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A Health System Analysis Approach to Health Outcomes in Medicare Clients With Chronic Illnesses

Christine A. Elnitsky
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**A HEALTH SYSTEM ANALYSIS APPROACH
TO HEALTH OUTCOMES IN MEDICARE CLIENTS WITH
CHRONIC ILLNESSES**

by

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ABSTRACT

A HEALTH SYSTEM ANALYSIS APPROACH TO HEALTH OUTCOMES IN MEDICARE CLIENTS WITH CHRONIC ILLNESSES

Christine A. Elnitsky
Old Dominion University, 2001
Director: Dr. Betty B. Alexy

Since 1863, outcomes measurement efforts have provided information to health care consumers, administrators, and policymakers in assessing concerns about access, quality and costs. With a growing population of older adults with chronic illnesses, cost-cutting strategies in health delivery systems, and federal endorsement of managed care systems, researchers have begun to evaluate the impact of different delivery system organizations on health. The current study combines two areas of health services research to provide the first published hierarchical analysis of the influence of delivery system factors, and a profile of population and community characteristics and utilization factors, on perceived health outcomes of a nationally representative sample of older adult Medicare beneficiaries with various chronic illnesses.

This study was designed to analyze the difference in health status outcomes across Medicare fee-for-service and health maintenance organization systems nationwide, and to explain health delivery system factors' effects on outcomes. Using a recently developed health outcomes classification scheme, a newly expanded Andersen and Aday Health System Model, and hierarchical multiple regression analysis methodology, health delivery system factors were found to have a significant impact on three of four client-centered outcome measures.

The results of this study suggest there are health delivery system factors affecting health outcomes of older adults with chronic illnesses. In addition, the findings imply that hierarchical regression analysis is a useful tool for explaining the unique contribution of several individual variables as well as several blocks of variables on perceived health

outcomes. Information from this study can be used to monitor outcomes of health care in this vulnerable population. inform development of chronic illness - related health policy. and encourage use of high quality public data resources available for health services research.

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CHAPTER I

INTRODUCTION

Policymakers and health care administrators have developed programs and policies in an attempt to contain costs and improve access and quality of care (Bernstein & Bernstein, 1996; GAO, 1995). Health outcomes measurement efforts have assisted in these attempts. Measurement of outcomes dates back to Florence Nightingale's mid-nineteenth century study of mortality rates in London hospitals (Altman & Reinhardt, 1996). Since 1863, these measurement efforts have used data to monitor outcomes and inform policymaking. In recent years, availability of administrative databases and computer resources have improved efforts to measure population health outcomes.

Chronic illnesses are considered the most serious health threat in the United States today (Robert Wood Johnson Foundation, 1997). Chronic illnesses are "not self-limiting but are ongoing over an extended period of time" (Millman, 1993, p. 11). The incidence and prevalence of chronic illnesses are positively correlated with increasing age. Nearly 100 million Americans have chronic illnesses. With an aging population the number and proportion requiring health services for such conditions is expected to increase (Day, 1993; National Institute on Aging, 1996). Chronic illnesses may limit the ability of older adults to live independently in the community. To sustain older adults' independence, national health promotion objectives aim to maintain the health and functional status of older adults (United States Department of Health and Human Services, 1990).

Federal endorsement of managed care systems increases the importance of evaluating the effectiveness of health systems in producing desired health outcomes. Because Medicare enrollees, as a group, are older and sicker (due to chronic illnesses)

than clients who typically enroll in managed care organizations (Jones & Lewin, 1996), and chronic conditions require regular or specialized care on an ongoing basis (Docteur, Colby, & Gold, 1996) this vulnerable group is at greater risk of potential adverse health outcomes (Clement, Retchin, Brown, & Stegall, 1994; Retchin et al., 1992; Ware, Bayliss, Rogers, Kosinski, & Tarlov, 1996).

Literature suggests that comprehensive care from a multidisciplinary team of health care professionals is necessary for effective control of chronic illnesses and the prevention of additional illnesses (Bierman & Clancy, 1999; Lewis & Lubkin, 1995; Millman, 1993; Physician Payment Review Commission, 1995). Treatment can retard progression and complications of chronic illnesses and regular health care is essential (Drury, Harris, & Lipsett, 1981; Lubkin, 1995). Failure to adequately manage the patient on an outpatient basis can adversely affect the disease's trajectory (defined as "the speed and severity of the disease's effects on a patient's health status," Millman, 1993, p.92) and result in adverse outcomes such as hospitalization, premature disability, and death (Drury et al., 1981; Lubkin, 1995). The National Center for Health Statistics, Centers for Disease Control and Prevention reported that 12% (3.1 million) of nationwide hospitalizations in 1990 were the result of potentially avoidable conditions (a health status outcome indicator among those with chronic illnesses) (Pappas, Hadden, Kozak, & Fisher, 1997). Wide variation by region suggested deficiencies in outpatient management or patient access problems resulting in poor health status outcomes (Millman, 1993; Pappas, et. al., 1997; Weissman, Gastonis, & Epstein, 1992).

Regular care of chronic illnesses may include nutritional counseling and necessary medication, or other treatments, and periodic tests (Drury et al., 1981; Millman, 1993).

For example, standard treatment for diabetes commonly includes diet control, exercise, and/or insulin or oral hypoglycemic agent medications. Health care providers prescribe these three treatment regimens depending on the severity of illness and other patient factors (Drury et al., 1981) as well as published standards of professional care. National guidelines recommend that diabetic clients should have hemoglobin A1c (glycosolated hemoglobin) tests, ophthalmic examinations, and total cholesterol tests at least once during each year (Allerheiligen, Erwin, Galazka, & Smith, 1990; American Diabetes Association, 1989).

Medicare is the largest purchaser of managed care services in the United States with almost 4 million older adults enrolled in health maintenance organizations (HMO) (GAO, 1996). Federal legislators and plan administrators are promoting increased enrollments (Bernstein & Bernstein, 1996; GAO, 1995). HMOs' reductions in service use and physician-payment arrangements, however, may create incentives to deny or delay care (Brink, 1996) to those who need it the most. For example, government studies report delays in treatment, incompetent or untimely treatment, and denial of access resulting in death in some Medicare cases (GAO, 1995). On the other hand, HMOs' structures may prevent poor outcomes among older adults by substituting outpatient care and new chronic disease care-management programs for more expensive inpatient care and by providing coverage for medical expenses not routinely covered by Medicare (e.g., prescriptions, eyeglasses) (Retchin et al., 1992). Research has shown that HMO inpatient hospitalization rates are lower than those of traditional Medicare fee-for-service (FFS) enrollees (Greenfield et al., 1992; Miller & Luft, 1994; Nelson et al., 1998).

Statement of the Problem

Transformation of health delivery systems, including continued cost-cutting strategies, could result in decreased access to and effectiveness of care for a growing population of older adults who require regular management of chronic illnesses for maintenance of health and continued independent living in the community. This prospect and the federal endorsement of managed care systems increase the importance of evaluating the effectiveness of delivery systems in producing desired outcomes (Bernstein & Bernstein, 1996; GAO, 1995).

Theoretical Framework

The theoretical framework for this study is based on the model developed by Andersen (1968) and refined by Aday and Andersen (1974) with health outcome measures of access as suggested by Aday, Begley, Lairson, and Slater (1993) which is currently referred to as the Health System Model. The theory proposes that health policy directly affects characteristics of the health delivery system and directly or indirectly affects characteristics of the population-at-risk to bring about changes in the use of health care services and in the consumer's health outcomes from and satisfaction with those services.

The model proposes that the delivery system directly affects utilization patterns, health outcomes and satisfaction of consumers (Aday & Andersen, 1974; Aday et al., 1993). The system may also impact population characteristics and indirectly affect its utilization of services and the consumer's health outcomes and satisfaction with care.

The Andersen & Aday framework was selected for use in this study because of its sensitivity to external environmental forces and health delivery system organizational

structures. In addition, the model is versatile, combining perspectives of diverse disciplines. The study tested the framework's application in comparing outcomes of Medicare beneficiaries in managed care delivery systems (where the HMO assumes financial risk for health care) and traditional fee-for-service arrangements in the present Medicare Managed Care policy environment.

Purpose of the Study

This study had two purposes. A first purpose of this study was to describe and explain health outcomes of older adult Medicare clients with chronic illnesses enrolled in HMO or FFS health delivery systems. Understanding the relationship between factors that influence health status is particularly important for studies that examine health delivery systems, since these relationships are of great interest from policy and planning perspectives. Health outcomes have become an issue of concern to managed care constituencies such as the older adult population, HMO delivery systems and government agencies. Health care consumers, administrators, and policy makers want to know the relative contribution of health delivery system structure and process factors to health outcomes among older adults with chronic illnesses.

A second purpose of the study was to test the expanded Health Behavioral Model of utilization recently modified to include a health outcome component (Andersen, 1995) which is currently referred to as the Health System Model. The current model contends that delivery system organizational structure affects health outcomes. This study evaluated the utility of the theoretical framework in explaining health outcomes of older adult Medicare beneficiaries with chronic illnesses exposed to HMO and FFS delivery system environments. The study analyzed existing data to explain the complex

relationship between health outcomes and different health delivery systems.

Central Research Question

The expanded Health System Model states that health delivery systems may directly affect consumer health outcomes. Since health delivery system organizational structures are rapidly changing, policy planners should know to what degree an organization can be altered before outcomes are affected. To test the utility of the expanded Health System Model in explaining health outcomes in different health delivery system organizations, the following question was studied: “ Do older adults with chronic illnesses in HMO systems have different health outcomes than older adults with chronic illnesses in FFS systems?”

Definitions

Definitions of terms of primary interest in this study follow. The primary predictor variable in this study was Medicare health delivery system type. The two types of delivery systems were HMO and FFS. An HMO is a managed care system that provides for the organized delivery of a comprehensive package of health care services within a specific geographic region to enrolled clients for a fixed capitated payment (predetermined, per member, per month, payment) from the Medicare program (Kovner, 1995; Laschober & Olin, 1996). HMOs provide for both the delivery and the financing of health care in an organized system.

A FFS health delivery system includes health care services provided by a variety of independent physicians and other providers in various outpatient (Medicare Part B) and inpatient (Medicare part A) settings in return for the payment of a fee. Enrolled clients pay a premium to Medicare, for which Medicare contracts to pay for the health

care after it is delivered by a variety of providers and hospitals.

The organizational structures of HMOs and FFS systems differ. In contrast to FFS systems, HMOs have a select network of providers (physicians, nurse practitioners and other health professionals), defined populations, comprehensive services, a preventive orientation, and centralized resources such as data systems, patient education and newsletters (Jones & Lewin, 1996; Wagner, 1997). A recent review of the literature suggests that these structural advantages over FFS systems have resulted in cost savings and improved preventive care (Miller & Luft, 1994).

Medicare HMOs take a variety of forms in delivering and financing care, including risk, cost, and healthcare prepayment plans (HCPP). Risk HMOs are paid a capitated payment to provide Part A and Part B services to Medicare enrollees. Cost HMOs are paid on a reasonable fee basis to provide Part A and Part B services to Medicare enrollees. HCPPs are paid on a reasonable basis to provide Part B services to Medicare enrollees.

The criterion variable in this study was perceived health outcome. Two measures of health outcome were explored: general health and functional status (capacity to perform basic, household, and advanced activities of daily living). Both health outcome measures represent generic measures of health based on the client's independent judgement. Both measures have predicted important objective (observable) health outcomes (Idler, 1992; Kaplan, 1987). There is literature relating general health to functional status (Liang, 1986; Linn & Linn, 1980; Wolinsky, Coe, Miller, & Pendergast, 1984). Moreover, both general health and functional status have been used as outcome variables (Katz et al., 1963; Kaplan, Greenfield, & Ware, 1989) and employed in outcome indexes in studies of

chronically ill adults (Greenfield et al., 1992; Ware et al., 1996). Both measures are recognized as distinct elements of health status and are affected by cognitive, emotional and social factors (Wolinsky et al., 1984). Thus, they may be considered reflective of health as a multidimensional phenomenon: a state of complete physical, mental and social well being, more than merely the absence of disease (World Health Organization, 1948).

Significance of the Study

This study explained the differences in health outcomes for a growing population of older adults with chronic illnesses in evolving Medicare HMO and FFS delivery systems. Except for reports on the 1986-1990 Medical Outcomes Studies of patients with hypertension, myocardial infarction, congestive heart failure, and depression (Greenfield, Rogers, Mangotick, Carney, & Tarlov, 1995; Ware et al., 1996), and the 1985-1986 Medicare Competition Demonstration study of clients with acute symptoms (Retchin et al., 1992), this may be the first study to describe HMO and FFS delivery system effects on outcomes among a nationally representative sample of community-dwelling clients with diverse chronic illnesses. The findings of this study go beyond prior publications on outcomes because of the concentration on a nationally representative sample of older adults with a variety of chronic illnesses living in the community and the use of more current data.

There is a need for studies to examine the impact of health delivery system organizational structures on perceived health outcomes. This may be the first study to test the relationship between delivery system and health outcome components of the recently expanded Health System Model. Furthermore this study examined the impact of a profile of population (and community) characteristics, inpatient utilization, and outpatient

utilization factors on health outcomes.

Federal Social Security Amendments of 1972 (Public Law 92-603) authorized Medicare administrators to contract with HMOs to provide health services to older adults and others in urban and rural regions of the nation. Because such contracts offered possible cost containment, Congress modified the program's HMO provision through the Tax Equity and Fiscal Responsibility Act of 1982 (TEFRA, Public Law 97-248). Today, over 4 million beneficiaries are enrolled in Medicare HMO systems (GAO, 1997). HMO cost containment incentive plans could lead providers to limit services inappropriately, resulting in irregular and inadequate care for older adults with chronic illnesses. The more risk transferred to providers and the closer the financial incentives are linked to decisions about individual clients, the greater the potential threat to health outcomes (GAO, 1998). Because Medicare enrollees with chronic illnesses require regular care and virtually all Medicare HMO enrollees reside in urban areas (Physician Payment Review Commission, 1995), they are at greatest risk of potential unintended adverse health outcomes. Urban health services research must anticipate these unintended effects and monitor outcomes for vulnerable populations in evolving health delivery systems.

CHAPTER II

LITERATURE REVIEW

This chapter is composed of four sections: theoretical model, background, measures of outcomes, and conclusions. In addition to reviewing the literature, this chapter has four objectives: (1) to describe the theoretical model for the study; (2) to select appropriate measures for determining outcome variations across HMO and FFS delivery systems; (3) to specify an activities of daily living classification system; and (4) to identify variables for the study that are consistent with the theoretical model and have support in the health services literature.

Theoretical Model

The theoretical framework for this study is based on the model developed by Andersen (1968) and refined by Aday and Andersen (1974) with health outcome measures of access as suggested by Aday, Begley, Lairson, and Slater (1993) which are reflected in the current model. The original Behavioral Model of health service utilization, first empirically tested by Andersen's (1968) dissertation, focused primarily on the characteristics of the population-at-risk as determinants of utilization of health services. The original model consisted of four components: 1) predisposing factors, 2) enabling factors, 3) need factors, and 4) use of health services.

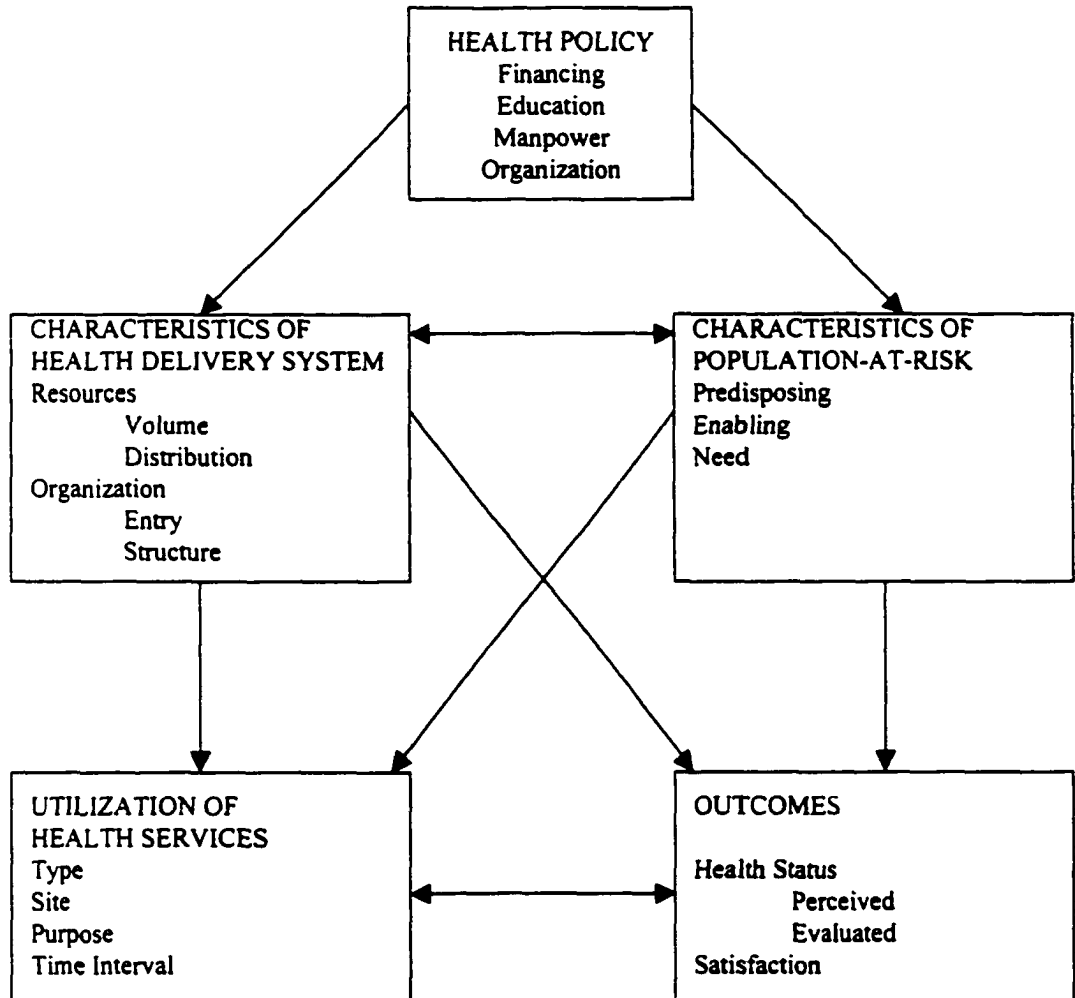
Aday and Andersen (1974) further developed the framework into a policy-focused Health System Model by explicitly including health delivery system resources and organization as well as national health policy as important determinants of the population's use of services and changes in use patterns over time. This phase of the model acknowledged the external environment (physical, political, and economic) as an

influence on health services utilization (Andersen, 1995). In addition, an explicit outcome of health services was added at this time: consumer satisfaction (Aday & Andersen, 1974).

