the GP encounters. Often, the only solution offered in these situations is a 'caution' from the GP. For those who were referred to a dietitian or 'weight watchers' this information was not asked for in the survey. Also, diet alone is not a sufficient explanation for disease occurrence. A number of other factors work together with diet as one component of consumption that may lead to illness, for example, smoking, lack of exercise and a high fat diet together increase risks of ischaemic heart disease (Davis and George 1989: 72). Relative weight is influenced by age, the number of cigarettes smoked and the amount of alcohol consumed.

5.3.3 Enabling Component

Andersen's model postulates that the enabling resource including income and health insurance provide the means for use of services, and increase the likelihood that use will take place. Income and presence of insurance coverage, via direct and indirect paths, influenced referral rates.

5.3.4 Predisposing Component

Age indirectly affected the referral rates via self-health status and numbers of cigarettes smoked. Although Harvey (1987) indicates that age is the single best predictor of illness, it would appear that age per se is not that important. Older people have generally more illnesses (AIH, 1992) and it is these two factors, age and illness, operating together that influenced referral rates.

The health regions with the higher female sex ratio have more referrals to other health services. This supports the hypothesis that women in general have higher rates of reported morbidity, mental health problems, chronic symptoms, and disability days (HTIC, 1988 and NSW Health Commission, 1979). Women also use more services than men, even after the visits associated with childbirth and pregnancy are discounted. Despite higher morbidity, women live longer than men and thus in the older age groups are the major users of services (Sorkin, 1992; HTIC, 1988).

Marital status had no direct impact on referral rates. However, via self-health and disability days, the regions with the higher percentage of 'unmarried' people or people without a partner were referred more often to other health care services. These people had poorer perceived health status and more disability days. Durkheim (1912) suggested the importance of an individual's social networks and ties to the broader social system for maintaining mental health. Marriage may also provide increased social integration and social support, resulting in improved

health and wellbeing and therefore lower utilisation of formal medical services. This view is supported by Grichting (1979), in his study to explain rates of ambulatory health care use: married persons, by and large, enjoyed better health than persons without immediate ties. He suggests that the emotional support provided by the nuclear family to its members reduces the necessity for visits to health care services.

As above, under Stage 1, education had no direct impact on referral rates. However, the region with the higher education level exerted an indirect influence on referral rates via, higher exercise levels. As discussed above, exercise increases the likelihood of injury that necessitates referral to specialist services.

The model did not fully explain the variation in usage suggesting some "missing" factors. All the above variables, when taken together, accounted for 43% of the variation in referral rates. Shortell (1975) indicated that supply variables could be important in explaining differences in utilisation rates after contact has been made with the GP. This is supported by a study conducted by Rossiter and Wilensky (cited in Feldstein, 1988) which concluded that physician-population ratios have a positive impact on physician-initiated visits. In light of the remaining variance to be explained a preliminary exploration of the possible contribution of supply factors was conducted in Stage 3.

5.4 Stage 3: Explaining Variation in Referral Rates in Two Health Regions

To examine the supply hypothesis - the more doctors and other health care resources the higher the referral rate - the health region with the highest (South Coast, Queensland) and the health region with the lowest (Goulburn) referral rates were compared with respect to the availability of doctors, specialists, radiological and pathological services. Findings supported Shortell's suggestion that regions with high referral rates will also have a much greater concentration of doctors, specialists and services than regions with low referral rates. Findings from the present study showed a marked difference in the numbers of GPs, specialists, radiological and pathological services between South Coast, Queensland and Goulburn health regions in spite of the fact that both regions had similar numbers of residents and were comparable in terms of demographic and social economic conditions. This suggests that these two regions would also have had very similar patterns of morbidity. Given this similarity in the populations, both in terms of numbers and characteristics, it is clear that there is a maldistribution of health care services between the two health regions - South Coast, Queensland appears to be more generously endowed with health care services than the Goulburn health region. One would be tempted to conclude from the above information that supply factors could very well be the "culprit" for the variance not accounted for in the previous stages of the analysis. In other words, the more doctors and specialist services the greater the total usage of health care services.

Various other studies have shown the influence of the supply of resources, such as the number of physicians and beds, on utilisation (Vayda, 1973; Bunker, 1970; Lewis, 1969). Lewis (1969) in a study of variations in the incidence of surgery demonstrated the association between the regional availability of facilities and manpower with the rates for several operative procedures. He concluded that the results might be interpreted as supporting a medical variation of Parkinson's law: "patient admission for surgery expand to fill beds, operating suites and surgeons' time". Bunker (1970) identified the number of beds and surgeons in proportion to population in accounting for the differences in surgical rates between the United States, England and Wales. Restriction in facilities and numbers of surgeons appear to contribute to the lower rates of operations in England and Wales. Studies in Australia showed similar results: the greater the supply of doctors in an area, the higher the total usage of medical services (AIH, 1992; The Age, 6 April, 1995:1).