Recognizing that utilization studies needed to examine use in the context of health outcomes of the population, measures of access were extended to include outcomes information important for health policy (Aday, Begley, Lairson, & Slater, 1993; Andersen, Davidson, & Ganz, 1994; Andersen, 1995). For example, effective access is realized when utilization improves consumer health status (Aday et al., 1993). Thus, health status can be considered as both a *predictor* (population need characteristic) and an *outcome* of utilization of services (Patrick & Erickson, 1993).

Recently, Andersen (1995) formally modified the model to include the health outcome component. The expanded model, currently referred to as the Health System Model used in this study is depicted in Figure 2.1.

Figure 2.1 Elaborated Health System Model



Adapted from: Aday, L. and Andersen, R. (1974). A framework for the study of access to medical care. *Health Services Research* 9, 212; Reprinted with the permission of the Health Research and Education Trust, 1974.

General Theory

The expanded Health System Model is an integrated framework which describes the concept of access to health care. The model proposes that health policy directly affects characteristics of the health delivery system and directly or indirectly affects characteristics of the population at risk to bring about changes in the use of health care services and in the consumer's health outcomes from and satisfaction with those services.

The model posits that the delivery system may directly affect utilization patterns and consumer health outcomes. The effects of the health delivery system are determined by the structure itself and not mediated by the properties of potential consumers. Alternatively, the system may impact the characteristics of the population and thus indirectly affect its utilization of services and consumers' outcomes of care.

Independent of system characteristics, population characteristics may directly affect use and satisfaction. These are the relationships most often reported in social research.

The health system model further implies that, over time, the use of services will influence consumer health outcomes which, in turn, may influence use. The model suggests both inpatient and outpatient indicators for the measurement of utilization. System and population components are depicted as process indicators. Utilization is depicted as either process or outcome indicator or both. Consumer health and satisfaction are depicted as outcome indicators (Aday & Andersen, 1974; Aday et al., 1993).

Key Components

Health Policy Variables

The basic framework suggests that one proceeds from health policy objectives

interacting with characteristics of the health delivery system and of the population at risk leading to the utilization of health services which, in turn, influences health outcomes. Improved access to care has been an important health policy goal, as evidenced by various financing, education, manpower and health care reorganization programs (Aday & Andersen, 1974). It is the effect of health policy in changing effective access to health care, that is, utilization that improves consumer health status outcomes, that administrators and policy makers are concerned with evaluating (Aday & Andersen, 1974).

An example of a policy variable consistent with the theoretical model is the Medicare HMO Program administered by HCFA (GAO, August 1995). Almost 4 million Medicare beneficiaries are enrolled in HMOs rather than traditional fee-for-service Medicare. Although HMOs must cover the benefits available under traditional FFS Medicare, HMOs differ in the provision of additional benefits, required premiums, networks of providers, and ability to satisfy members (GAO, October 1996). Additional services provided by some HMOs, not covered under traditional Medicare, may include outpatient prescription drugs and routine physical exams (GAO, October 1996).

Health Delivery System Variables

Characteristics of the delivery system are aggregate structural properties.

Differences between systems may be investigated while using the individual as the unit of analysis (Anderson, Smedby, & Anderson, 1970). The theoretical model identifies organization and resources as two distinct types of health delivery system variables that influence utilization and outcomes (Aday & Andersen, 1974).

Organization variables refer to the manner in which resources are coordinated and

controlled in the process of providing health services. The components of organization are structure and entry. Structure refers to characteristics of the delivery system that determine who the patient sees and how the patient is treated following entry into the system. An example of structural variables consistent with the theoretical model is the coordination and control of triage and treatment that is implicit or inherent in the different organizational structures of HMO and FFS systems (Aday & Andersen, 1974). Entry refers to the process of gaining entrance into the system and continuance of treatment process.

Resource variables refer to the assets available for use in the health delivery system. The components of resources are volume and distribution (Aday & Andersen, 1974). Community resource variables are commonly used in small area analysis studies employing the framework (Briggs, 1993).

Population-at-Risk Variables

The model posits that three types of population variables influence utilization and outcomes: predisposing, enabling, and need factors. Predisposing and enabling variables may be mutable (changeable) or immutable (unchangeable) (Aday & Andersen, 1974). Tables 2.1 and 2.2 summarize the relationship between population-at-risk variables and perceived health outcomes (health status and functional status) reported in the health services literature.

Predisposing factors such as age, gender, education, race, and marital status exist prior to illness and lay the foundation for individual health outcomes. Predisposing, enabling and need characteristics of the population-at-risk influence perceived health outcomes. In terms of predisposing characteristics, the literature indicates: as age

increases, health ratings decrease until one reaches the oldest ages (75 +) when the trend is reversed (Ferraro & Feller, 1996; Idler, 1993; Johnson & Wolinsky, 1993; Linn & Linn, 1980; Mutchler & Burr, 1991); females may have better health outcomes than males (Ferraro, 1993; Idler, 1993; Johnson & Wolinsky, 1993; Linn & Linn, 1980; Mutchler & Burr, 1991); as education increases, health outcomes increase (Ferraro, 1993; Idler, 1993; Johnson & Wolinsky, 1993; Mutchler & Burr, 1991); consumers who are married have more positive health outcomes (Goldman et al., 1995; Mutchler & Burr, 1991); and different races have different health outcome patterns (Ferraro, 1993; Ferraro & Feller, 1996; Johnson & Wolinsky, 1993; Mutchler & Burr, 1991). Racial differences in health outcomes suggest that Blacks and non-white populations tend to report poorer general health status (Ferraro, 1993; Mutchler & Burr, 1991) and more limitations in ADLs and IADLs (Ferraro, 1993; Johnson & Wolinsky, 1993; Mutchler & Burr, 1991; Verbrugge et al., 1990). Apparently, depending upon sample selection, some studies indicate significant race-by-gender interactions with poorer health status for either Black females or Black males than for other races (Ferraro, 1993; Ferraro & Feller, 1996).

Enabling variables are the resources available to individuals for use of services.

Enabling characteristics of the population also influence perceived health outcomes. The theoretical model indicates that income, insurance coverage or extent of coverage and attributes of the community of residence (e.g. census region, and metropolitan character) are enabling variables which influence the individual's demand for health care (Aday & Andersen, 1974) and subsequent outcomes. Type of health insurance plan, income, census region of residence and metropolitan residence are examples of enabling variables. The literature reports that those with additional private insurance have improved

perceived health outcomes (Mutchler & Burr, 1991) and greater income is associated with better perceived health (Goldman et al., 1995; Mutchler & Burr, 1991), but statistically significant differences in perceived health by census region or metropolitan status of residence were not evident.

Need variables refer to illness, which is the most immediate cause of health service use. Need characteristics of the population influence perceived health outcomes. Indicators of evaluated need include diagnoses assigned by the delivery system (i.e. clinical diagnostic categories) (Aday & Andersen, 1974). Diagnosed chronic disease conditions help to define the patient's status and cause of service use. As it relates to the population-at-risk, the individual is the unit of analysis (Aday & Andersen, 1974). The literature indicates that with increasing prevalence of chronic conditions, individuals are more likely to report poor versus good or better general health (Ferraro & Feller, 1996; Idler, 1993; Linn & Linn, 1980) and greater limitations in activities of daily living and instrumental activities of daily living (Goldman et al., 1995).

Table 2.1:

Community Studies Reporting Association Between Various Predictor Variables and
General Health

| Source | Predictor | Relationship |
|---|--------------------------|--|
| Levkoff (1987) Mutchler & Burr (1991) | Age | (-) as age ↑, HS ↓ (-) |
| Cockerham et al. (1983) Idler (1993) Johnson & Wolinsky (1993) | Age | (+) as age ↑, HS ↑ (+) (+) |
| Ferraro (1980) Linn & Linn (1980) Ferraro & Feller (1996) | Age | (-) for 65-74 year-olds (+) for 75 and over |
| Ferraro (1980) Idler (1993) Johnson & Wolinsky (1993) Linn & Linn (1980) Mutchler & Burr (1991) | Gender | (+) female (+) female (-) female (+) male (-) female |
| Ferraro (1980) Cockerham et al., (1983) Mutchler & Burr (1991) Idler (1993) Johnson & Wolinsky (1993) | Education | (+) (↑edu related to ↑ HS) (+) (+) (+) (+) |
| Cockerham et al. (1983) Mutchler & Burr (1991) Ferraro (1993) | Black Race | (+) (-) (-) |
| Ferraro (1993) Ferraro & Feller (1996) | Race X Gender | (-) Black female (-) Black male |
| Mutchler & Burr (1991) | Marital status | (+) Married |
| Mutchler & Burr (1991) | Private insurance | (+) |
| Mutchler & Burr (1991) | Income | (+) |
| Ferraro (1980) Linn & Linn (1980) Idler (1993) Ferraro & Feller (1996) | Number Chronic illnesses | (-) (-) (-) (-) |
| Ferraro & Feller (1996) | Serious illness | (-) |

Table 2.2:

Community Studies Reporting Association Between Various Predictor Variables and
Limitations in Functional Status

| Source | Predictor | Relationship* |
|--|--------------------|---|
| Verbrugge et al (1990) Mutchler & Burr (1991) | Age | (+) ADL, IADL; as age increases adl limitations increase (+) ADL |
| Verbrugge et al. (1990) Mutchler & Burr (1991) Johnson & Wolinsky (1993) | Female Gender | (+) ADL, IADL (+) ADL (-) AADL |
| Goldman et al. (1995) Belloc et al. (1971) Mutchler & Burr (1991) | Low Income | (+) ADL |
| Mutchler & Burr (1991) | Private insurance | (-) ADL |
| Mutchler & Burr (1991) Belloc et al. (1971) | Education | (-) ADL; as education increases, limitations decrease |
| Goldman et al. (1995) Belloc et al. (1971) | Marital Status | (+) ADLs in never married (+) ADLs in separated |
| Verbrugge et al. (1990) Goldman et al., (1995) | Chronic Conditions | (+) ADL, IADL (+) ADL |
| Verbrugge et al. (1990) Ferraro (1993) Mutchler & Burr (1991) Johnson & Wolinsky (1993) | Race | (+) ADL, IADL for non-white (+) ADL for Blacks (+) HADL in Blacks |

* Key: Functional status categories (Wolinsky & Johnson, 1991):

BADL is basic activities of daily living; need for help with personal activities bathing, dressing, getting out of bed, walking, toileting;

HADL is household activities of daily living; need for help with household chores such as meal preparation, shopping and light and heavy housework;

AADL is advanced activities of daily living; need for help with managing money, in using the telephone, and in eating.

ADL is activities of daily living; traditionally includes bathing, dressing, toileting, transferring, walking, and eating.

IADL is instrumental activities of daily living; traditionally includes using telephone, shopping, mobility, cooking meals, and managing money.

Utilization Variables

The theoretical model posits that utilization is a construct and a process measure for access to health care (Aday & Andersen, 1974). The model recommends measurement of the dependent variable of utilization of health services by type, site, purpose, and time interval. Type of utilization refers to the kind of service and who provided it (e.g. outpatient visit; inpatient stay). Site of the care refers to the place where service was received (e.g. Outpatient: outpatient, medical provider, emergency room; Inpatient: Hospital). Purpose generally refers to whether the visit was for preventive, illness related, or custodial care. Because the data source lacks a variable that records purpose, it was not measured in this study.

Time interval for a visit refers to contact, volume, or continuity measures. Contact refers to whether or not an individual entered the health delivery system in a given period of time (e.g. percent with outpatient visits in interval). Volume refers to the number of contacts and revisits in a time interval (e.g. number of outpatient visits per individual in interval). Continuity refers to the linkage and coordination of services with a particular illness episode. "The impact of various determinants of utilization may vary depending on the type, site, purpose or time interval analyzed" (Aday & Andersen, 1974, p. 215).

Outcomes

Health outcomes refer to the level of health status of the population. This component explicitly recognizes that health services are expected to maintain and improve the health status of the population (Andersen, 1995). Effective access is established when it is shown that use improves health status (Aday et al., 1993).

Effectiveness is concerned with health outcomes achieved in actual practice of health care

with typical patients and providers in the natural community environment (Aday et al., 1993). Outcomes assessment examines the linkages between organizational structures, health care processes and health outcomes (Aday et al., 1993). Assessment focuses on the interaction of structures and processes in achieving improvements in the health of clients. According to the framework, health outcomes may be measured by client perceptions or professional provider evaluations. In this study, clients' perceived general health and functional status were examined as the outcomes that reflect effectiveness of services provided to chronically ill older adult Medicare clients in HMO and FFS delivery systems.

Previous Application of the Framework

The Health System Model, developed by Andersen (1968), refined by Aday and Andersen (1974), and expanded to include outcome measures as suggested by Aday, Begley, Lairson, and Slater (1993), has not been extensively tested. Studies have examined the use of the health delivery system components in relation to utilization, but tests of the health status outcome component have been largely neglected to date.

Aday and Anderson's framework has been used in various national and community surveys of access (Aday, Andersen, & Fleming, 1980; 1984; Aday, Andersen, Loevy, & Kremer, 1985; Andersen et al., 1987). The Aday and Andersen (1974) framework was used by Urrita-Rojas and Aday (1991) to design and conduct a health needs assessment of a Hispanic immigrant and refugee community in 1987. Characteristics of both the health delivery system and the population were included in the study. The characteristics of the health delivery system were categorized as availability (volume and distribution) and organization (entry and structure). Information on the

availability and distribution of health care facilities and personnel in the community was obtained from record sources, institutions and interviews with key community informants. The authors concluded that use of the framework provided several benefits: the empirical approach for measuring access to health care was applicable to the public health-focused community assessment; the broader conceptual context of the framework was relevant for health policy and program development; and the survey package developed could be useful for other public health and nursing researchers. Analysis of community assessment data documented the need for expanded health delivery system facilities and services (Urrutia-Rojas & Aday, 1991).

The model was also used in a community survey that evaluated the impact of an innovative primary care model, the Robert Wood Johnson Foundation Community Hospital- Medical Staff Sponsored Group Practice Program, on access to medical care in the areas served by these programs (Aday et al., 1985). Reports suggest the model was useful in cataloguing information on access through local as well as national surveys. It was useful in describing relationships and exploring health care needs assessment, planning, and program impact evaluation activities. In the CHP evaluation, the health care organization-related policy option served as the starting point for measuring access in this study that focused on a small-area. The CHP was designed during a period when issues of access were more prominent concerns than cost containment.

Researchers concluded that program impact on access varied according to differences in organizational and community characteristics (Aday et al., 1985). There were no statistically significant differences in the number of hospital days or number of physician visits between users of CHP and users of other sources of care. However, the

CHP did reduce hospital use when they examined the direction of the findings across geographic sites. In ten of eleven sites, CHP users averaged fewer days in the hospital than the comparison group.

The Andersen framework has been used in various studies of the health and health services utilization of older adult respondents to the National Health Interview Survey (Wolinsky, 1990; Wolinsky, Arnold, & Nallapati, 1988; Wolinsky & Coe, 1984; Wolinsky, Coe, Miller, Pendergast, Creel, & Chavez, 1983). In general, these studies found that the framework explained less of the variance in older adult's utilization of services than it has for general population studies. Overall, these studies found that need characteristics were the major determinants of utilization and the amount of variance in service utilization explained by the model was small (i.e. 5.4% to 6.5% for outpatient physician's services; 5.6% to 7.4% for hospital stays).

One of Wolinsky's studies was a proportional hazards analysis of mortality outcomes over an eight year period in 7,527 older adult respondents to the Longitudinal Survey on Aging (Wolinsky, Johnson, & Stump, 1995). This study used hierarchical methods to introduce predisposing, enabling, need, and utilization predictors into sequential logistic regression models. Region of residence, but not population density, was a significant risk factor for mortality in this study. Those living in the North Central (Adjusted Odds Ratio 1.2174; partial r .0167; p = .0001) or Western (Adjusted Odds Ratio 1.1630; partial r .0100; p = .0093) regions of the United States were more likely to die than those in the Southern region (χ^2 2067; p < .0001). Both baseline number of physician visits (Adjusted Odds Ratio 1.0163; partial r .0134; p = .0012) and mean number of

hospital episodes per year (Adjusted Odds Ratio 1.5990; partial r .1261; $p = .0001$) had significant effects. "An increase of one hospital visit per year increased the odds of dying by 60%" (Wolinsky et al., 1995, p. 158).