However, the conclusion should not be drawn that those in South Coast, Queensland are better off in terms of health care. It is not clear if increased service usage has any material benefit for people's overall health status. Indeed, there may be an inverse relationship between "excessive" service and health (Illich, 1974). According to Taylor (1979), some studies of the survival rates of patients with heart attacks run counter to the wisdom that coronary care units (CCU) in hospitals provide the best treatment for patients. Neither do we know if regions that have lower rates fail people in their quest for optimal health. The issue involved in assessing appropriate use is problematic. Goran (1979) argued that the lowest use of medical or surgical procedures across

regions represented the target level that all areas should strive to achieve. Others take exception to this position. Some have expressed concern that the low rates may be attributed to a failure to meet the existing needs of the population (Pearson et al.,1968). We are left with the thorny question: are referral rates too high in the health region of South Coast, Queensland or too low in the health region of Goulburn?

5.5 Implications and Recommendations

In reviewing the explanatory power of Andersen's model it is evident that the 'need' variables - self-health status and disability days - were important factors in accounting for the variation in consultation rates and to a lesser extent in referral rates. In relation to referral rates, lower income and lower education did not account for referral rates. This is surprising considering that the poor and less educated have poorer health status and hence greater call on services (AIH, 1990:37). With the availability of Medicare one might expect to see that poverty was not a barrier to care. In general, referral is only possible after one has seen the GP. However, where access to services is poor it may be impossible to get the care needed. There is mounting evidence that doctors and specialists locate themselves in 'well- to-do' urban areas (Roseman and McKinnon, 1992). Therefore, Medicare will not fulfil the needs of the lower income groups and, by implication, of the most ill, unless they have easy access to services.

On a wider front, recall, Stage 3 results indicated that the region with more services had greater referral rates. Supply factors, it would seem, are important for a fuller understanding of health service uptake regardless of one's income and health status. The findings allow us to say that in health regions with the highest and lowest supply of services is a corresponding high and low referral rate. However, it is not possible to say that supply factors "drive" these different referral rates. In general, both patients and physicians influence levels of utilisation, but at different points in the health care continuum and for different types of services. Patients are more likely to initiate first contact, but physicians normally are responsible for initiating referrals, follow-up visits, etc. The effect of the supply factor on referral services needs careful consideration. The two major goals of any health care policy (as discussed in Chapter One) are: equitable access and quality of care. According to Andersen (1975), equitable access is achieved when demographic and need variables account for most of the variance in utilisation. Inequitable access occurs when social structure such as enabling factors of income and physical access to services determine who gets medical care.

The 'need' for care is also an intermediate factor through which the predisposing and enabling factors affect the course of action. Findings indicated that some of the perceived need for care was influenced by behavioural or lifestyle factors such as alcohol consumption and lack of exercise. If this is so, the health services delivery system may have to deal with the deleterious effects of prevailing lifestyle behaviours. Examination of the education variable indicated that the 'need' for care is greater in the less educated group via behavioural/lifestyle factors. Thus

the generally higher prevalence of smoking, physical inactivity, obesity and harmful levels of alcohol consumption amongst people of lower socioeconomic status must be addressed. Counselling and health promotion programs to educate people about their health problems are required so that they can recognise symptoms early and seek appropriate medical help (Palmer and Short, 1989). These efforts would seem useless in situations where access to health facilities is poor or non-existent. Therefore, to improve health seeking behaviour of people it is necessary not just to provide "counselling" about how to live better. More importantly perhaps, one needs to consider the removal of economic barriers and ensure that services are easily accessed by the consumer. As the President's Commission (1983) argued: "everyone requires access to some level of care: enough to facilitate a reasonably full and satisfying life". Improving people's access to health services is essential if better health outcomes and social justice for all are to be achieved. Good access to services requires increasing people's knowledge about available health services and improving physical access to these services.

Ensuring equal access to services should not be confused with notions of quality of care. In the case of the health regions with unequal referral rates the question is begged: are referral rates too high in the health region with the highest referral rates or too low in the region with the lowest referral rates? Many of the policy issues raised by the question of which rate is right can be resolved only by gathering information on the changes in mortality, morbidity, and functional status associated with the use of medical care (Wennberg, 1986). Quality of care is achieved when health

services provided maintain and improve health status of the population, both as perceived by the population and evaluated by the professionals. The inclusion of health status outcomes in health care studies would be desirable for health policy and health reforms. Health status outcome measures should examine whether the use of health care services improves health status or consumer satisfaction. Choices can then be made in the allocation of financial resources based on such cost-benefit analysis techniques, maximising output for every input of money. In recognition of this, Andersen (1994) suggested changes to his model. He emphasised the dynamic and non-recursive nature of a health services' use model including health status outcomes. The revised model portrays the multiple influences in health services use and subsequently on health status. It includes a feed-back loop showing that outcome in turn affects subsequent predisposing and perceived need for services as well as health behaviour.

Various studies have been conducted to examine the significance of supply of surgeons as a factor in producing variation in surgery rates and the outcomes of such variations (Lewis, 1969; Vayda, 1973; Wennberg and Gittelsohn, 1982; Renwick and Sadkowsky, 1991). Other services, like radiology for instance, have generally been ignored in relation to access and outcome factors. Focussed information on individual specialist services would be illuminating and informative for policy formulation. Deeble (1991) reported that the largest rates of increase in medical services from 1985 to 1990 in Australia were in the diagnostic services, particularly in pathology and radiology. In the case of radiology, evidence has been produced, particularly in the United

Kingdom and the United States, to suggest that the marginal cost of this service is often greater than the resulting health benefits (Sorby, 1992). X-rays are potentially dangerous and therefore the minimum number of examinations necessary for a diagnosis should be carried out. Access to specialised services are also overwhelmingly concentrated in the state capital cities. For example, CAT scanners are grossly maldistributed in the states of New South Wales and Victoria (Taylor and Goldstein, 1981).

According to Scotton and Ferber (1978), the essential problem in providing health services is to develop the 'proper' mix between principles of equity, adequacy and efficiency. In light of the above, further studies are recommended to measure access to services, supply factors and health outcomes in an interrelated fashion. Such a model can be used to evaluate individual services and services in general so as to provide the necessary information for making enlightened policy decisions in the area of health services delivery.

APPENDIX A

Computation of Indices

I. Computation of Cigarettes Smoked throughout Lifetime

Studies have shown that the increased incidence of cancer of the lung is in direct proportion to the number of cigarettes smoked per day and lowered incidence of lung cancer is in direct proportion to the number of years since the habit of smoking has been dropped (Doll and Hill, 1964). Thus to ascertain the total amount of cigarettes that a respondent had consumed since he/she started smoking it is necessary to combine indicators obtained by the ABS from two questions. Each respondent was asked how many cigarettes he smoked a day and how old he/she was when he/she started to smoke regularly. The index for number of cigarettes smoked was computed as follows:

Number of cigarettes consumed per day x duration (number of years) of smoking habit x 365 days.

Some under-reporting of smoking, both in terms of persons identifying as current smokers and in the reported quantity smoked is expected to have occurred (Castles, 1991). The reasons for this may be due to guilt/embarrassment, social pressures and probably recall problems especially the duration of smoking habit.

II. Computation of Average Daily Alcohol Consumption

To ascertain the amount of alcohol consumed respondents were asked several questions. Respondents were asked if they had consumed any drinks containing alcohol in the previous seven days. Respondents who answered in the affirmative were asked for each of the seven days the type of drinks they had, the quantities consumed for each type and whether the total amount consumed in that week was more, less or about the same as usual. Information was collected in respect of seven categories of alcoholic drinks: extra/special light beer, low alcohol beer (including shandies), full-strength beer (including home-brew and stout), wine (including wine coolers), spirits (including cocktails and liqueurs), fortified wine and other alcoholic drinks (including alcoholic cider). Reported quantities of drinks were converted to millilitres of alcohol present in the drinks. Quantities of alcohol consumed were summed and divided by seven to provide total consumption during the reference week within each of the seven drink categories. The index for daily amount of alcohol consumed is computed as follows:

$$\text{Sum}(\text{amount of light beer} + \text{amount of low alcohol beer} + \text{amount of full strength beer} + \text{amount of wine} + \text{amount of spirits} + \text{amount of fortified wine} + \text{amount of other alcoholic drinks}) / 7.$$

Some under-reporting of consumption in terms of persons identifying as having consumed alcohol in the reference week, and in the amount drunk, is expected to have occurred (Castles, 1991). A comparison with the 1977 Survey of Alcohol and Tobacco Consumption Patterns, according to

the ABS, indicated that reported consumption only accounted for around half of apparent consumption. It was also noted by ABS that the National Health and Medical Research Council grouped respondents into relative health risk categories by the amount consumed not just on a daily basis but on a regular basis, whereas the indicators derived from the 1989/90 NHS relate to consumption during the reference week and take no account of whether or not consumption in that week was more, less or similar to usual consumption level.

III Computation of Daily Amount of Exercise Performed

Exercise referred to physical activity undertaken for recreation, sport or health/fitness purposes during the two weeks prior to interview. It is generally agreed that this is relevant to health especially in the prevention of certain illnesses and therefore reducing the demand for health services. Three categories of exercises undertaken by respondents in the previous fortnight were established: walking for exercise or recreation, moderate exercise that caused a moderate increase in the heart rate, or breathing of the respondent and vigorous exercise defined as activities that caused perspiration and a large increase in the heart rate and breathing of the respondent. For each of these categories, respondents were asked the number of times they had exercised in the two weeks and the total amount of time spent on exercise in each category. Because information was not recorded in the survey about the types of activities undertaken such as aerobics, jogging, squash, an intensity factor was used to produce a descriptor of relative overall exercise level. The index of daily amount of exercise was computed as followed:

$$(\text{No. of times activity undertaken} \times \text{Average time of session} \times \text{Intensity}) / 14$$

where intensity is a measure of energy expended carrying out the exercise, expressed as a multiple of the resting metabolic rate. The values applied were: 3.2 for walking, 5.7 for moderate exercise and 8.5 for vigorous activities.

In general, the use of a fortnight reference period was not considered to pose significant recall problems for respondents. For most people, participation in exercise is regular (Castles, 1991).