Researchers have experienced problems in applying Andersen's model to the study of older adults. The model has a relatively low utility in predicting utilization among the elderly, perhaps due to measurement and modeling problems. First, measures of the health care delivery systems used by older adults have not been available (Wolinsky, 1990). Second, measures of enabling characteristics have not been significantly related to utilization or outcomes. Since 98% of the older adult population is covered by Medicare insurance, a single insurance variable may be too limited to represent the economic component "enabling" characteristics when studying this particular population. The advent of managed care, however, may increase the relevance of insurance factors. For example, many older adults now carry private Medigap insurance coverage in addition to Medicare. Enabling characteristics of the community of residence are not consistently related to utilization and outcomes (Wolinsky, Johnson, & Stump, 1995).

Application of the Health Delivery System Component

There is very limited empirical evidence relating organizational structure to utilization of, or outcomes from health services (Andersen, Smedby, & Anderson, 1970). Only three studies were found that tested the health delivery system component of the framework. All three studies used the Behavioral Model of health services use and focused on determinants of utilization, rather than determinants of health outcomes.

In an international comparative study, Andersen, Smedby & Anderson (1970) compared nationwide social surveys representative of two different country's populations

(United States and Sweden) to study the influence of health delivery systems on the use of physician, hospital, drug and dental health services. The model for the study assumed a valid comparison between Swedish and American health systems because the two health systems had been shaped by similar social, economic, and political systems; had responded to the same medical scientific forces; and had common measures of service use. The unit of analysis in this study was the individual but different organizational structures (United States and Sweden) were examined.

Analyses provided support for the model in that system effects (organizational structure) on the utilization of health services in Sweden and the United States did exist. Differences were attributed to the different ways care was organized in the two countries. People in the United States consumed more physician services (6.2 visits per year) than those in Sweden (3.6 visits per year) and these differences were supported in multivariate analyses ($p=.05$). Mean number of physician visits was higher in the United States (4.0) than in Sweden (2.5) although no difference was found in the proportion of the population with doctor visits across different delivery systems. Multivariate models identified predictors of system differences for persons 21 and over for number of physician visits (age, sex, education, region, symptoms and level of health explained 14% of the variance in the United States), hospital care (health insurance and level of health explained 7.3% of the variance in the United States), and number of hospital days (marital status, race, income, region, & level of health explained 13% of the variance in the United States). The study provided evidence that outpatient care was being replaced by inpatient care in Sweden in that people in that system used more hospital services.

Two unpublished dissertation studies were found that tested the health delivery

system component of the framework. Santos (1990) used the Health System Model (Aday & Andersen, 1974) to analyze the effect of health delivery system and population characteristics (i.e., education, income, and occupation) on the use of discretionary (preventive) health care among 4,111 adult Chicanos (aged 17 and over) responding to the 1980 Hispanic Health and Nutrition Examination Survey while controlling for other individual and health delivery system determinants. The study findings indicated that health delivery system factors (having a regular source of care, having health insurance & having dental insurance coverage) were important predictors of preventive health care service use (physical exam and dental exam). Self-perceived health status (need) was as important a determinant as dental insurance coverage as they related to having a preventive dental exam. Multiple classification analysis models accounted for 4.1 % of the explained variance related to having a routine physical exam and 15 % of the variance in having a preventive dental exam ($p \leq .05$). Health delivery system determinants were found more strongly related to the utilization behaviors than were the individual determinants. Having a physical exam was strongly influenced by having a regular source of care. Having a dental exam was strongly influenced by having dental insurance.

Briggs (1993) used a reduced Aday-Andersen model in a small area analysis of primary care physician office services use by Blue Shield enrollees (under 65) across Iowa to determine if changeable health delivery system characteristics (geographic differences) affected utilization rates. The study used a population-based patient classification system of ambulatory care groups (ACG) differentiated by case-type-specific office use rates to categorize enrollees. Health delivery system factors (physician supply and hospital use/capacity groups) were found to have an impact on six of eleven

high volume group-specific use rates. Briggs (1993) defined primary care physician office visits as face-to-face solo interactions with primary care physicians in all places of outpatient service. The reduced model, analyzed with hierarchical block entry of components into multiple regression models, explained 20% of the variance in use rates for the ambulatory care group “all other diagnoses” among 35-65 year olds (ACG 49); enabling factors accounted for 6%; physician supply factors accounted for 6%; and hospital capacity/use factors accounted for 12% of use rate variance ($p \leq 0.01$). Hospital capacity/use factors included number of outpatient services and facilities in each health service area, and number of outpatient services and facilities per 1,000 population in each health service area.

Overall, the Briggs (1993) study explained 14% to 24% of the variation in six of eleven ambulatory care group-specific outpatient use rates. The researcher concluded that physician and hospital use/capacity resource factors had significantly influenced physician visit rates, even after accounting for enabling factors, in only ACG49 “all other diagnoses” among 35-65 year olds. The study lacked a randomized sampling design, thus limiting findings to the specific groups studied. Furthermore, the study assumed that the prevalence of disease conditions and severity of illness did not affect use of primary care services. Although the study supported the theoretical framework in that delivery system organizational resources (physician supply and hospital capacity/use) did appear to influence utilization, the study was not designed to examine inpatient hospital utilization nor health outcomes resulting from outpatient or inpatient utilization.

Background

Background information for the study will focus on three major areas. The three

major areas of focus include: effects of delivery system organizational structure on health outcomes, relationship between utilization of health services and health outcomes, and the relationship between delivery system characteristics and utilization patterns.

Effects of Delivery Systems Organizational Structure on Health Outcomes

Four community studies comparing the effects of HMO and FFS delivery systems on health outcomes among chronically ill older adults and showing mixed results will be discussed. One study reports on the Medicare Competition Demonstration (MCD), funded by HCFA, that examined process and outcomes in 26 HMOs that operated as demonstration sites for Medicare risk contracts from 1983 to 1985 (Langwell & Hadley, 1989). Two different studies report findings from the Medical Outcomes Study (MOS) that sampled physician offices and their clients in three cities (Boston, Los Angeles, and Chicago) to compare utilization and outcomes in different delivery systems and among different physician specialties from 1986 to 1993 (Greenfield, Rogers, Mangotich, Carney, & Tarlov, 1995). The final study reports on access to care and outcomes for Medicare patients with an acute or a chronic symptom who were enrolled in HMO or FFS systems (Clement, Retchin, Brown, & Stegall, 1994). A table (Table 2.3) of the studies' design characteristics and close examination of two pivotal studies are included. Analysis of the two pivotal studies' support of the Health System Model is discussed.

Part of the MCD, a one-year (1985-1986) quasi-experimental non-randomized prospective pretest-posttest telephone survey evaluated access to and outcomes of care in 1,873 Medicare HMO enrollees in 17 cities and 917 Medicare FFS enrollees in 10 matched cities (Retchin et al., 1992). Participants were randomly selected from enrollee lists of the delivery systems. To avoid treatment diffusion threats to the study's internal

validity. FFS sites were drawn from regions without HMOs and matched on selected community characteristics (e.g. hospital occupancy rate, hospital days per person, population demographics, physician supply, geographic region, and average personal income). Thus the study design may have controlled potential confounding of the two distinct treatment systems of interest. While both groups of participants reported symptoms, sought care, and were seen in outpatient settings at similar rates, there were significant differences in functional status outcomes (activities of daily living and instrumental activities of daily living): fewer HMO enrollees (5.3%) experienced declines in functional status than did FFS enrollees (8.5%) between baseline and follow-up (χ^2 , $p < .01$). Logistic regression analysis, however, adjusted for predisposing, enabling and need characteristics of the patients and showed the reported differences to be related to differences in study groups at baseline (Retchin, et al., 1992). Access (as entry and utilization) to and quality (as functional status outcomes) of care delivery by HMOs was found comparable to that provided by FFS settings (Retchin et al., 1992).

It is important to note that in the MCD study ADLs were only measured if respondents reported impairment with one or more IADLs. ADL questions reflect relatively severe limitations in physical functioning. IADL items, on the other hand, reflect higher levels of function: cooking, shopping and cleaning activities. IADL scales are not simply measures of physical function, rather they reflect social roles as well as physical function (McDowell & Newell, 1996). Including both ADLs and IADLs would have provided outcome measures that were broader in scope.

Part of the MOS, an observational study reported findings of the four-year follow-

up of patients (18-97 years old) with one of two specific chronic illnesses: hypertension (n=1,044) and non-insulin dependent diabetes mellitus (n=317) (Greenfield, Rogers, Mangotich, Carney, & Tarlov, 1995). The MOS sampled one HMO group practice in each of three cities (Boston, Los Angeles, and Chicago) and 12 multispecialty FFS groups serving the same regions. From these delivery systems, physicians were randomly sampled and patients attending the offices of enrolled physicians were randomly sampled. The study examined differences in outcomes between 1986 and 1990 summary measures on the Medical Outcomes Study 36-item Short-Form Health Survey (SF-36). Although the eight health status sub-scales from the SF-36 used Likert-type summated ratings, summary functional status and general health perception indexes were constructed by adding weights from clinical experts' opinions to the participants' survey scores. Although it would be useful to know how the weighting was conducted, full description of the approach was not provided. Analysis of variance models adjusted for predisposing, enabling and need characteristics of the participants and revealed no significant differences in adjusted 4-year general health perceptions for clients with hypertension (HMO -0.3; FFS 2.0) or those with non-insulin dependent diabetes (HMO -2.0; FFS 0.2) (Greenfield, et al., 1995). Furthermore, no significant differences were found in adjusted 4-year functional status index scores for clients with hypertension (HMO -2.6; FFS -3.3) or those with diabetes (HMO -7.6; FFS -1.4) (Greenfield, et al., 1995). Researchers found no significant differences in general health or functional status outcomes for patients treated in different care delivery systems.

In a more recently published nested study of the MOS (Ware, Bayliss, Rogers, Kosinski, & Tarlov, 1996), researchers reported findings of the four-year follow-up of

2,708 elderly Medicare and low income patients with five different chronic illnesses: hypertension, diabetes, myocardial infarction, congestive heart failure, and depressive disorder. The study explored differences in outcomes using 1986 and 1990 summary measures on the Medical Outcomes Study 36-item Short-Form Health Survey (SF-36). Baseline scores were adjusted using covariates in regression models to make the groups more equal in predisposing, enabling, and need characteristics. Multinomial logistic regression analysis compared average changes and categorical changes (better, worse, same) in SF-36 health outcomes across groups. Pairwise comparisons between categories of change, but not mean change scores, in health outcomes were significantly different. Chronically ill older adult patients in HMO delivery systems (54%) were nearly twice as likely to decline in health outcomes over time as were those in traditional FFS delivery systems (28%) (χ^2 , $p < .001$) (Ware et al., 1996). The difference in health outcomes remained regardless of baseline health status, across all three study cities. Researchers suggested that most studies of one year duration do not find differences in outcomes and that this four-year design underscored the importance of longer follow-ups (Ware, et al., 1996). On the other hand, reliability of the categorical measures was not addressed and multiple testing threats existed in the study. Moreover, rapid changes in health delivery systems suggest the need to monitor shorter term outcomes for potential adverse results.

Finally, a cross-sectional, observational, 1990 household telephone survey of a nationally representative sample of HMO (n=6,476 enrollees) and FFS (n=6,381 enrollees) Medicare beneficiaries reporting chronic joint pain or acute chest pain during the previous year evaluated access to and outcomes of care (Clement, Retchin, Brown, &

Stegall, 1994). After controlling for predisposing and need characteristics with logistic regression models, researchers found no differences between the two groups in complete elimination of pain symptoms. Therefore, researchers examined outcomes with a finer distinction: moderate improvements in the severity of the pain symptoms (i.e., less pain). Among HMO and FFS enrollees who were still having pain, HMO enrollees were less likely to report improvement than FFS enrollees were (Odds ratio 0.72; 95% confidence interval 0.59-0.86; $p=.01$; two-tailed test). Researchers reported reduced utilization of services in Medicare HMOs and less improvement in one of four outcomes examined (Clement et al., 1994). Table 2.3 summarizes the studies reviewed.

Table 2.3

Community Studies Reporting Effects of Delivery Systems on Health Outcomes

| STUDY | SAMPLE | SELF-ASSESSMENT MEASURES | OTHER CONTROL VARIABLES |
|-------------------------|---|---|---|
| Retchin et al., 1992 | MCD N= 1,873 HMO enrollees in 17 cities; N= 916 FFS enrollees in 10 matched cities. Ages 67 and over | IADLS: <ul style="list-style-type: none"> • Shopping • Handling finances • Taking medicines • Preparing meals • Transportation • Using the telephone ADLS: <ul style="list-style-type: none"> • Dressing • Eating • Toileting • Grooming • Bathing • Transferring | <ul style="list-style-type: none"> • Age \geq 80 • Female gender • Marital status • Monthly income $<$\$400 • Health conditions • Functional status • Health status • History of hospitalization |
| Greenfield et al., 1995 | MOS Total MOS sample: 2 year- n=532 Hypertension n=170 Diabetes 4 year- n=1044 Hypertension n=317 Diabetes 7 year- n=1296 Hypertension n=424 Diabetes Ages 18-76 years | Not explicitly stated. Summary of 8 health status scales of SF-36. Summary of health outcomes and functional status outcomes added reported scores with weights derived from clinical opinion. Converted to three change categories: same (not more than expected by chance); better (improved more than expected by chance); and worse (declined more than expected by chance and those who died during follow-up given score of 0). | For clients with hypertension: <ul style="list-style-type: none"> • Age • Site • Sex • Race • Education • Poverty status • Presence of congestive heart failure • Comorbidities For clients with Diabetes: <ul style="list-style-type: none"> • Age • Site • Sex • Race • Education • Annual income • Complications of diabetes • Comorbidities |

Table 2.3

(Continued)

| STUDY | STATISTICS | POWER | THREATS |
|-------------------------|---|---|---|
| Retchin et al., 1992 | <ul style="list-style-type: none"> • Logistic Regression for decline in ≥ 1 IADL • Odds Ratios • 95% confidence intervals | Sufficient to detect difference of ≥ 5 percentage points on a binary variable with a power of .85 where one value has a mean .15 for a 2-tailed test @ .05 significance level. | <p>Selection- not a randomized trial. Although baseline measures were controlled other risk factors may have biased delivery system selection; high disenrollment overall (18%) from HMOs but tested with and without disenrollees; results may not be generalized to other cities or rural areas.</p> <p>Mono-operation bias Definition of the DV</p> <p>Description of the IV</p> <p>Novelty effects</p> <p>Recall bias</p> |
| Greenfield et al., 1995 | <ul style="list-style-type: none"> • ANOVA models • 95% confidence intervals • Confidence intervals <u>not</u> adjusted for multiple comparisons | Sample yielded sufficient power to detect a 3 point difference in aggregate mean health and physical function between delivery systems. | <p>Selection- not a randomized trial. Although baseline measures were controlled, other risk factors may have biased group selection; results may not be generalized to other cities or rural areas.</p> <p>Mono-operation bias Definition of the DV</p> <p>Description of IV</p> |

Table 2.3

(Continued)

| STUDY | SAMPLE | SELF-ASSESSMENT MEASURES | OTHER CONTROL VARIABLES |
|----------------------|--|--|--|
| Ware et al., 1996 | <p>MOS</p> <p>37% were > 65 years</p> <p>N= 822 elderly Medicare patients with one of five chronic illness tracer conditions:</p> <ul style="list-style-type: none"> • Hypertension • Diabetes • Myocardial infarction • Congestive heart failure • Depressive disorder | <p>Not explicitly stated.</p> <p>Summary of 8 health status scales of SF-36.</p> <p>Summary of health outcomes added reported scores with weights derived from clinical opinion.</p> <p>Converted to three change categories: same (not more than expected by chance); better (improved more than expected by chance); and worse (declined more than expected by chance and those who died during follow-up given score of 0).</p> | <ul style="list-style-type: none"> • Age • Sex • Race • Poverty status (per capita household income) • Summary index of comorbid conditions • Initial health status <p>Due to low prevalence of comorbid conditions, a summary index of 11 acute & chronic conditions was developed.</p> |
| Clement et al., 1994 | <p>Market area and zip code stratified random sample, representative of 1990 Medicare enrollees aged 65 and over entitled to Medicare for one year or more with at least 9 months in either HMO or FFS delivery system.</p> <p>Two symptom groups:</p> <ul style="list-style-type: none"> • Chronic joint pain • Acute chest pain <p>Ages 65 and over</p> <p>N= 6,476 in HMO N= 6,381 in FFS</p> | <ul style="list-style-type: none"> • Whether patients experienced complete resolution of the symptom (y/n). • For those still experiencing pain, whether there was lessening of the pain after treatment (y/n). | <ul style="list-style-type: none"> • Age • Gender • Race • Marital status • Education • Lives alone • Employed • Health status • History of cancer, stroke, heart disease • ADL/IADL • Utilization |

Table 2.3

(Continued)

| STUDY | STATISTICS | POWER | THREATS |
|----------------------|---|--|---|
| Ware et al., 1996 | <ul style="list-style-type: none"> • Multinomial logistic regression compared categorical changes • <u>No</u> adjustments for multiple comparisons | Power was greater than 80% to detect an average difference of 2 points or larger on a scale of 0-100 in comparison between HMO and FFS systems using 2-tailed tests and alpha @ .05. | <p>FFS clients were older, more likely female, in poverty, more likely to have had recent myocardial infarction than HMO clients were.</p> <p>Selection bias- not a randomized trial. Although baseline measures were controlled, other risk factors may have biased group selection; results may not be generalized to other cities or rural areas.</p> <p>Mono-operation bias Definition of the DV</p> <p>Description of IV</p> |
| Clement et al., 1994 | <ul style="list-style-type: none"> • Logistic Regression • Odds Ratios & • 95% confidence intervals for the ratios are presented for the likelihood of enrollment in an HMO for each of the outcome measures | Sample yielded 80% power to detect an effect of 2 percentage points on a binary variable with a mean of .20 or O.R. of ≥ 1.34 for positive effects or $\leq .75$ for negative effects for binary variable with mean of .50 when using 2-tailed test @ .05 significance level. | <p>Selection- HMO clients with joint pain reported better general health; better functional status; were less likely to have history of serious illness; and were less likely to be women than FFS clients.</p> <p>Ambiguity/ reverse causality</p> <p>Mono-operation bias Definition of DV</p> <p>Description of IV</p> |

Closer examination of two pivotal studies already reported is in order. The two studies of interest are the MOS (Ware et al, 1996) and the MCD study (Retchin et al., 1992). Variation in findings between these studies may be attributed to differences in historical context, methodology, and outcome measures. Changes in health delivery systems during the history of these studies may have occurred. The MCD was conducted earlier (1983-1985) in the development of HMOs than was the MOS (1986-1993). The MCD was a demonstration project implemented under special conditions in an early phase of the development of managed care for Medicare populations. The MOS examined well-established HMOs operating in their natural environments. Neither of these studies provided nationally representative samples that would allow generalization of findings to other cities or rural areas.