APPENDIX B

Tables to Show Linearity between Predicted Probabilities and Independent Variables as per Andersen's Model in the Prediction of GP Consultation Rates

Table I. Plot of Predicted Probability with Age

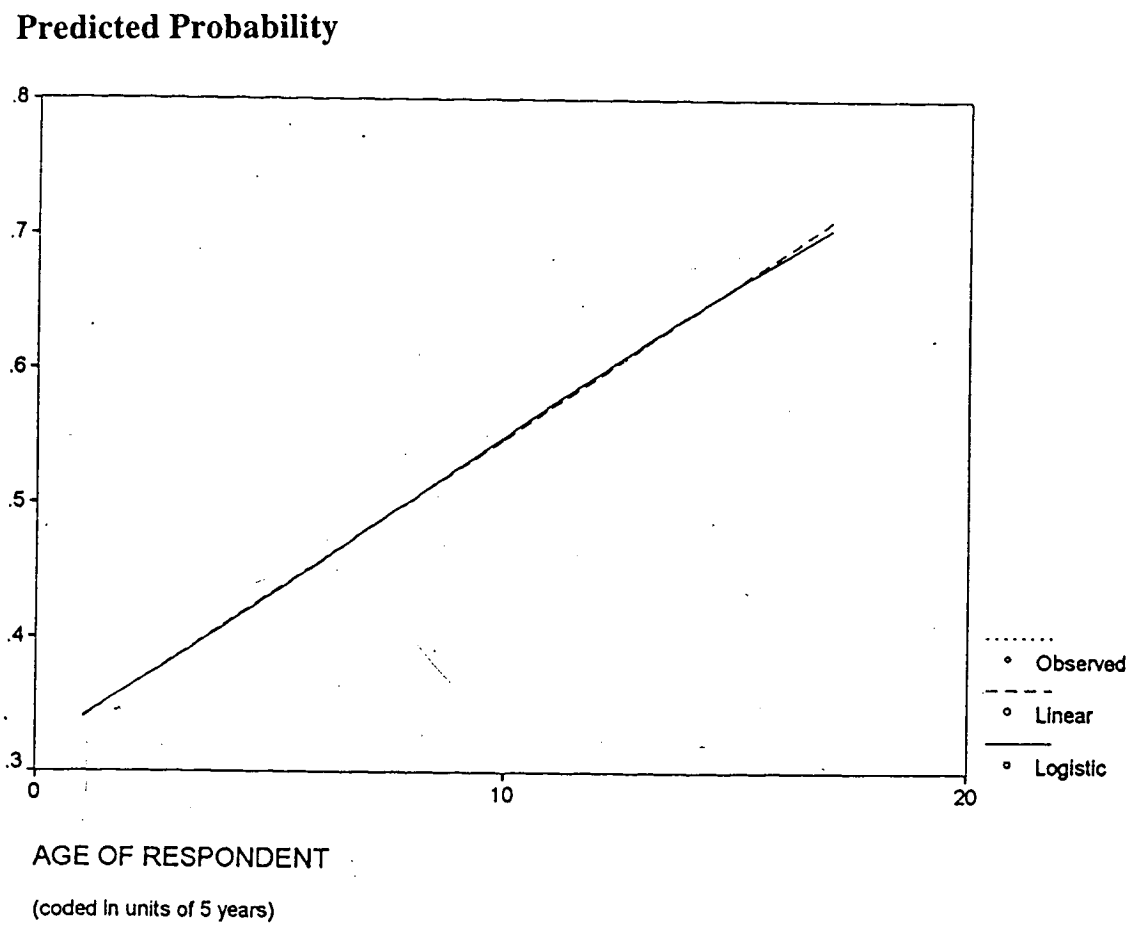


Table II. Plot of Predicted Probability with Income

Predicted Probability

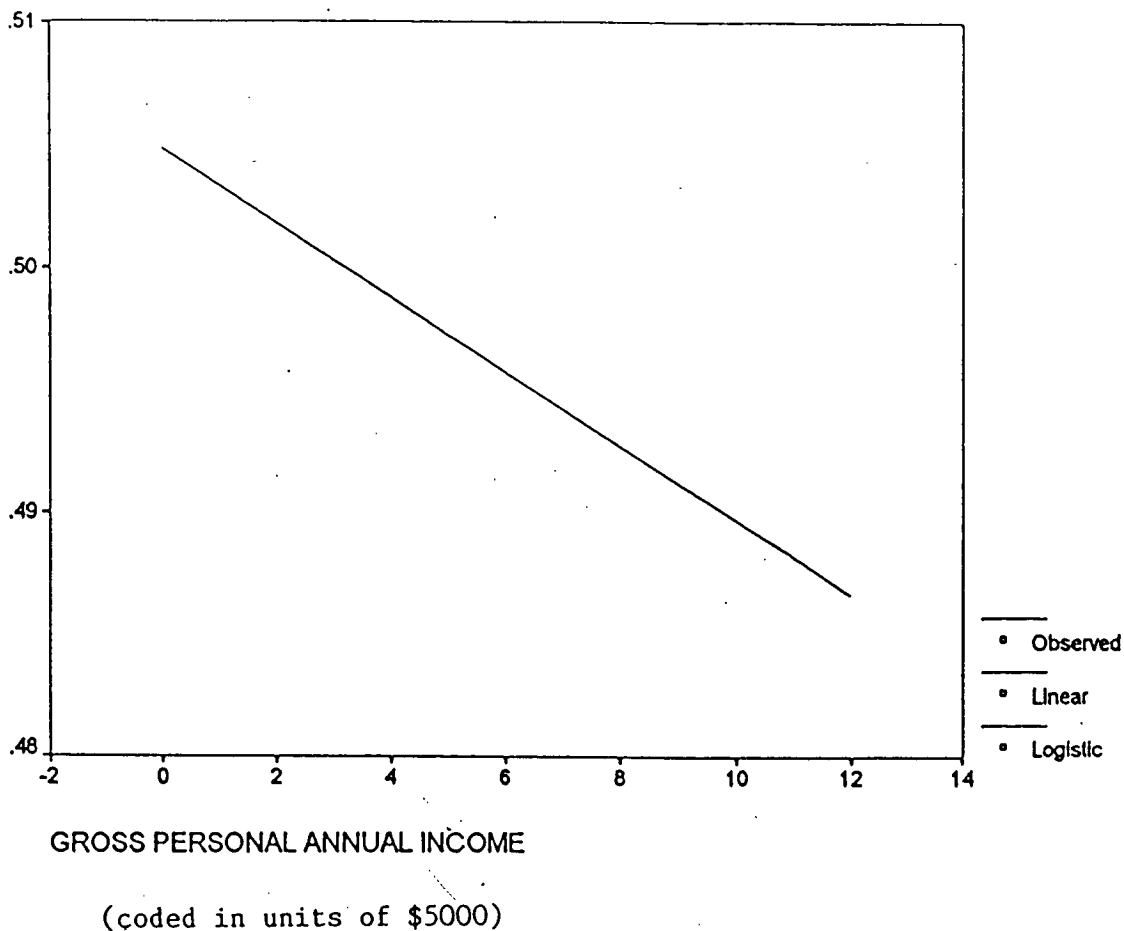


Table III. Plot of Predicted Probability with Exercise

Predicted Probability