The MCD was a one-year prospective study that found no significant differences in outcomes for clients in HMO and FFS systems operating in controlled environments and not interacting with each other. The MOS was a two- four- and seven-year outcomes study that reported significant differences in outcomes between HMO and FFS systems operating and interacting in their natural environments. MOS researchers noted the necessity of longer follow-up times in order for studies to detect changes in outcomes (Ware et al., 1996).

Furthermore, both the MCD and the MOS used generic forms of outcome measures that may not have been sensitive enough to detect differences of small effect sizes. The MCD used a profile of ADL and IADL measures while the MOS used a standardized index score of the SF-36. The MCD used somewhat limited operational criteria: not measuring ADLs unless respondents reported having had limitations in at least one

IADL. This limitation might have overlooked some small differences between groups.

The MOS reported a sufficient power to detect much smaller changes (two points) than did the MCD (five points). Both studies used similar statistical analysis methods: regression models. However, the MOS controlled for more factors than did the MCD. Given that the MCD had both a smaller power and fewer controls for error variance, it is feasible that this study was unable to detect existing differences between groups. On the other hand, failing to adjust for multiple comparisons may have threatened statistical conclusion validity in the MOS.

Four studies were found that examined the influence of delivery system organizational structures on perceived health outcomes for chronically ill older adult clients. Only two studies, Retchin et al., (1992) and Ware et al., (1996), included individuals with diverse chronic illness conditions. Although the two studies did not directly test the Health System Model, they provided some support for the theoretical framework. Ware et al., (1996) identified differences in health outcomes for clients in different delivery systems, providing evidence of the impact of different organizational structures. Both studies examined various population factors (predisposing, enabling, and need characteristics) as determinants of outcomes from health systems, but each omitted factors such as other insurance coverage (Retchin et al., 1992; Ware et al., 1996), education (Ware et al., 1996), and marital status (Ware et al., 1996). Neither study included enabling characteristics of the community (i.e., census region or metropolitan character of residence), as suggested in the model.

Moreover the Health System Model contends that outcomes assessment examines the linkages between organizational structures, care processes, and outcomes (Aday et al.,

1993). Neither the MCD (Retchin et al., 1992) nor the MOS (Ware et al., 1996) included utilization factors in the multivariate (outcomes) models reported. Utilization factors as care processes are key factors to consider according to the model.

Relationship Between Utilization of Services and Health Outcomes

Literature reports an association between use of regular health care services and lower rates of avoidable hospitalization (defined as a poor health outcome) for those with diabetes and other chronic conditions (Parchman & Culler, 1994). The Institute of Medicine's Access Monitoring Project, a study directed by Millman (1993), proposed a set of specific indicators to assess and monitor access to health care at the national level. Existing data bases were used to measure the indicators. The National Health Interview Survey was one of the major data sources employed in the project. Using secondary analysis of longitudinal survey data from the National Health Interview Survey (1976-1989), the Access Monitoring Project found that Medicare recipients without supplemental private insurance were much less likely to receive regular health care if they had low income. Differences in proportions with regular care according to race and region of residence disappeared once controls were included for income and insurance. Differences between high- and low-income categories for privately insured suggested coinsurance and deductible effects. Chronically ill Medicare clients not receiving regular care ranged from 5% (Medicare and private health insurance) to 10% (Medicare only). Average number of annual outpatient contacts among chronically ill clients was 12.9 (Medicare only) to 16.5 visits (Medicare and private health insurance). Reported differences were significant at the 5 percent level or less although specific statistical tests were not explicitly stated (Millman, 1993). The project concluded that under-use of the

outpatient health care delivery system by those with chronic illnesses “as reflected by few or irregular physician visits or a less than optimal regimen of care may indicate an access problem” (Millman, 1993, p. 91). Underuse would apparently be defined by practice standards for each specific chronic illness.

Limited empirical evidence was found that examined the influence of utilization of services on health outcomes among older adults with diverse chronic illness conditions. The Institute of Medicine’s Access Monitoring Project (Millman, 1993) provided some support for the theoretical framework. Population characteristics (low income, lack of other insurance) influenced clients’ likelihood of receiving regular health care. Population characteristics included race, income, other insurance, and an enabling characteristic of the community, region of residence, as suggested by the model. Regular outpatient care visits provided useful process measures, and indicators for access monitoring, as suggested by the Health System Model.

Relationship Between Delivery System Organizational Structure and Utilization

Relationships between delivery system characteristics and utilization patterns have been studied. Miller and Luft (1994) recently summarized what was known about the relationship between managed care plans and the utilization of health resources in nine same-disease studies, including Medicare beneficiaries, conducted from 1980-1993. They found that clients in HMOs experienced slightly lower hospitalization rates, 1-20% shorter lengths of stay in hospital, similar rates of physician office visits, and greater use of preventive services than clients in FFS systems (Miller & Luft, 1994).

Nelson et al., (1998) used data from the MOS in a four-year longitudinal observational study on 1,681 older clients (mean age 60 years) with chronic illnesses

(hypertension, diabetes, myocardial infarction, or congestive heart failure) to compare inpatient and outpatient utilization between prepaid and FFS insurance payment systems. System of care was classified based on type of insurance reimbursement reported by patients. The study used ANOVA to report observed, unadjusted rates; logistic regression to analyze reports of any hospitalization or outpatient visits; and ordinary least squares regression to analyze levels of utilization for those reporting any utilization. Predisposing (age, gender, education, race, family size), enabling (income, geographic location) and need (chronic disease and severity, physical functioning, mental health) factors explained 7.1% of the variance in hospitalizations and 9.1% of the variance in physician office visits. Prepaid patients having any hospitalization averaged 11.4 % per year, compared with FFS patients' 14.7 % per year (ANOVA $p=.04$). After adjusting for population-at-risk variables in regression models, expected hospitalization rates were 15 % lower for prepaid patients (171 hospitalizations/ 1,000 patients/ year) than FFS patients (202 hospitalizations/ 1,000 patients/ year) ($p=.08$). Researchers published percentages and rates as opposed to ANOVA tables in the research article.

Prepaid patients having any physician office visit during a six month period was 89.8 %. compared with FFS patients' 86.0 % (ANOVA $p=.06$) (Nelson et al., 1998). After adjusting for population-at-risk variables, differences between expected physician office visit rates were small but significant (87.4 % for prepaid patients and 88.0 % for FFS patients; $p=.02$). Physician office visit rates were similar (4.36 visits/patient/six months for prepaid; 4.38 visits/patient/six months for FFS). A surprising finding was that sicker prepaid patients had 12 % fewer hospitalizations than comparable FFS patients ($p=.04$), whereas healthier prepaid patients had 4 % more hospitalizations than FFS patients

($p = .08$). Researchers reported that only factors intrinsic to the HMO and FFS systems could explain the differences, apparently, since they had controlled for population characteristics in the statistical models.

Hellinger (1996) reviewed results of studies comparing utilization of services in managed care plans to that in FFS plans with a particular focus on financial incentives that impact physician practice patterns related to hospitalization, outpatient visits, and cost of care. Although the studies reviewed were subject to potential biases from patient selection effects, physician selection effects, and unmeasured system characteristics, the review concluded that in every study financial incentives inherent in the different delivery systems are key to explaining HMO's reductions in utilization of services (Hellinger, 1996).

Greenfield, et al. (1992) explored differences in utilization between systems of care (i.e. solo and specialty physician practices) and physician specialties among MOS participants with diabetes mellitus or hypertension. Cross-sectional survey data on 22,223 patients and 362 providers, that controlled for patient need by adjusting patient mix, found that FFS systems had 41% higher hospitalization rates than HMO systems ($p < .05$) and office visit rates for FFS (4.30 visits/patient/year) systems were 8% lower than those for the HMO (4.68 visits/ patient/year) ($p < .001$). Both organizational system and payment method had independent effects on utilization. HMO patients had reduced rates of hospitalization and higher rates of office visits than did FFS patients (Greenfield et al, 1992). Results suggested that health system, payment method, and physician specialty provide independent incentives that influence utilization patterns regardless of patient health status, with FFS arrangements favoring high use rates of hospitals (Greenfield et

al., 1992).

Clement, et al., (1994) evaluated differences in utilization patterns across the two delivery systems (i.e. as defined by HCFA list files). This cross-sectional 1990 household telephone survey of a nationally representative sample of HMO (n=6,476 enrollees) and FFS (n=6,381 enrollees) included Medicare beneficiaries reporting chronic joint pain or acute chest pain during the previous year. After controlling for predisposing and need characteristics with logistic regression models, differences in utilization were identified. Physician visits were more likely among HMO clients with chronic joint pain than comparable FFS clients (Odds ratio 1.19, 95% confidence interval 1.03-1.38, p=.05) but HMO clients were less likely to be seen by specialists (Odds ratio .62, 95% confidence interval .53-.73, p=.001). Furthermore, researchers found that HMO clients with chronic joint pain were less likely to be followed-up (Odds ratio .77, 95% confidence interval .66-.90, p=.001) or monitored closely (Odds ratio .85, 95% confidence interval .72-.99, p=.05) after their initial visits than were FFS clients. Similar results were found for clients with acute chest pain symptoms. Results of the study consistently supported conclusions that physician visits were less likely, but specialist visits, and closer follow-ups and monitoring were more likely for clients with either chronic or acute symptoms in FFS systems (Clement et al., 1994).

A number of studies were found that examined the relationship between delivery system and utilization patterns. Comparisons between the studies were not clear because of different definitions for delivery systems, different study populations and different definitions of utilization. While these inconsistencies existed, there did appear to be a general trend in the findings. The general trend indicates fewer hospitalization events and

similar or higher outpatient visits in HMOs than in FFS systems.

These studies provide support for the Health System Model. The studies' findings suggest different rates of hospital and outpatient utilization between HMO and FFS systems. These findings are consistent with the model's premise that delivery systems directly affect client utilization patterns. Furthermore study findings support the model's contention that predisposing, enabling and need factors of the population influence utilization patterns (Clement et al., 1994; Greenfield et al., 1992; Nelson et al., 1998).

A limitation of these studies is that selection biases exist in some studies (Greenfield, et al., 1992; Nelson et al., 1998). In addition, physician selection biases exist in some studies (Greenfield et al., 1992; Nelson et al., 1998). Although the Health System model suggests that enabling characteristics of the community of residence are important factors to consider, unmeasured regional (Greenfield et al., 1992; Nelson et al., 1998) and delivery system characteristics may exist in some studies (Hellinger, 1996).

Summary

Frequently used to analyze population factors that influence client utilization of care, use of the Health System Model for examining the role of delivery system factors has been largely neglected. Previous research has examined population characteristics and delivery system organizational structures and their relationship to health services utilization. Only two studies were found that examined the influence of delivery system factors on client-centered perceived health outcomes among chronically ill older adults. These two studies provide limited support for the utility of the Health System Model in examining relationships between delivery system organizational structure and utilization.

Perceived Health as an Outcome Measure

Perceived health status is recognized as an outcome of health service utilization by participants in the development of the Andersen framework. The original framework focused on determinants of health service utilization. In the original framework, health status was used as one aspect of the need characteristic of the population-at-risk: a factor that influenced utilization. With further development of the framework, the need to examine utilization of health services in the context of health outcomes of the population was recognized. The outcomes component was expanded and measures were extended to include health status outcomes information important for policy decisionmaking (Aday, Begley, Lairson, & Slater, 1993; Andersen, Davidson, & Ganz, 1994; Andersen, 1995).

Studies testing the perceived health outcome component of the Andersen framework were not identified. Andersen (1995), however, has recently published information about the evolving model and has encouraged health services researchers to test the current framework.

Theoretically, perceived health can be measured in various ways. Ideally a measure of perceived health should reflect both positive and negative attributes (i.e., good, and poor health) of the concept. It is feasible that different measures might provide data that are more comprehensive, therefore multiple measures are desirable in that they will reduce the likelihood of invalid conclusions. Since this study is concerned with measurement of perceived health outcome, and clients' opinions and autonomy are increasingly recognized to have value in their own right, measures based on clients' independent judgements were used in this study.

A frequently discussed issue involves the contrast between objective and

subjective health status indicators. In essence, this argument reflects the difference between measurements based on laboratory tests and measurements in which a person makes a judgement that represents health status. Indicators based on judgements are considered "subjective" regardless of who makes the rating (McDowell & Newell, 1996). Physician assessments are considered subjective (Kane & Kane, 1981, p. 221). Objective measures such as laboratory tests would also have an associated margin of error. These discussions are consistent with Andersen's framework in that health status outcomes may be either perceived or evaluated. Perceived health status would be consistent with the subjective health status indicators. Evaluated health status measures might include laboratory test measures. If clinician evaluations were considered more objective than client's self-perceptions, then evaluated health status measures might include clinician opinions. This study was concerned with health status outcomes as perceived by the clients or consumers of health care services themselves, that is, self-reported outcomes. In this study, clinician judgements and laboratory tests were not measured.

Considerable attention has recently been paid to the issue of assessing health status measurement among the older adult population. Studies suggest that valid and accurate reflections of older adult's health will require measures of both global summary (general health status) and functional profile (ADLs and IADLs) dimensions of health status. Because global and functional dimensions of health status represent distinct phenomena that are only moderately related (i.e. $r = .37$), studies that fail to measure both domains are likely to result in lower explained variance and invalid conclusions (Wolinsky, Coe, Miller, & Pendergast, 1984).

For studies of older adult populations with chronic illnesses, it is important to

measure aspects of health that may be relevant in gerontological research, such as mobility (functional status) and support efforts (reporting assistance received with ADLs or IADLs) (McHorney, 1996). Such measures as functional status may be more useful and discriminating in studies of older adults than for other subpopulations (McHorney, 1996). Authors suggest that reports of assistance received provides more useful information about support efforts/resources than reports of assistance needed. This study did, therefore, include both global summary and functional profile dimensions by using reports of general health status and limitations in ADLs and IADLs.

Furthermore, gerontological research provides quantitative support for the premise that global (general health status) and functional (ADLs /IADLs) status represent two distinct dimensions of the health status construct. Wolinsky et al. (1984) randomly sampled 401 older adults (65 and over) living in the St. Louis metropolitan statistical area using factor analysis techniques to examine the distinct domains that underlie seven commonly used health status measures. The measures included general perceived health, mental orientation, ADL, IADL, perceived sensory functions, nutritional risk, and mental health. The single-item perceived health question, the ADL, and the IADL measures had the highest standardized factor loading scores (-.73, -.74, -.64 respectively) of all items loading on the global and functional dimensions respectively in exploratory and principal components factor analyses. These two factors (global dimension and functional dimension) explained 56% of the variance in the seven health status measures employed. Wolinsky et al., (1984) concluded that both the perceived health and the ADL/IADL measures “are highly reliable and valid measures” (p. 91).

In further studies, Wolinsky & Johnson (1991) identified multiple item scales

reflecting functional status capabilities that were modeled after various measures of activities of daily living. The researchers used theoretically derived factor and principal components analyses of 21 activities of daily living and instrumental activities of daily living to reduce the data and identify three latent variables among a nationally representative sample of older adult respondents to the Longitudinal Survey on Aging (Wolinsky & Johnson, 1991). The first factor identified was the basic activities of daily living (BADL). The BADL had a minimum factor loading of .718 and internal consistency reliability score of .83. It consisted of five items from the traditional activities of daily living, including having difficulties with personal activities of bathing, dressing, getting out of bed or chair, toileting, and walking. The second factor identified was the household activities of daily living (HADL) (factor loading= .73; alpha= .83). The HADL consisted of four items taken from the instrumental ADLs, including having difficulties with household activities such as meal preparation, shopping, and light and heavy housework. The third factor identified was the advanced (i.e. cognitive) activities of daily living (AADL) (factor loading= .68; alpha= .64). The AADL consisted of three items from the original ADL and IADL scales such as difficulties with managing money, using the telephone, and eating. The AADL items represented a unique set of activities that focused on cognitive capacity. Impairments in cognitive capacity identified with the AADL included the inability to communicate on the telephone, to remember telephone numbers and the need to eat, and to plan for the future (i.e. schedule meals and manage money).

Scoring for the items ranges from 0-5 for BADL, 0-4 for HADL, and 0-3 for AADL. For each of the scales, the researcher indicates the total number of functional

limitations identified in the scale. For example, if the client requires assistance with five activities in the BADL, their score would be five. If the client requires assistance with no BADL, their score would be zero. Construct validation of the three ADL scales using the longitudinal Survey on Aging was further supported in additional studies (Johnson & Wolinsky, 1993; Johnson & Wolinsky, 1994; Wolinsky, Johnson, & Stump, 1995). It is important to note that these studies were all based on use of the original Behavioral Model of health service utilization.

Research using the BADL, HADL, and AADL classification scheme suggests the need to analyze these functional status factors as separate scales in gerontological studies in order to increase sensitivity of measures that may have small effect sizes, especially with regard to measurement of relatively minor differences in health status that may exist in older adult populations. For example, limitations in HADLs noted in the Longitudinal Survey on Aging have been found to make it difficult for older adult respondents to live independently in the community (Wolinsky, Callahan, Fitzgerald, & Johnson, 1992). The activities of daily living classification system identified by Wolinsky and colleagues was used to examine functional health status in this research because 1) it is in accordance with perceived outcome measures of the theoretical model, 2) it has construct validation support, and 3) it is oriented towards and meaningful to various providers.

Idler (1992) viewed self-perceived health status as the end result of a complicated cognitive process in which the individual considers all information about his/her health, chooses a threshold relevant to himself or herself, and selects a rating based on ones own criteria and values. This view implies that the individual uses internal processes inaccessible to external observers. It also suggests that the individual combines objective

and subjective information with judgements about what the information means to them personally. Similarly, some researchers posit that subjective reports can not be wrong because “individuals are, by definition, the only judges of what constitutes...health.... for themselves” (Angel & Gronfein, 1988, p. 465).

The primary criterion variable in this study was perceived health outcome. Two measures of health outcome were explored: general health and functional status (capacity to perform basic, household, and advanced activities of daily living). Both health outcome measures represent measures of health based on the client’s independent judgement. Both measures have predicted important objective (observable) health outcomes (Idler, 1992; Kaplan, 1987) and there is literature relating general health to functional status (Liang, 1986; Linn & Linn, 1980; Wolinsky, Coe, Miller, & Pendergast, 1984). Moreover, both general health and functional status have been used as outcome variables (Katz et al., 1963; Kaplan, Greenfield, & Ware, 1989) and employed in outcome indexes in studies of chronically ill adults (Greenfield et al., 1992; Ware et al., 1996). Both measures are recognized as distinct elements of health status that are affected by cognitive, emotional and social factors (Wolinsky et al., 1984). Thus, they may be considered reflective of health as a multidimensional phenomenon: a state of complete physical, mental and social well being, more than merely the absence of disease (World Health Organization, 1948).

Limitations of Previous Research

While the Health System Model has frequently been used to analyze factors that influence client utilization of health care services, its use in examining the role of health delivery system organizational factors has been somewhat neglected. The Health System

Model suggests, however, that these are key factors to consider. Therefore, they were addressed in this research.

Although there is a large amount of research dealing with utilization, there is a limited amount of research examining health outcomes as suggested in the recently expanded model. Only two studies were found that examined the influence of delivery system factors on client-centered outcomes among older adults with diverse chronic illness conditions and their findings were in conflict.

A number of studies have examined various population characteristics as determinants of outcomes from health services, as noted in Tables 2.1, 2.2. Some researchers have not included enabling attributes of the community of residence (census region, metropolitan character of residence) while others have failed to take differences in outpatient and inpatient utilization factors into account. There is no one standard approach. There is a need for research to determine the impact of these different factors on outcomes.

In summary, this research addressed these two limitations of previous research:

1. The impact of health delivery system organizational structures on perceived health outcomes.
2. The impact of a profile of population (and community) characteristics, inpatient utilization, and outpatient utilization factors on perceived health outcomes.

The theoretical framework for this study combined both individual (population and community characteristics) and system (health delivery system organizational structure) level variables as determinants of health outcomes. Therefore, this study

included both levels of variables in examining the differences in health outcomes for chronically ill older adults cared for in HMO and FFS systems.

The basic hypothesis of this study was that clients' health outcomes are influenced by the interaction of the delivery system, population characteristics, and service utilization factors. The Health System Model is relevant to this study to the extent that evidence of the explanatory power of the delivery system organizational structure for outcomes appears likely to be strongest when the characteristics of the population (and community) are examined in relation to health delivery system organizational characteristics and health services utilization patterns of the population. This may be particularly true where the population is one with a high prevalence of chronic illness conditions and medical insurance coverage.

CHAPTER III

METHODS

This chapter discusses the study's observational design and statistical methods. The objectives for this chapter are: first, identify the data source; second, bridge the theoretical model with a hypothesized model for analysis; third, specify the study hypotheses; fourth, identify computer software and hardware support; fifth, explicate procedures for protection of human subjects; and sixth, describe how the hypotheses were tested.

Research Design

An observational, descriptive cross-sectional research design was used to describe and explain health delivery system effects on health status outcomes among older Medicare clients with chronic illnesses. Two groups were defined by their exposure, in 1995, to different Medicare health delivery systems: HMO and FFS. Random assignment of participants was not possible as intact groups were studied using linked survey and administrative data collected without manipulation of variables and provided by the HCFA. HCFAs complex, stratified, multi-stage, un-equal probability, list-sampling procedures produced a nationally representative sample of Medicare enrollees, of which a sub-sample of 1995 participants was used in this study (Adler, 1994).

Assumptions

This study assumed that self-reported health is an accurate reflection of outcome. Studies have found that self-ratings of health among older adults are valid measures of a respondent's objective health status (Ferraro, 1980; Linn & Linn, 1980; Cockerham, Sharp, & Wilcox, 1983) and are correlated with objective measures (Idler & Kasl, 1991). Furthermore, older adults' self-ratings of health have proven to be precise and valid for estimating demand for health services (Ware, Brook, Davies, & Lohr, 1980), and are useful as health outcome measures in their own right (Wolinsky, 1988). Additional assumptions were made. It was assumed that:

- The health outcome measures employed in the study are sensitive enough to be useful in evaluating health services.
- Data was compiled accurately.
- Respondents report all service utilization events.
- The general health measure (a single item) is reliable.
- Exposure time to the delivery systems of interest was sufficient to have had an effect on health outcomes reported by respondents.
- Outcomes are reflective of performance/process of care in HMO and FFS systems.

Limitations

Interpretation of the data on health outcomes was complex. While the observational design of the study makes it difficult to attribute cause and effect to statistical relationships, causative exposures relative to the outcome may be inferred and may indicate a need for further study and data collection. While the data for this study were collected in 1995 and changes in delivery systems have taken place since that time, the 1995 MCBS provided a relatively large, nationally representative sample and was the most current data set available. Because the study involved clients in a variety of health delivery systems, which are constantly changing, characteristics of the systems that might be responsible for different patterns of health outcomes could not be identified. Although this study attempted to account for measures of utilization (inpatient hospital stay events and outpatient visits and services), length of hospital stays and associated financial costs of utilization were beyond the scope of the study. It is important to note that this research focused on general health and functional status as outcome measures among clients with diverse chronic illnesses since they are a primary concern of clients, providers, administrators and government. There are a number of other chronic illnesses, such as mental illnesses (e.g. chronic depression), however, that are extremely important and need to be considered in future studies. It should be noted that respondents may have had other chronic conditions that were not identified in the survey instrument.

Although reliability estimates for the survey data collection were not available, representativeness of the data was strengthened by methods used by the Health Care Financing Administration (HCFA) and its contracted research firm, Westat Inc. Computer-assisted-personal-interviews were conducted by interviewers in the homes of respondents. Recall bias was controlled by surveying Medicare enrollee panel members three times (once every four months) and providing members with health event calendars and reminders to collect health care receipts. Interviewers were trained and the reliability of their coding was tested annually (B.Long, personal communication, January 1998). While three survey interviews in one year facilitated participant recall, repetition may also have resulted in a survey effect (over-reporting of utilization). However, survey effects would have been controlled by interviewers asking for utilization since the previous interview and by linking administrative claims data to survey data.

This study analyzed data collected at three different times over the year in 1995. Health and functional status questions were asked in the Fall (September-December) round of interviews. Utilization questions were asked at the other two interviews (January-April; May-August). The timing of health status questions strengthens the construct validity of self-reported perceived health status as an outcome measure in this study.

Identification of Data Source

To estimate the risk of health delivery system to health outcomes, the investigator analyzed data from the **1995 Medicare Current Beneficiary Survey Cost and Use File (MCBS)**, which was released for public use in March, 1998. The MCBS is a multipurpose ongoing household panel survey of a representative sample of the Medicare population, sponsored by HCFA in the Department of Health and Human Services of the U. S. Government. The data have been collected for policy analysis since 1991. Field work on the MCBS is conducted by Westat, Inc., a contracted survey research firm.

The MCBS is a longitudinal panel survey. Survey participants are interviewed

three times a year for four years. The sample is selected from Medicare enrollment files to represent the entire Medicare population and specific age groups: under 45, 45 to 64, 65 to 69, 70 to 74, 75 to 79, 80 to 84, and 85 and over (Health Care Financing Administration, 1998). Disabled persons (under age 65) and very old persons (age 80 and over) are oversampled to insure a sample size sufficient to produce reliable estimates for analyses of these groups. The sample is drawn from 107 primary sampling units (major geographic areas) chosen to represent the Nation (including the 50 States, the District of Columbia and Puerto Rico). The sample design is a stratified area probability design with three stage selection: 107 metropolitan statistical areas and clusters of non-metropolitan counties; 1,437 zip code clusters within each area; and participants within each zip code cluster.

The MCBS includes a sample representative of the entire Medicare population. That is, everyone who was ever enrolled in either one or both parts (A and/or B) of the program at any time during the 1995 calendar year. Those entitled to Medicare coverage for all of 1995, those whose eligibility began during 1995, and those who died during 1995 are represented (Health Care Financing Administration, 1998). The sample was drawn from Medicare enrollment lists of persons entitled to Medicare on January 1, 1994 and continuously enrolled into 1995 (original sample and supplemental sample I, II, and III), new enrollees added in 1994 and continuously enrolled into 1995 (supplemental sample IV), and new enrollees added in 1995 (supplemental sample V). These new participants had their initial interviews in September-December round of 1994, 1995, and 1996 respectively. Initial interviews included baseline survey questions about living situation and health status, but not questions about cost and utilization. Since newly added participants were not asked cost and utilization questions in 1995, comparable 1995 participants were identified (based on their utilization profiles) and new participant's total (Medicare and non-covered) utilization and costs were imputed (Health Care Financing Administration, 1998). Eligible respondents for the 1995 MCBS totaled

17,575 persons. The 1995 MCBS is composed of interviews with 12,096 participants from six panels, with an initial response rate of 85%, subsequent year's response rate of 93% and a cumulative response rate of 69 percent (Health Care Financing Administration, 1998).

MCBS participants (or their designated proxy respondents) were surveyed in the community using computer-assisted personal interviewing survey instruments installed on notebook computers. The computer program guides the interviewer through a series of questions, skip patterns and follow-up questions, records responses, and compares with specifications to edit allowable codes and relationships with other responses. This method decreases the need for later editing and corrections. When completed, the interviewer may transmit the data by telephone to the home office computer. If participants are unable to answer questions, they are asked to designate a proxy respondent (family member or close acquaintance). Approximately 12 percent of the community interviews of each round are done by proxy (Health Care Financing Administration, 1998).

The MCBS links health delivery system data (HMO, FFS) and population-at-risk data (income, educational level, health insurance, chronic illnesses) gathered by surveys and Medicare administrative data to utilization data (outpatient visits and inpatient stays) and health outcome data (general health and functional status) gathered by surveys (Eppig & Chulis, 1997). The MCBS provides a relatively complete data set with information on all self-reported utilization of health services, whether covered by Medicare or not, and services provided by HMOs (Eppig & Chulis, 1997), necessary to provide a rich understanding of the determinants of health outcomes in this study. The 1995 MCBS was the most current data set available (Health Care Financing Administration, 1998).

Analytic Weights

The MCBS includes a cross-sectional full sample weight for each participant in the data set. This weight reflects the overall probability of selection for each person, including adjustment for oversampling, survey nonresponse and post-stratification. The

weights inflate the sample to the total Medicare population in 1995. Even with these weights, this analysis may not perfectly represent the characteristics of all non-institutionalized, non-disabled, older adult Medicare beneficiaries reporting diagnosis of at least one chronic illness.

The MCBS also includes 100 replicate weights for each participant in the data set. Replicate weights for MCBS data were computed by Westat using Fay's method of balanced repeated replication, a method appropriate for complex samples in which two primary sampling units were sampled within each stratum. These weights are used for estimating variance and standard error for statistical hypothesis testing (Health Care Financing Administration, 1998). That is they make the F tests and t-tests valid (Dr. A. Chu, October, 2000).

Sample and Setting

A subset of a nationally representative sample of the Medicare population included in the MCBS was used in this study. Specifically, the sample included all older adult respondents aged 65 years and over, living in the community, reporting diagnosis of one or more chronic illnesses, and starting Medicare entitlement in 1994 or before. Both genders, all racial groups, and all geographic regions sampled and meeting these criteria were included to accurately reflect the diversity of the older adult Medicare population. Approximately 10% to 12% of Medicare beneficiaries were expected to be enrolled in HMOs (HCFA, 1994; Nelson et al., 1996). Enrollees with one or more of twelve different chronic illness diagnoses were included. The sample included MCBS panel members continuing to participate in rounds 1,4,7,10, & 13 of the survey (1991-1995).

Exclusion Criteria

Exclusion criteria were based on the limits of the MCBS data base and the focus of this study. In this research, MCBS enrollees were excluded if they were under 65 years of age, resided in facilities/institutions, reported no chronic illnesses, started Medicare enrollment in 1995, or were classified as disabled. This study omitted four sources of

bias. Disabled clients (defined by the Medicare eligibility status code variable in the data set) were excluded as they are a select group with severe functional status limitations and fewer financial resources (Adler, 1995). Clients residing in institutions were excluded because important variables would not be available and there is concern about reliability of reported data (Gruenberg, Kaganova, & Hornbrook, 1996). Clients starting Medicare entitlement in 1995 were excluded because their exposure to the delivery systems of interest would be limited to less than one calendar year.

In this research, older adults with chronic illness were excluded if the database lacked sociodemographic data, chronic illness history data, or general health status data. Approximately two percent (1.7 %) of the eligible enrollees were excluded because of missing data (Table 3.1).

Table 3.1

Frequencies of Older Adults With Chronic Illness Excluded From Study Population

| Study Variable | Number Excluded |
|----------------------------|-----------------|
| Race | 82 |
| Education | 70 |
| Marital Status | 4 |
| General Health | 13 |
| Activities of Daily Living | 15 |

Analytic Framework

As indicated, the Health System Model was selected as the conceptual framework that guided the analysis. Since the model has been described earlier in detail, the focus here is on the hypotheses of interest and the data available in the MCBS with which to

operationalize it. The hypothesized model, depicted in Figure 3.1, used the variables noted in the theoretical model section of the review of literature. Operationally, all variables in this study were based on the variables in the MCBS.

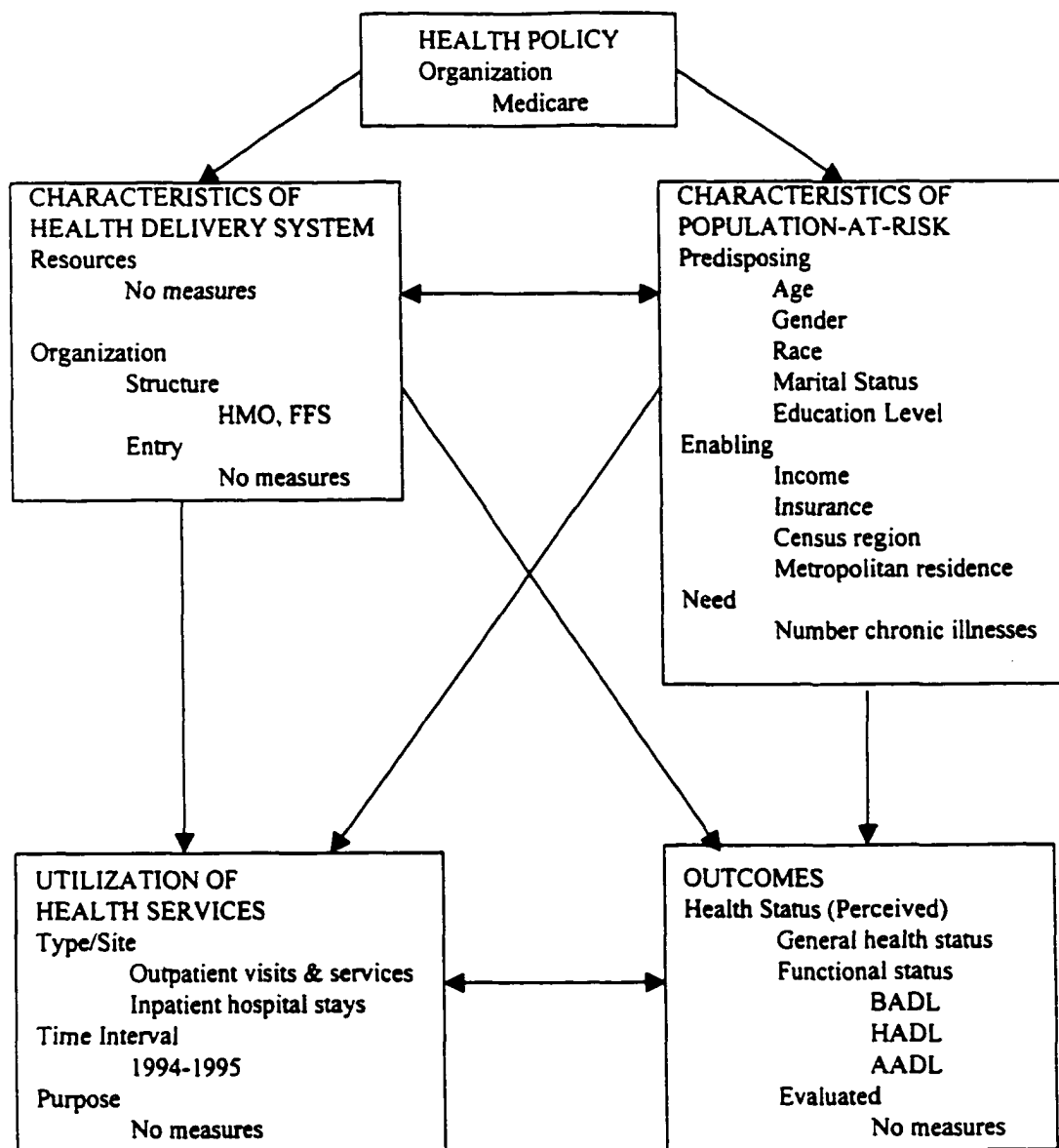
The primary predictor variable, health system, was based only on annual insurance coverage variables (Medicare HMO or FFS). Although it would have been desirable, no information was available on the specific features of client's individual health delivery systems. Consequently, in this study, Medicare HMO encompassed participants enrolled in any type of Medicare HMO and Medicare FFS includes large and small practices.