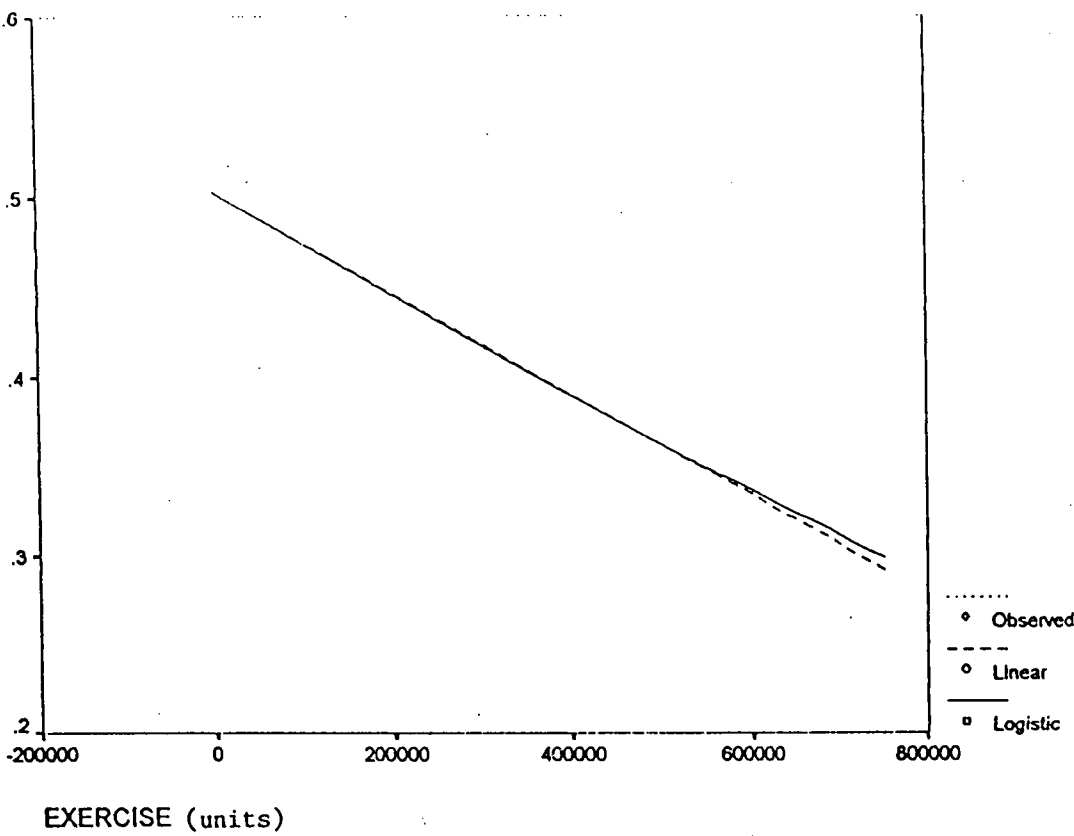


Table IV. Plot of Predicted Probability with Alcohol Consumption

Predicted Probability

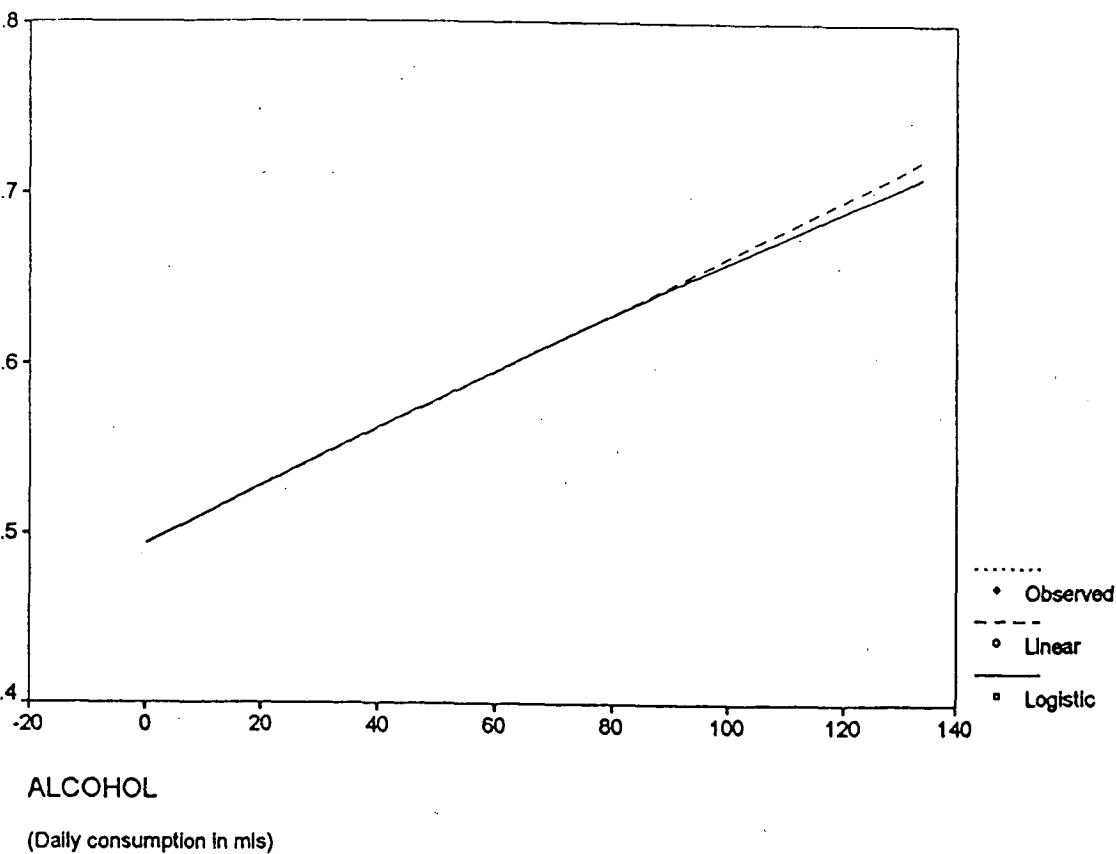
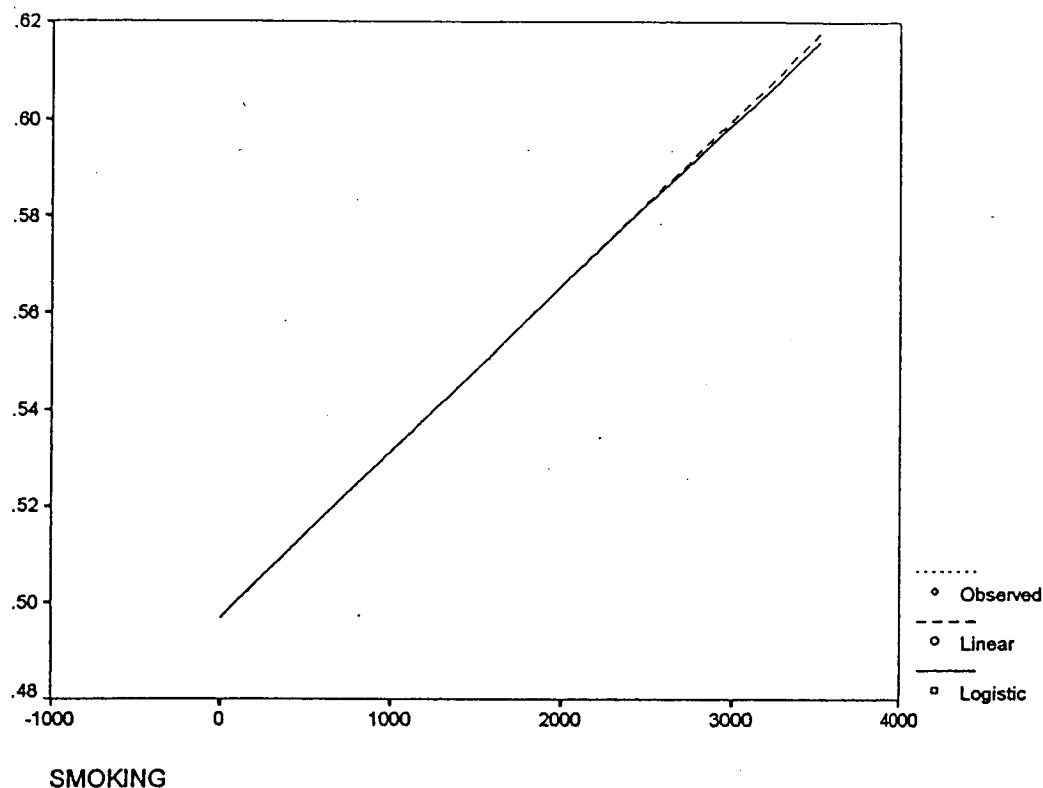