Secondary predictor variables in this study included characteristics of the population-at-risk categorized as predisposing, enabling, and need, and utilization of health services. *Predisposing variables* included age, gender, race, marital status, and education level. *Enabling variables* included income, insurance (Medicaid, private), census region of residence, and metropolitan status/character of residence. *Need variables* included participant reports of having been diagnosed with any of 12 chronic illness conditions. *Utilization* included outpatient visits (total number of visits and services provided by medical providers or in hospital emergency rooms) and inpatient hospital stays (total number of hospital admissions of at least 24 hour duration).

The criterion variable, perceived health status, included self-reports of general health and functional status. General health was one measure. Functional status was based on three measures as recommended in recent studies (Wolinsky & Johnson, 1991). General health was defined as the participant's response to a question asking them to rate their general health compared to others of the same age on a five-point Likert-type scale (excellent, very good, good, fair, poor). The general health scale was not collapsed so that the heterogeneity of client responses would be retained. Although it would have been desirable, no information was available on the professionally evaluated health status or the rationale for individual ratings.

Functional status was defined as participant's response (yes/no) to a series of questions asking if they have any difficulty doing each of twelve everyday activities. For each activity respondents were also asked if the difficulty with each activity was because of a health or physical problem. *Basic activities of daily living* included bathing, dressing, getting out of bed, walking, and toileting. *Household activities of daily living* included meal preparation, shopping, light housework, heavy housework. *Advanced activities of daily living* included managing money, using the telephone, and eating.

Figure 3.1 Health System Model: Older Adults With Chronic Illness in the Community



Adapted from: Aday, L. and Andersen, R. (1974). A framework for the study of access to medical care. *Health Services Research* 9, 212; Reprinted with the permission of the Health Research and Education Trust, 1974.

Specification of Hypotheses

Four specified original study hypotheses, each with associated population-at-risk hypotheses, and utilization hypotheses, and each originating from the hypothesized model, are presented below. Although the hypotheses are numbered “a” through “l” for each accompanying original hypothesis, for easy reference, each population-at-risk variable, and utilization variable was tested separately. Each hypothesis was statistically analyzed as a two-tailed test unless designated differently. The designated one-tailed tests were in accordance with the theoretical direction discussed in the review of literature. Because Wesvar complex samples software does not do one-tailed tests, these were estimated by running each hypothesis test as a two-tailed test and dividing the resulting p-value by 2. This approach required assuring that the difference between groups was in the proper direction. Hypotheses on basic and household activities of daily living were based on findings from ADLs and IADLs due to limited research on the newer classification system. The following definitions were used in the hypotheses: (1) outpatient visits and services is the total number of medical provider events (including visits, services, and procedures and excluding home health care) and outpatient hospital emergency room events in the calendar year; (2) inpatient stays is the total number of hospitalizations of at least 24 hour duration in the calendar year; (3) minority race includes all races other than White; (4) additional insurance includes either Medicaid or private insurance.

Specified Original Hypotheses include:

1. HMO clients will report poorer general health than will FFS clients once characteristics of the population-at-risk and utilization of health services are controlled (one-tailed test).

Population-at-risk Hypotheses

Predisposing

- 1a. Older clients will report significantly poorer general health than clients who are younger (one-tailed test).
- 1b. Clients with higher levels of education will report significantly better general health than will clients with lower levels of education (one-tailed test).
- 1c. Female clients will report significantly better general health than will male clients (one-tailed test).
- 1d. Married clients will report significantly better general health than clients who are not married (one-tailed test).
- 1e. Minority clients will report significantly poorer general health than will white clients (one-tailed test).

Enabling

- 1f. Clients with higher incomes will report significantly better general health than will clients with lower incomes (one-tailed test).
- 1g. Clients with additional insurance will report significantly better general health than will clients without additional insurance (one-tailed test).
- 1h. Clients residing in metropolitan and non-metropolitan areas will report significantly different general health levels.

- 1i. Clients residing in different census regions will report significantly different general health levels.

Need

- 1j. Clients with more chronic illness conditions will report significantly poorer general health than will clients with fewer chronic illness conditions (one-tailed test).

Utilization Hypotheses

- 1k. There will be a significant relationship between client's number of outpatient visits and their general health.
- 1l. There will be a significant relationship between client's number of inpatient stays and their general health.
2. There will be no difference in limitations in basic activities of daily living between HMO and FFS clients once characteristics of the population-at-risk and utilization of health services are controlled.

Population-at-risk Hypotheses

Predisposing

- 2a. Older clients will report significantly poorer independent capacity in basic activities of daily living than clients who are younger (one-tailed test).
- 2b. There will be a statistically significant relationship between client's education and their independent capacity in basic activities of daily living.
- 2c. Female clients will report significantly poorer independent capacity in basic activities of daily living than will male clients (one-tailed test).
- 2d. Married clients will report significantly better independent capacity in basic

activities of daily living than will clients who are not married (one-tailed test).

- 2e. Minority clients will report significantly poorer independent capacity in basic activities of daily living than will white clients (one-tailed test).

Enabling

- 2f. Clients with higher incomes will report significantly better independent capacities in basic activities of daily living than will clients with lower incomes (one-tailed test).

- 2g. Clients with additional insurance will report significantly better independent capacities in basic activities of daily living than clients without additional insurance (one-tailed test).

- 2h. Clients residing in metropolitan and non-metropolitan areas will report significantly different independent capacities in basic activities of daily living.

- 2i. Clients residing in different census regions will report significantly different independent capacities in basic activities of daily living.

Need

- 2j. Clients with more chronic illness conditions will report significantly poorer independent capacity in basic activities of daily living than clients with fewer chronic illness conditions (one-tailed test).

Utilization Hypotheses

- 2k. There will be a significant relationship between client's number of outpatient visits and their independent capacity in basic activities of daily living.

- 2l. There will be a significant relationship between client's number of inpatient stays and their independent capacity in basic activities of daily living.

3. There will be no difference in limitations in household activities of daily living between HMO and FFS clients once characteristics of the population-at-risk and utilization of health services are controlled.

Population-at-risk Hypotheses

Predisposing

- 3a. Older clients will report significantly poorer independent capacity in household activities of daily living than clients who are younger (one-tailed test).
- 3b. Clients with higher levels of education will report significantly better independent capacity in household activities of daily living than clients with lower levels of education (one-tailed test).
- 3c. Female clients will report significantly poorer independent capacity in household activities of daily living than will male clients (one-tailed test).
- 3d. Married clients will report significantly better independent capacity in household activities of daily living than will clients who are not married (one-tailed test).
- 3e. Minority clients will report significantly poorer independent capacity in household activities of daily living than will white clients (one-tailed test).

Enabling

- 3f. Clients with higher incomes will report significantly better independent capacities in household activities of daily living than clients with lower incomes (one-tailed test).
- 3g. Clients with additional insurance will report significantly better independent capacities in household activities of daily living than clients without additional insurance (one-tailed test).

- 3h. Clients residing in metropolitan and non-metropolitan areas will report significantly different independent capacities in household activities of daily living.
- 3i. Clients residing in different census regions will report significantly different independent capacities in household activities of daily living.

Need

- 3j. Clients with more chronic illness conditions will report significantly poorer independent capacity in household activities of daily living than clients with fewer chronic illness conditions (one-tailed test).

Utilization Hypotheses

- 3k. There will be a significant relationship between client's number of outpatient visits and their independent capacity in household activities of daily living.
- 3l. There will be a significant relationship between client's number of inpatient stays and their independent capacity in household activities of daily living.
- 4. There will be no difference in limitations in advanced activities of daily living between HMO and FFS clients once characteristics of the population-at-risk and utilization of health services are controlled.

Population-at-risk Hypotheses

Predisposing

- 4a. Older clients will report significantly poorer independent capacity in advanced activities of daily living than clients who are younger (one-tailed test).
- 4b. Clients with higher levels of education will report significantly better independent capacity in advanced activities of daily living than will clients with lower levels of

education (one-tailed test).

- 4c. Female clients will report significantly poorer independent capacity in advanced activities of daily living than will male clients (one-tailed test).
- 4d. Married clients will report significantly better independent capacity in advanced activities of daily living than will clients who are not married (one-tailed test).
- 4e. Minority clients will report significantly poorer independent capacity in advanced activities of daily living than will white clients (one-tailed test).

Enabling

- 4f. Clients with higher incomes will report significantly different independent capacities in advanced activities of daily living than will clients with lower incomes.
- 4g. Clients with additional insurance will report significantly different independent capacities in advanced activities of daily living than will clients without additional insurance.
- 4h. Clients residing in metropolitan and non-metropolitan areas will report significantly different independent capacities in advanced activities of daily living.
- 4i. Clients residing in different census regions will report significantly different independent capacities in advanced activities of daily living.

Need

- 4j. Clients with more chronic illness conditions will report significantly poorer independent capacity in advanced activities of daily living than will clients with fewer chronic illness conditions (one-tailed test).

Utilization Hypotheses

- 4k. There will be a significant relationship between client's number of outpatient visits and their independent capacity in advanced activities of daily living.
- 4l. There will be a significant relationship between client's number of inpatient stays and their independent capacity in advanced activities of daily living.

Research Procedures

Computer Software and Hardware Support

MCBS data were analyzed with a standard statistical software (SPSS version 8) and a special sample survey software (Wesvar Complex Samples version 3.0). In SPSS, the procedures for calculating standard deviations assume that the data were collected in a simple random sample. Standard statistical software does not take into account the characteristics of the MCBS 1995: unequal probability selection, clustering, stratification, and nonresponse adjustments. Wesvar Complex Samples software was used to avoid biased point estimates, inappropriate standard deviations and confidence intervals, and misleading tests of significance that can result from using standard statistical software to analyze complex sample survey data. Replicate weights provided with the MCBS data were used for calculating the variance estimates for statistics. In Wesvar, the replication method was set to Fay's and Fay's factor K was set at 0.30.

The Old Dominion University Computer Services' IBM 3090 mainframe computer and an IBM-type desktop computer provided the required hardware support. With the assistance of university computer services programming personnel, the investigator accessed the data on the university's mainframe computer, converted files and transferred the data to the personal computer to conduct the analyses in Windows-driven programs. Data files were converted into an SPSS compatible format. Checks to ensure the integrity of the data when it was transferred between software packages included reasonableness checks and record counts.

Protection of Human Subjects

On March 17, 1998, the Human Subjects and Institutional Review Boards of Old

Dominion University found this study to be exempt from review because the MCBS is a public use file and HCFA removed all personal identifiers from the data (Adler, 1994) prior to delivering the data tape to the investigator. On April 30, 1998, HCFA administrators approved the use of the MCBS in this study. There was no risk to subjects because there was no contact with them and the study involved analysis of existing data that had no personal identifiers. The investigator safeguarded the data by using private users account and secure password to access the data on the mainframe computer to download to personal computer, maintaining custody of the mainframe tape under lock and key, and password-protecting access to the data on the personal computer. The data were returned to HCFA on completion of the study. Three copies of the published dissertation will be submitted to HCFA.

A Priori Power Analysis

The power of a statistical test is the probability of correctly rejecting the null hypothesis when it is false. Errors in conclusions are affected by sample size, research design, strength of the relationship between variables, and the type of statistical test being done. In general, the larger the sample, the more powerful the statistical test will be. Power analysis takes into account the estimated effect size in identifying the sample size needed to reduce the risk of a Type II error. Effect size is, in general, "the impact made by the independent variable" (Munro & Page, 1993 p.55). When an impact is weak, it is possible that it will not be apparent in the sample, as a result of sampling error. This study's planned least squares regression analyses required a minimum sample size for statistical reliability (Polit, 1996). At the same time, literature suggests that effect size may be quite small in the population under study. Given the known size of this study's

sample, the estimated effect size was therefore figured a priori. Effect size was determined by entering sample size tables with the desired significance level (.05), the desired power (.80), and known sample size (N= 785 Medicare HMO enrollees). These inputs resulted in information that this study would have sufficient power to detect a weak effect size (as a function of sample size) of between .10 and .15 in a one or two tailed independent samples t-test, or a weak correlation (in a two-tailed test) between $r = .05$ and $.10$ (Polit, 1996; Burns & Grove, 1993).

In multiple regression, the sample size needed to reject the null hypothesis is a function of effect size, number of predictors, desired power, and the significance level used. Effect size is generally estimated based on prior research or pilot work. If there is no information about the likely value of R^2 , one can use estimates that the effect will be either small ($R^2 = .02$), moderate ($R^2 = .13$) or large ($R^2 = .30$) (Polit, 1996). Effect size was calculated by using power tables and a formula. First, power tables for multiple regression for significance level of .05 were entered with values for number of predictor variables (15) and power (.80) producing a tabled value of 18.81. Next the tabled value was used in the formula :

$$N = \frac{L}{\gamma} + k + 1$$

where N= estimated number of cases needed
 L= tabled value for a specified p. and power
 γ = estimated effect size
 k= number of predictor variables (Polit, 1996)

This produced an estimated sample size of 940 when a small effect size of .02 was used. When an effect size of .03 was used, the estimated sample size of 627 was produced. This study therefore had the power to detect a moderately small effect size, given the sample size of 785 Medicare HMO enrollees.

Study Variables

Formation of Health Delivery Systems

Measurement and Calculation

The Health Care Delivery Systems were formed by aggregating the monthly group health plan variables (H_PLTP01 through H_PLTP12) in the MCBS data. Beneficiaries with predominantly (6 or more months in 1995) Medicare managed care (HCPP, Risk HMO, or Cost HMO) enrollment were identified as participants in Medicare HMO systems (N= 785). Beneficiaries enrolled in Medicare HMO systems for less than 6 months, thereby limiting exposure to the delivery system, were omitted (N= 104) from the study. This helped assure the mutual exclusiveness and consistent exposure to each health delivery system. Beneficiaries with Medicare coverage but no Medicare group health participation in the calendar year were identified as Medicare FFS enrollees. In accordance with the discussion in the literature review, it was assumed that the insurance enrollment variable was an adequate representation of health delivery system organizational structure.

Descriptive Statistics

Formation of the health delivery systems resulted in two groups for this study. Only 10.5% (785 persons) of the sample was enrolled in Medicare HMO delivery systems, representing an estimated 2,766,141 persons nationwide. The majority, 89.5%

(6,975 persons) were enrolled in Medicare FFS delivery systems, representing an estimated 23,690,248 persons nationwide. Overall, the sample represents 26,456,389 Medicare enrollees nationwide in 1995. It is interesting to note that 84% of those enrolled in Medicare managed care were enrolled in Risk HMOs, 14% were enrolled in HCPPs, and only 2% were enrolled in Cost HMOs.

Trimming of the Data

Descriptive statistics of the resulting sample suggested that additional trimming of the data was necessary. The statistics included: mean outpatient visit rate 16, standard deviation 42, skewness 6, kurtosis 73, interquartile range 6-21; mean income \$22,946, median \$16,800, skewness 14, kurtosis 333, interquartile range \$9,600 to \$27,351. Further trimming of the data was considered but not used in these statistical analyses because the literature indicated that the violation of the normality assumption of either t-test or ANOVA procedures is not critical with extremely large samples (N= 7,760) (Glass, Peckham, & Sanders, 1972; Polit, 1996). That is, t-test and ANOVA are robust to such violations in cases of large samples.

Actual Sample Size

The study population resulted in a 1995 MCBS sample of 7,760 persons representing 26,456,389 persons nationwide. Of these, 89.5% (N=6,975 persons) were enrolled in Medicare FFS health delivery systems and 10.5% (N=785 persons) were enrolled in Medicare HMO health delivery systems. This sample size satisfied the a priori requirements noted earlier and was large enough to allow up to 39 variables in the multivariate model, as the desired number of cases per independent variable is 15 to 20 cases in multiple regression analysis (Hair et al., 1995).

Predisposing Variables

Measurement And Calculation Of The Predisposing Variables

The predisposing variables for this study included measures of age, gender, race, marital status, and education level. Each of these measures is discussed below.

Descriptive statistics of the variables follow.

Age. This variable was measured using the ratio level MCBS variable H_AGE. The variable comes from HCFA source files and reflects the enrollee's age in years. The variable D_STRAT was used to report frequencies by age stratum.

Gender. Gender was measured using the nominal dichotomous MCBS variable H_SEX. The variable comes from HCFA source files and reports the enrollee as either female or male.

Race. This variable was measured using the nominal MCBS variable H_RACE. The variable comes from HCFA source files and reports the enrollee as being White, Black, Other, Asian, Hispanic, or North American Native. Note that this variable originally contained six categories but recoding into three categories (i.e. White, Black, Other) for descriptive purposes and two categories (i.e. White, Non-white) for bivariate and multivariate tests was necessary because some categories had few responses.