Table V. Plot of Predicted Probability with Cigarette Consumption

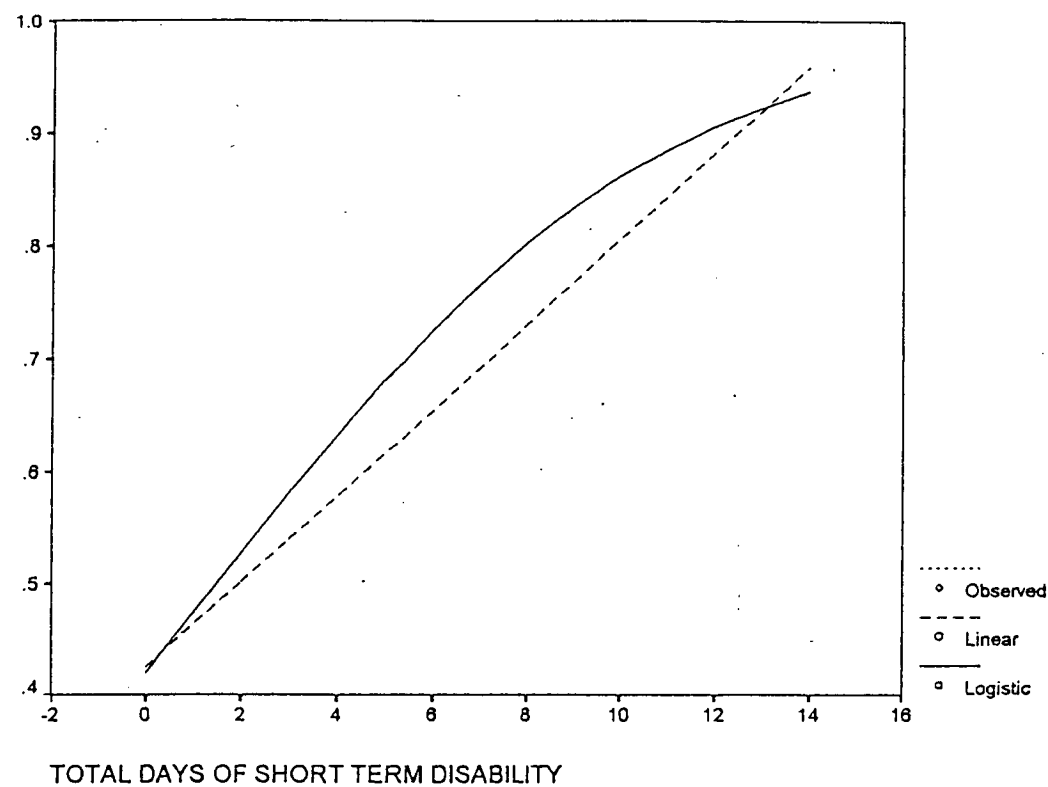
Predicted Probability



(Number of cigarettes smoked per lifetime/365 days)

Table VI. Plot of Predicted Probability with Disability Days

Predicted Probability



APPENDIX C

Tables to Show the Results of Multiple Regression Analyses to Look at Intermediate Effects of Selected Independent Variables as per Andersen's Model on Referral Rates in the Health Regions

Table I. Regression of Self-assessed Health on Selected Variables

Independent variable	B	Beta	t
Disability days	.06	.22	2.28*
Relative weight	-.00	-.27	-2.37*
Cigarette consumption	.00	.53	4.78*
Alcohol consumption	-.01	-.29	-2.21*
Exercise	-.00	-.12	-.98
Insurance coverage	.08	.18	1.31
Income	-.03	-.29	-1.51
Education	-.02	-.03	-.17
Partnership	.19	.17	1.34
Sex	.24	.10	.93
Age	.02	.29	2.50*
Constant	.38		.47

R = .72; F = 8.24*

*p < .05

Note: Self-assessed health ratio: Good=1, Poor=2

Disability days: 0.48 - 1.14

Relative weight: Acceptable=0, Unacceptable=1

Cigarettes smoked (*365 days): 52 - 121

Alcohol consumption (mls): 2.23 - 6.815

Exercise level (units): 4903 - 14988

Insurance cover ratio: Yes=1, No=2

Income distribution (\$): 12,300 - 20,550

Education: High=1, Low=2

Partnered: Yes=1, No=2

Age profile (years): 29.7 - 41.25

Table II. Regression of Short-term Disability Days on Selected Variables

Independent Variable	B	Beta	t
Relative weight	.00	.11	.53
Cigarette consumption	-5.61E	-.06	-.31
Alcohol consumption	.00	.02	.10
Exercise	-9.29E	-.01	-.07
Insurance coverage	- .09	-.05	-.24
Income	- .03	-.09	-.27
Education	.16	.07	.26
Partnership	1.37	.34	1.61
Sex	-2.37	-.27	- 1.54
Age	.11	.39	2.09*
Constant	1.35		.42