Marital Status. Marital status was measured using the nominal MCBS variable SPMARSTA. The variable comes from survey data and reports the enrollee's response as being married, widowed, divorced, separated, or never married. Data were collected reflecting five categories. For clarity in description, this variable was recoded into two categories, married and not married.

Education. This variable was measured using the interval level MCBS variable

SPHIGRAD. The variable comes from survey data that reports the enrollee's highest school grade completed. Responses range from first grade or less to six or more years of college. For clarity in descriptive analysis, this variable was recoded into four categories, < high school (<1st grade to 8th grade), some high school (9th grade to 11th grade), high school graduate (12th grade), and some college (1 to 6+ years of college).

Descriptive Statistics of the Predisposing Variables

Predisposing variables are described in Table 3.2. The table reports the unweighted n, that is the number of cases in the sample represented by each category. It also reports the weighted n, that is the estimate of the Medicare FFS & HMO population with chronic illnesses residing in the community represented by each category. Finally it reports the weighted percentage, that is the estimate of the percentage of the Medicare FFS & HMO population with chronic illnesses residing in the community represented by each variable category.

Although Medicare's older adults with chronic illnesses who reside in the community cannot be classified into a homogenous group, the typical enrollee in 1995 was a married (58%), white (89%), female (58%), approximately 75 years of age (SD 6.8 years). The majority of the population (52%) was 65 to 74 years of age. Approximately 22% was 75 to 79 years of age. Over a quarter of the population (26%) was 80 years old or over. Approximately 8% of the population was Black. The "Other" category included only 3% of the population representing Asian, Hispanic, or North American Native race. The 1995 Medicare population had relatively high education levels, over 50% having graduated high school and/or attended college.

Table 3.2

Descriptive Statistics of the Predisposing Variables

| Variables | Unweighted n ¹ | Weighted Population n ² | Weighted Percent ³ |
|---|---------------------------|------------------------------------|-------------------------------|
| <u>Age*</u> | | | |
| 65-69 years | 1,588 | 6,187,789 | 23.4 |
| 70-74 years | 1,608 | 7,498,561 | 28.3 |
| 75-79 years | 1,549 | 5,899,093 | 22.3 |
| 80-84 years | 1,580 | 3,906,603 | 14.8 |
| 85+ years | 1,435 | 2,964,343 | 11.2 |
| <u>Gender</u> | | | |
| Female | 4,540 | 15,445,432 | 58.4 |
| Male | 3,220 | 11,010,957 | 41.6 |
| <u>Race</u> | | | |
| White | 6,805 | 23,474,214 | 88.7 |
| Black | 725 | 2,184,334 | 8.3 |
| Other | 230 | 797,841 | 3.0 |
| <u>Marital Status</u> | | | |
| Married | 4,170 | 15,310,410 | 57.9 |
| Not Married | 3,590 | 11,145,979 | 42.1 |
| <u>Education**</u> | | | |
| < High School (<1 st grade – 8 th grade) | 2,233 | 6,640,363 | 25.1 |
| Some High School (9 th grade–11 th grade) | 1,252 | 4,176,761 | 15.8 |
| High School Graduate (12 th grade) | 2,312 | 8,387,610 | 31.7 |
| Some college (1 to 6 + years) | 1,963 | 7,251,654 | 27.4 |

¹ Sum of the unweighted cases for each variable is 7,760.

² Estimate of the Medicare FFS & HMO population with chronic illnesses residing in the community.

³ Estimate of the percentage of the population represented by each variable category.

* Mean (SD) 75.3 (6.8) age of the 65 and over Medicare FFS & HMO population

** Mean (SD) 11.1 (3.7) education of the 65 and over Medicare FFS & HMO population

Enabling Variables

Measurement and Calculation of the Enabling Variables

The enabling variables for this study included both personal and community resource measures of income, insurance, census region of residence and metropolitan residence. Each of these measures is discussed below. Descriptive statistics of the enabling variables follow.

Income. This variable was measured using the ratio level MCBS variable INCOME_C. The variable comes from survey data and reports the enrollee's actual income in dollars. For clarity in description, the variable was recoded into six categories ranging from \$10,000 or less to \$50,001 or more.

Insurance. This variable includes two items that were measured using two MCBS variables: D_CAID and D_PHI. Both variables were derived by HCFA from several key variables and report the enrollee's annual Medicaid coverage (D_CAID) and annual private health insurance coverage (D_PHI). D_CAID response categories were: comes from survey, HCFA records, both, or no coverage. D_PHI response categories were: employer sponsored, self purchased, both, unknown, or no coverage. D-CAID was recoded by the investigator (as either having coverage or not having coverage) for use in this study. D-PHI was recoded by the investigator (as either having coverage or not having coverage) for use in this study.

Census Region. This variable was measured using the nominal MCBS variable D_DIVCUR. The variable was derived by HCFA from several key variables and reports the enrollee's current census division of residence. The ten different census divisions in the MCBS include New England, Middle Atlantic, East North Central, West North

Central, South Atlantic, East South Central, West South Central, Mountain, Pacific, and Puerto Rico. For clarity in description, these ten regions were grouped into 5 categories according to established census divisions (U.S. Bureau of the Census, 1994). Northeast includes New England and Middle Atlantic. Midwest includes East North Central and West North Central. South includes South Atlantic, East South Central, and West South Central. West includes Mountain and Pacific. Puerto Rico was retained although it is not represented in traditional census divisions.

Metropolitan Residence. This variable was measured using the dichotomous MCBS variable H_METRO. The variable comes from HCFA source files and reports the enrollee's metropolitan status of residence as either metropolitan area or non-metropolitan area. A useful indicator of urbanization, Metropolitan Statistical Areas are defined by the U.S. Bureau of Census as including at least one city of 50,000 or more persons and the surrounding area, including other cities and counties that are socially and economically integrated (U.S. Bureau of the Census, 1994).

Descriptive Statistics of the Enabling Variables

Enabling variables are described in Table 3.3 . The table reports the unweighted n, that is the number of cases in the sample represented by each category. It also reports the weighted n, that is the estimate of the Medicare FFS & HMO population with chronic illnesses residing in the community represented by each category. Finally it reports the weighted percentage, that is the estimate of the percentage of the Medicare FFS & HMO population with chronic illnesses residing in the community represented by each variable category.

Median annual income of Medicare's 1995 non-institutionalized, non-disabled

older adults with chronic illnesses was \$16,800 (IQR \$9,600- \$27,351). The 95% confidence interval of mean income of the population was \$22,079 to \$23,813. There is 95% confidence that the true population mean income is in this interval. The majority of the population (60%) reported incomes of \$20,000 or less. Nearly three quarters of Medicare enrollees (71%) were also covered by additional private insurance policies while only 12% had dual Medicaid eligibility. The largest group of 1995 Medicare enrollees (36%) resided in the Southern region. Northeast, Midwest and Western residences were represented by 21%, 24%, and 18% of the population respectively. Only 1% of the population resided in Puerto Rico. Approximately 27% of the population resided in non-metropolitan areas.

Table 3.3

Descriptive Statistics of the Enabling Variables

| Variables | Unweighted n ¹ | Weighted Population n ² | Weighted Percent ³ |
|-------------------------------|---------------------------|------------------------------------|-------------------------------|
| <u>Income*</u> | | | |
| \$10,000 or less | 2,395 | 7,183,094 | 27.2 |
| \$10,001 to 20,000 | 2,600 | 8,702,889 | 32.9 |
| \$20,001 to 30,000 | 1,442 | 5,362,425 | 20.3 |
| \$30,001 to 40,000 | 604 | 2,353,724 | 8.9 |
| \$40,001 to 50,000 | 322 | 1,219,772 | 4.6 |
| \$50,001 or more | 397 | 1,634,483 | 6.2 |
| <u>Insurance⁴</u> | | | |
| Private | 5,406 | 18,780,248 | 71.0 |
| Medicaid | 1,081 | 3,174,845 | 12.0 |
| <u>Census Region</u> | | | |
| Northeast | 1,526 | 5,568,482 | 21.0 |
| Midwest | 1,812 | 6,345,198 | 24.0 |
| South | 2,870 | 9,501,336 | 35.9 |
| West | 1,400 | 4,727,907 | 17.8 |
| Puerto Rico | 152 | 313,468 | 1.2 |
| <u>Metropolitan Residence</u> | | | |
| Metropolitan | 5,585 | 19,423,360 | 73.4 |
| Non-Metropolitan | 2,175 | 7,033,029 | 26.6 |

¹ Sum of the unweighted cases for each variable is 7,760.

² Estimate of the Medicare FFS & HMO population with chronic illnesses residing in the community.

³ Estimate of the percentage of the population represented by each variable category.

⁴ Amounts do not total 100% as not all participants had either type of insurance coverage.

Metropolitan Residence is an indicator of urbanization, metropolitan statistical areas include at least one city of 50,000 or more persons and the surrounding area, including other cities and counties that are socially and economically integrated (U.S. Bureau of Census, 1994).

• Median (IQR) \$16,800 (\$17,751) income of the 65 and over Medicare FFS & HMO population

• Mean (SD) \$22,946 (\$29,773) income of the 65 and over Medicare FFS & HMO population

Need Variables

Measurement and Calculation of the Need Variable

The need variable for this study was diagnosis of a chronic illness. The chronic illness variable was measured in two ways as discussed below. Descriptive statistics of the need variable follow.

Chronic Illness. Chronic illness was measured in two different ways. The first method used participant reports of medical provider's diagnoses of each of 12 potential chronic illnesses. Individual chronic illnesses and their respective nominal dichotomous (yes, no) MCBS variables included: hardening of the arteries (OCARTERY), hypertension (OCHBP), myocardial infarction (OCMYOCAR), angina pectoris/coronary heart disease (OCCHD), other heart condition (OCOTHART), stroke/brain hemorrhage (OCSTROKE), cancer/tumor other than skin (OCCANCER), diabetes (OCDIABTS), rheumatoid arthritis (OCARTHRH), arthritis (OCARTH), Parkinson's disease (OCPARKIN), and emphysema, asthma, chronic obstructive pulmonary disease (OCEMPHYS). Individual chronic illnesses were used to describe the prevalence rates of each illness in the study population. Other heart conditions includes congestive heart failure, problems with valves of the heart, or problems with the rhythm of the heartbeat.

The second method used to measure chronic illnesses was the investigator's ratio level summary of each participant's total number of chronic illnesses derived from the aforementioned 12 chronic illness variables. For clarity in description, the number of chronic illnesses was ranked into 5 categories: 1, 2, 3, 4-5 and 6-11 chronic illnesses.

Descriptive Statistics of the Need Variable

Need variables are described in Tables 3.4 and 3.5. The tables report the unweighted n, that is the number of cases in the sample represented by each category. They also report the weighted n, that is the estimate of the Medicare FFS & HMO population with chronic illnesses residing in the community represented by each category. Finally they report the weighted percentage, that is the estimate of the percentage of the Medicare FFS & HMO population with chronic illnesses residing in the community represented by each variable category.

Table 3.4 reports the prevalence rates for each of 12 chronic illness diagnoses for Medicare's older adult population with chronic illnesses residing in the community. In this population, the most prevalent chronic illnesses were osteoarthritis (66%), hypertension (61%), other heart conditions (33%), cancer other than skin cancer (22%), and diabetes (20%). Overall, these top five chronic illnesses were followed, in decreasing order of prevalence, by angina, myocardial infarction, coronary artery disease, rheumatoid arthritis, chronic obstructive pulmonary disease (COPD), stroke, and Parkinson's disease.

Table 3.5 shows the percentage of the 1995 Medicare population with specified numbers of diagnosed chronic illnesses. Most chronically ill Medicare enrollees (67%) had 3 or less chronic illnesses. Approximately a quarter of Medicare enrollees (23%) had 4 to 5 chronic illnesses. Only 10% reported 6 or more chronic illnesses. The average non-institutionalized, non-disabled, older adult with chronic illnesses enrolled in Medicare in 1995 had 3 chronic illnesses (SD= 1.8 illnesses).

Table 3.4

Descriptive Statistics of the Need Variables: Chronic Illness Diagnoses

| Variables | Unweighted n ¹ | Weighted Population n ² | Weighted Percent ³ |
|---------------------------------------|---------------------------|------------------------------------|-------------------------------|
| <u>Chronic Illnesses</u> | | | |
| Osteoarthritis | 5,259 | 17,576,002 | 66.4 |
| Hypertension | 4,817 | 16,234,864 | 61.4 |
| Other Heart Condition* | 2,649 | 8,651,956 | 32.7 |
| Cancer (not skin) | 1,714 | 5,793,610 | 21.9 |
| Diabetes | 1,507 | 5,149,028 | 19.5 |
| Angina / Coronary Heart Disease | 1,482 | 4,902,523 | 18.5 |
| Myocardial Infarction | 1,451 | 4,770,837 | 18.0 |
| Chronic Obstructive Pulmonary Disease | 1,264 | 4,380,639 | 16.6 |
| Hardening of the Arteries | 1,346 | 4,349,419 | 16.4 |
| Rheumatoid Arthritis | 1,314 | 4,157,524 | 15.7 |
| Stroke | 1,080 | 3,438,743 | 13.0 |
| Parkinson's Disease | 126 | 390,258 | 1.5 |

¹ Sum of the unweighted cases for each variable is 7,760.

² Estimate of the Medicare FFS & HMO population with chronic illnesses residing in the community.

³ Estimate of the percentage of the population represented by each variable category.

* Other heart condition includes congestive heart failure, problems with valves of the heart, or problems with the rhythm of the heartbeat.

Table 3.5

Descriptive Statistics of the Need Variables: Number of Chronic Illnesses

| Variable | Unweighted n ¹ | Weighted Population n ² | Weighted Percent ³ |
|---------------------------|---------------------------|------------------------------------|-------------------------------|
| <u>Chronic Illnesses*</u> | | | |
| 1 illness | 1,561 | 5,672,542 | 21.4 |
| 2 illnesses | 1,931 | 6,833,681 | 25.8 |
| 3 illnesses | 1,567 | 5,253,995 | 19.9 |
| 4-5 illnesses | 1,853 | 5,951,671 | 22.5 |
| 6-11 illnesses | 848 | 2,744,500 | 10.4 |

- ¹ Sum of the unweighted cases for each variable is 7,760.
- ² Estimate of the Medicare FFS & HMO population with chronic illnesses residing in the community.
- ³ Estimate of the percentage of the population represented by each variable category.
- * Mean (SD) 3 (1.8) chronic illnesses in 65 and over Medicare FFS & HMO population

Utilization Variables

The utilization variables for this study included outpatient visits and services and inpatient hospital stays. Because the MCBS provides both list file and survey information, this study was able to include both Medicare covered and non-covered outpatient visits and services and inpatient hospital stays.

Measurement and Calculation of Utilization Variables

Outpatient Visits and Services. Outpatient visits were defined as the total number of visits and services provided by medical providers or in outpatient department or clinic of a hospital. Outpatient visits and services were measured by combining two ratio level variables. The two variables were OPAEVNTS and EVTYPE. OPAEVNTS represented outpatient hospital and emergency room visits without associated hospital stays. EVTYPE included medical, surgical, and diagnostic visit, service, or procedure provided

by any listed provider types. Provider types included medical doctor, nurse, nurse practitioner, optometrist, osteopath, physical therapist, speech therapist, occupational therapist, intravenous and respiratory therapist, chiropractor, physicians assistant, podiatrist, psychiatrist, psychologist, and clinical social worker. For example, each visit of the client to a general practitioner, a specialist, and an optometrist, and each physical therapy session, intravenous therapy event, and podiatry event was enumerated as a separate visit, service, or procedure. EVTYPE did not include laboratory, pharmacy or durable medical equipment or supplies. HCFA selected MP (medical provider) visits from the MPE record using the MCBS variable EVTYPE (event type) and omitted separate billing doctor, separate billing lab, and other medical expenses. MP visits were organized in the MCBS by event rather than by unique individual and each individual might have had more than one visit. It was necessary for HCFA to aggregate the visits for each individual, thus omitting the provider type from the data available for analysis in this study.

Inpatient Stays. Inpatient stays were defined as the total number of hospital admissions of at least 24 hour duration and were measured using the MCBS variable IPAEVNTS. This is a ratio level variable.

Descriptive Statistics of the Utilization Variables

Utilization variables are described in Table 3.6. The table reports the unweighted n, that is the number of cases in the sample represented by each category. It also reports the weighted n, that is the estimate of the Medicare FFS & HMO population with chronic illnesses residing in the community represented by each category. Finally it reports the weighted percentage, that is the estimate of the percentage of the Medicare FFS & HMO

population with chronic illnesses residing in the community represented by each variable category.

In 1995, the average older adult Medicare enrollee with chronic illnesses residing in the community had 12 (IQR 6-21) outpatient visits or services provided by medical providers in offices, hospital outpatient departments, or emergency rooms. Only 3.7% of the chronically ill Medicare population had no visits or services. At the same time, the average older adult with chronic illnesses residing in the community had no hospital stays of 24 hour duration or longer. Approximately 79% of Medicare's older adult enrollees had no hospitalizations. Overall, 96.3% of the population of chronically ill older adults had one or more outpatient visits or services, but only 21.5% had one or more hospital stays in the calendar year.