R = .17, F = .749

*p< .05

Note: Disability days: 0.48 - 1.14

Relative weight: Acceptable=0, Unacceptable=1

Cigarettes smoked (*365 days): 52 - 121

Alcohol consumption (mls): 2.23 - 6.815

Exercise level (units): 4903 - 14988

Insurance cover ratio: Yes=1, No=2

Income distribution (\$): 12,300 - 20,550

Education: High=1, Low=2

Partnered: Yes=1, No=2

Age profile (years): 29.7 - 41.25

Table III. Regression of Relative Weight on Selected Variables

Independent variable	B	Beta	t
Cigarette consumption	.04	.14	.86
Alcohol consumption	- .44	- .14	- .73
Exercise	.12	.06	.34
Insurance coverage	29.84	.62	3.70*
Income	1.00	.09	.34
Education	17.80	.28	1.21
Partnership	-12.84	- .11	- .60
Sex	21.44	.08	.56
Age	- 1.96	- .23	-1.48
Constant	-50.19		- .62

$R = .37, F = 2.42^*$

* $p < .05$

Note: Relative weight: Acceptable=0, Unacceptable=1

Cigarettes smoked (*365 days): 52 - 121

Alcohol consumption (mls): 2.23 - 6.815

Exercise level (units): 4903 - 14988

Insurance cover ratio: Yes=1, No=2

Income distribution (\$): 12,300 - 20,550

Education: High=1, Low=2

Partnered: Yes=1, No=2

Age profile (years): 29.7 - 41.25

Table IV. Regression of Cigarette Consumption on Selected Variables

Independent Variable	B	Beta	t
Alcohol consumption	1.80	.16	.82
Exercise	-.42	-.06	-.32
Insurance coverage	-77.95	-.45	-2.93*
Income	-3.95	-.10	-.37
Education	-34.16	-.15	-.64
Partnership	6.56	.02	.08
Sex	-208.34	-.23	-1.53
Age	10.44	.34	2.32*
Constant	497.35		1.74

R = .33, F = 2.34*

*p < .05

Note: Cigarettes smoked (*365 days): 52 - 121
 Alcohol consumption (mls): 2.23 - 6.815
 Exercise level (units): 4903 - 14988
 Insurance cover ratio: Yes=1, No=2
 Income distribution (\$): 12,300 - 20,550
 Education: High=1, Low=2
 Partnered: Yes=1, No=2
 Age profile (years): 29.7 - 41.25

Table V. Regression of Alcohol Consumption on Selected Variables

Independent Variable	B	Beta	t
Exercise	.16	.26	1.76
Insurance coverage	.84	.06	.43
Income	2.74	.82	4.18*
Education	4.79	.24	1.26
Partnership	-10.91	-.30	-2.01*
Sex	-.17	-.00	-.02
Age	.04	.01	.12
Constant	.90		.04

R = .52, F = 5.94*

*p < .05

Note: Alcohol consumption (mls): 2.23 - 6.815
 Exercise level (units): 4903 - 14988
 Insurance cover ratio: Yes=1, No=2
 Income distribution (\$): 12,300 - 20,550
 Education: High=1, Low=2
 Partnered: Yes=1, No=2
 Age profile (years): 29.7 - 41.25

Table VI. Regression of Exercise on Selected Variables

Independent Variable	B	Beta	t
Insurance coverage	- 7.62	- .31	-2.44*
Income	1.42	.26	1.28
Education	-11.25	- .35	-1.77
Partnership	2.05	.03	.22
Sex	-33.87	- .26	-2.07*
Age	.83	.19	1.50
Constant	78.45		2.32

R = .43, F = 5.09

*p < .05

Note: Exercise level (units): 4903 - 14988
Insurance cover ratio: Yes=1, No=2
Income distribution (\$): 12,300 - 20,550
Education: High=1, Low=2
Partnered: Yes=1, No=2
Age profile (years): 29.7 - 41.25

Table VII. Regression of Insurance Coverage on Selected Variables

Independent Variable	B	Beta	t
Income	.12	.53	2.26*
Education	.14	.11	.45
Partnership	-.58	-.24	-1.28
Sex	.55	.10	.68
Age	-.02	-.10	-.64
Constant	1.07		.64

R = .15, F = 1.41

*p < .05

Note: Insurance cover ratio: Yes=1, No=2
Income distribution (\$): 12,300 - 20,550
Education: High=1, Low=2
Partnered: Yes=1, No=2
Age profile (years): 29.7 - 41.25

Table VIII. Regression of Income on Selected Variables

Independent Variable	B	Beta	t
Education	-3.96	-.66	-5.63*
Partnership	2.34	.21	1.80
Sex	-3.40	-.14	-1.45
Age	.11	.14	1.42
Constant	11.26		2.43

R = .63, F = 17.66*

*p < .05

Note: Income distribution (\$): 12,300 - 20,550
Education: High=1, Low=2
Partnered: Yes=1, No=2
Age profile (years): 29.7 - 41.25

Table IX. Regression of Education on Selected Variables

Independent Variable	B	Beta	t
Partnership	-1.07	-.58	-4.66*
Sex	-.31	-.08	-.62
Age	-.01	-.07	-.52
Constant	4.04		5.08

R = .35, F = 7.63*

* p < .05

Note: Education: High=1, Low=2
Partnered: Yes=1, No=2
Age profile (years): 29.7 - 41.25

Table X. Regression of Partnership on Selected variables

Independent Variable	B	Beta	t
Sex	.20	.09	.62
Age	-.02	-.21	-1.38
Constant	1.33		2.74

R = .04, F = .988

*p< .05

Note: Partnered: Yes=1, No=2
Age profile (years): 29.7 - 41.25

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