Table 3.6

Descriptive Statistics of the Utilization Variables

| Variables | Unweighted n ¹ | Weighted Population n ² | Weighted Percent ³ |
|--|---------------------------|------------------------------------|-------------------------------|
| <u>Outpatient Visits and Services*</u> | | | |
| 0 visits or services | 263 | 987,108 | 3.7 |
| 1 – 5 visits or services | 1,499 | 5,327,450 | 20.1 |
| 6 - 10 visits or services | 1,729 | 5,832,012 | 22.0 |
| 11 – 15 visits or services | 1,354 | 4,497,071 | 17.0 |
| 16 – 20 visits or services | 890 | 2,982,983 | 11.3 |
| 21 - 25 visits or services | 615 | 2,064,707 | 7.8 |
| 26 – 30 visits or services | 399 | 1,331,747 | 5.0 |
| 31 – 35 visits or services | 306 | 980,612 | 3.7 |
| 36 or more visits or services | 705 | 2,452,699 | 9.3 |
| <u>Inpatient Stays**</u> | | | |
| 0 inpatient stays | 5,956 | 20,769,815 | 78.5 |
| 1 inpatient stay | 1,103 | 3,507,988 | 13.3 |
| 2 or more inpatient stays | 701 | 2,178,585 | 8.2 |

¹ Sum of the unweighted cases for each variable is 7,760.

² Estimate of the Medicare FFS & HMO population with chronic illnesses residing in the community.

³ Estimate of the percentage of the population represented by each variable category.

* Mean (SD) 16 (20) outpatient visits of the 65 and over Medicare FFS & HMO population
Median (IQR) 12 (15) outpatient visits of the 65 and over Medicare FFS & HMO population

** Mean (SD) 0.4 (0.9) hospital stays of the 65 and over Medicare FFS & HMO population
Median (IQR) 0 (0) hospital stays of the 65 and over Medicare FFS & HMO population

Outpatient visits and services includes medical, surgical, or diagnostic visit, service, or procedure provided by medical doctor, nurse, nurse practitioner, optometrist, osteopath, physical therapist, speech therapist, occupational therapist, intravenous and respiratory therapist, chiropractor, physicians assistant, podiatrist, psychiatrist, psychologist, and/or clinical social worker. Visits and services were provided in office, clinic, urgent care, or outpatient hospital, emergency room without 24 hour hospital stay. For example, each visit of the client to a general practitioner, a specialist, and an optometrist, and each physical therapy session, intravenous therapy event, and podiatry event was enumerated as a separate visit, service, or procedure. It does not include laboratory, pharmacy or durable medical equipment or supplies.

Perceived Health Status Or Outcome Variables

Measurement And Calculation Of The Outcome Variables

The outcome variables for this study included measures of general health status, BADL, HADL, and AADL. Each of these measures is discussed below. Description of the internal consistency reliability of the scales follows.

General Health Status. This variable was measured using the ordinal MCBS variable GENHELTH. This variable reflects the respondent's answer to the survey question: "In general, compared to other people your age, would you say that your health is excellent, very good, good, fair, or poor?". Responses were scored on a five-point Likert type scale with higher scores indicating poorer health.

BADL. This variable was measured using a two step process. The first step required the conversion of two variables (HPPD- and DON'T-) for each basic activity (bathing/showering, dressing, getting in/out of chair, walking, and toileting) into one variable (NEW-). The HPPD- variable represented the respondent's answer to the survey question: "Do you have any difficulty doing each of these activities by yourself and without special equipment?". Response categories for this item were yes, no, doesn't do. Respondents who answered doesn't do were asked "Is this because of a health or physical problem?". Response categories for this DON'T- item were yes, no, or bedridden, etc. Conversion of the two variables into one (NEW-) variable for each activity involved combining those who responded yes to both questions and combining those who responded no or bedridden etc. to both questions. The second step required that each of the NEW- variables be combined into a single variable for analysis in this study, resulting in a summary variable of the number of BADLs with which the respondent had difficulty

or limitations. Limitations in BADLs therefore could range from 0 to 5. Higher scores indicate more limitations.

HADL. This variable was measured using a similar two step process. The first step required the conversion of two variables (PRB- and DON'T-) for each household activity (making meals, shopping, doing light housework, and doing heavy housework) into one variable (NEW-). The PRB- variable represented the respondent's answer to the survey question: "Do you have any difficulty doing each of these activities by yourself?".

Response categories for this item were yes, no, doesn't do, and inapplicable. Respondents who answered doesn't do were asked "Is this because of a health or physical problem?".

Response categories for this DON'T- item were yes or no. Conversion of the two variables into one (NEW-) variable for each activity involved combining those who responded yes to both questions, combining those who responded no to both questions, and retaining those in the inapplicable category. The inapplicable category was retained to accurately reflect the fact that many male respondents reportedly do not make meals, shop, or do housework. The second step required that each of the NEW- variables be combined into a single variable for analysis in this study, resulting in a summary variable of the number of HADLs with which the respondent had difficulty or limitations.

Limitations in HADLs therefore could range from 0 to 4. Higher scores indicate more limitations.

AADL. This variable was measured using a similar two step process. The first step required the conversion of two variables (PRB- or HPPD- and DON'T-) for each advanced activity (managing money, using telephone, and eating) into one variable (NEW-). The PRB- variable represented the respondent's answer to the survey question: "Do you have any difficulty doing each of these activities (using the telephone; managing money) by yourself?". The HPPD- variable represented the respondent's answer to the survey question: "Do you have any difficulty eating by yourself and without special equipment?". Response categories for this item were yes, no, bedridden, etc. Respondents who answered doesn't do were asked "Is this because of a health or physical problem?". Response categories for this DON'T- item were yes or no. Conversion of the two variables into one (NEW-) variable for each activity involved combining those who responded yes to both questions and combining those who responded no or doesn't do to both questions. The second step required that each of the NEW- variables be combined into a single variable for analysis in this study, resulting in a summary variable of the number of AADLs with which the respondent has difficulty or limitations. Limitations in AADLs therefore could range from 0 to 3. Higher scores indicate more limitations.

Internal Consistency Reliability

To estimate internal consistency of the BADL, HADL, and AADL scales a reliability analysis was conducted using the full sample's weighted responses to each of the scales. Cronbach's alpha results from this analysis appear in Table 3.7. The reliability coefficients, reflections of average inter-item correlation, suggest that 85% of the variance in BADL, 83% of the variance in HADL, and 65% of the variance in AADL is due to true differences in respondent answers and not due to random error. Overall, the

scales are considered reliable. According to McDowell & Newell (1996) Cronbach's alpha coefficients of .60 or higher are considered "acceptable in comparing groups" (p. 41).

Table 3.7

Summary of Cronbach's Alpha Coefficients for BADL, HADL, and AADL Scales

| Scale | Alpha Coefficient ^a |
|--------------------------------------|--------------------------------|
| Basic Activities of Daily Living | .85 |
| Household Activities of Daily Living | .83 |
| Advanced Activities of Daily Living | .65 |

^a Weighted by cross-sectional full sample weight N= 26,456,389

Statistical Methods

Overview

The literature suggests that multiple linear regression is one of the statistical methods used when explaining the complex relationships that characterize health status outcomes (Andersen, Smedby, & Anderson, 1970). Multiple regression is an appropriate method in this study because several independent variables may mutually influence outcomes and this approach allows one to relate the multiple hypotheses in an interactive manner to test their effects (Kerlinger & Pedhazur, 1973; Cohen & Cohen, 1983). Multiple regression is appropriate in this study because it: describes the relationship between independent variables and the dependent variable while controlling for the effects of other variables; determines which of several independent variables are

important and which are not important for explaining the dependent variable; assesses both the unique influence of individual independent variables and the contribution of a set or block of independent variables; and determines the best mathematical model for describing the relationship between a dependent variable and one or more independent variables (Hair et.al., 1995; Cohen & Cohen, 1983). Multiple regression models were used in this research to explain the unique contribution of several individual variables as well as several blocks or sets of variables on perceived health outcomes.

Sampling Theory

Classic sampling theory is concerned with making inferences about characteristics of the population from which the sample is taken. Sample measures are used to estimate population parameters. If different samples were taken from the same populations, then the estimates would likely be different (Korn & Graubard, 1999; Scheaffer, Mendenhall, & Ott, 1996). The standard error of the sample estimate indicates how variable the estimator would be over repeated samples of the population. The sample estimate and its standard error are the necessary components of repeated sampling inference for a finite population parameter (Korn & Graubard, 1999).

Special Procedures

Traditional procedures for calculating variances in hypothesis tests assume that the data were collected from a simple random sample. These procedures are not appropriate for statistical testing based on the MCBS sample. Due to the complexity of the MCBS stratified, unequal probability, multistage sampling design, estimates of the parameters of interest, based on values in the sample, would lead to under-estimation of the true sampling error if statistical analysis assumed simple random sampling was used.

For descriptive statistics on variables in the study, accurate estimates of population percentages, means, and standard deviations were obtained by weighting the data with the full sample cross sectional weight. The full sample weight adjusts for the unequal probability of selection and nonresponse in the list sample (Dr. A. Chu, October 2000).

To obtain unbiased estimates in hypothesis tests, replication methods were used to analyze MCBS data. Analysis of bivariate and multivariate tests required use of 100 replicate weights to accurately estimate standard errors and variance in the MCBS data. Fay's method of balanced repeated replication is a resampling method specially designed for variance estimation of survey data obtained by stratified sampling (Shao & Tu, 1995). The replication method used variability among selected replicates, or subsamples, to estimate the variance of the full sample statistics. For example, weighted least squares is calculated in Wesvar as the difference between the full- sample-weighted sums of squares and the sums of squares of the 100 replicates. Without these special procedures, it is likely that standard errors and confidence intervals would be underestimated (Laschober & Olin, 1996) thus threatening statistical conclusion validity of the study.

A computer-intensive statistical method, balanced repeated replication requires repeatedly computing the statistic n times. In the case of the MCBS, 100 replicate weights, computed by Westat using Fay's variant of balanced repeated replication, were included with the data. Westat computed the weights by forming replicate samples, or half samples, selected from one of two primary sampling units from each stratum. Each replicate consisted of a different half-sample. It was not necessary to form all possible half-sample replicates because the information from all possible replicates is believed to be captured by using a smaller number of "balanced" half-samples (Laschober & Olin,

1996). Using Fay's method, Westat adjusted sample weights by factors between zero and two. The weights for selected primary sampling units in each half sample were doubled and the weights for nonselected primary sampling units were set at zero. Fay's method is believed to provide good estimates of standard errors for a variety of statistical tests (Laschober & Olin, 1996).

Multiple Linear Regression Modeling

Multiple linear regression models mirror the complexity of health outcomes by considering the mutual influence of several independent variables in an interactive manner. Therefore, regression analyses appropriate to the data levels were conducted to identify variables that would explain health outcomes in older adult Medicare enrollees with chronic illness.

Multiple linear relationships between nominal, ordinal, interval and ratio level independent variables and ordinal, treated as interval, dependent variables were tested using hierarchical multiple linear regression. This approach allowed examination of the effect of health delivery system after the effects of population characteristics and utilization factors had been controlled. In Wesvar's Complex Samples software, each hierarchical regression was run in five steps. The first step was run with one block of predictor variables (predisposing) and one criterion variable. The second step was run with two blocks of predictor variables (predisposing and enabling) and one criterion variable. The third step was run with three blocks of predictor variables (predisposing, enabling, and need) and one criterion variable. The fourth step was run with four blocks of predictor variables (predisposing, enabling, need, and utilization factors) and one criterion variable. The fifth step was run with five blocks of predictor variables

(predisposing, enabling, need, utilization, and health delivery system) and one criterion variable. Separate regression models were run for each of the health status outcome variables: general health, BADL, HADL, and AADL. A block of variables may be significant when some individual variables are not (Hair et.al., 1995).

Assumptions of Multiple Regression

The assumptions of least squares regression are: normal distribution, homoscedasticity, linearity, and independence. At any combination of the X values there is a normal distribution of Y. The variance of Y is the same at each combination of the X values. The expected value of Y is a linear function of the model parameters (the betas). The Y values are measured independently of each other (Cohen & Cohen, 1983).

The literature states that regression analysis is relatively robust when departures from the assumptions occur, particularly when the n is large and the purpose is explanation of significance tests of partial coefficients' departure from zero and the sign of the coefficients, as opposed to cases in which the purpose of the regression equation is prediction (Cohen & Cohen, 1983). This study has a large n (7,760) and its purpose is explanation of the interactive relationships between several independent variables and selected health outcomes.

Theory for how best to search for violations of assumptions using residual analysis has not been determined in the survey sampling literature (Korn & Graubard, 1999; Dr. A. Chu, September, 2000). The statistical literature on complex sampling survey analysis methods suggests that fewer model assumptions may apply in studies utilizing replication methods (Korn & Graubard, 1999). In replication methods, used to analyze complex sample data, each observation has an associated weight. For multiple linear regression the

weight is a weighted least squares estimator on the diagonal in the vector matrix estimation (Korn & Graubard, 1999). Searching for violations of assumptions in this study is addressed in chapter 4 multivariate results.

CHAPTER IV

RESULTS

This chapter presents the results of the bivariate analyses between each of the 4 dependent variables and the 13 hypothesized secondary independent study variables tested in this research. It shows, moreover, the 4 major hypotheses tested by multiple regression analyses in this study. The results of analyses are organized into relevant constructs of the Health System Model. The model suggests that three broad categories of factors impact health outcomes: population-at-risk factors, utilization factors, and health delivery system factors (Aday & Andersen, 1974; Aday et al., 1993). Population-at-risk factors include predisposing, enabling and need characteristics (Andersen, 1968). Utilization factors include outpatient visits and services and inpatient hospital stays. Health delivery system factors include Medicare FFS or HMO delivery systems. Of the 4 major hypotheses and 52 subhypotheses formulated for this study, 43 were supported.

Outcome Variable: Perceived Health Status

In this research, perceived health status was measured by the following variables: 1) general health status; 2) BADLs; 3) HADLs; and 4) AADLs. According to the coding for each of these measures, higher numbers indicated poorer health status or functional status. Perceived health status outcome variables are described in Table 4.1. The table reports the unweighted n, that is the number of cases in the sample represented by each category. It also reports the weighted n, that is the estimate of the Medicare FFS & HMO population with chronic illnesses residing in the community represented by each category. Finally it reports the weighted percentage, that is the estimate of the percentage of the Medicare FFS & HMO population with chronic illnesses residing in the

community represented by each variable category.

General health status was good or better for the majority (74%) of Medicare's 1995 non-institutionalized, non-disabled older adults with chronic illnesses. On average, general health status was very good to good for the Medicare population ($M=2.76$). Most of the population (68.9%) had no limitations in BADLs. Approximately 18% of the population had limitations in 2 or more BADLs. The average limitations in BADLs was about one ($M=0.73$). Except for a relatively small group for whom HADLs were inapplicable (1.3%), the majority of the Medicare population (62%) had no limitations in HADLs. Approximately 18% of the population was limited in 2 or more HADLs. The population overall had an average of one limitation in HADLs ($M=0.76$). The majority of older adults with chronic illnesses (86%) reported no limitations in AADLs. Approximately 5% of the population was limited in 2 or more AADLs. Average limitations in AADLs did not rise to the level of even one limitation ($M=0.21$) for the population.

Table 4.1

Descriptive Statistics of the Outcome Variables

| Variables | Unweighted n ¹ | Weighted Population n ² | Weighted Percent ³ |
|--|------------------------------|---------------------------------------|----------------------------------|
| <u>General Health Status*</u> | | | |
| Excellent | 1,087 | 3,922,391 | 14.80 |
| Very Good | 2,058 | 7,387,275 | 27.90 |
| Good | 2,411 | 8,256,007 | 31.20 |
| Fair | 1,559 | 4,854,998 | 18.40 |
| Poor | 645 | 2,035,718 | 7.70 |
| <u>Basic Activities of Daily Living**</u> | | | |
| No Limitations | 5,012 | 18,223,442 | 68.90 |
| Limited in 1 | 1,093 | 3,440,518 | 13.00 |
| Limited in 2 | 581 | 1,695,491 | 6.40 |
| Limited in 3 | 350 | 1,017,124 | 3.80 |
| Limited in 4 | 293 | 878,701 | 3.30 |
| Limited in 5 | 431 | 1,201,113 | 4.50 |
| <u>Household Activities of Daily Living***</u> | | | |
| No Limitations | 4,494 | 16,428,242 | 62.10 |
| Limited in 1 | 1,449 | 4,854,536 | 18.30 |
| Limited in 2 | 574 | 1,701,326 | 6.40 |
| Limited in 3 | 354 | 977,921 | 3.70 |
| Limited in 4 | 758 | 2,141,103 | 8.10 |
| Inapplicable | 131 | 353,261 | 1.30 |
| <u>Advanced Activities of Daily Living****</u> | | | |
| No Limitations | 6,424 | 22,786,060 | 86.10 |
| Limited in 1 | 836 | 2,313,975 | 8.70 |
| Limited in 2 | 327 | 896,135 | 3.40 |
| Limited in 3 | 173 | 460,219 | 1.70 |

¹ Sum of the unweighted cases for each variable is 7,760.

² Estimate of the Medicare FFS & HMO population with chronic illnesses residing in the community.

³ Estimate of the percentage of the population represented by each variable category.

* Mean (SD) 2.76 (1.14) general health of the 65 and over Medicare FFS & HMO population

** Mean (SD) 0.73 (1.36) BADL of the 65 and over Medicare FFS & HMO population

*** Mean (SD) 0.76 (1.23) HADL of the 65 and over Medicare FFS & HMO population

**** Mean (SD) 0.21 (0.58) AADL of the 65 and over Medicare FFS & HMO population

Research Hypotheses: Two Sample or Bivariate Test Results

This section discusses the two sample, bivariate, research hypotheses identified in Chapter III. These hypotheses examined relationships between each individual population-at-risk characteristic, utilization factor, health delivery system variable, and the dependent variable, health outcomes. Since perceived health outcomes (Johnson & Wolinsky, 1993; Linn & Linn, 1980; Mutchler & Burr, 1991) and utilization (Johnson & Wolinsky, 1991; Mutchler & Burr, 1991) vary by population characteristics, two-sample tests appropriate to the data levels were conducted to identify significant predictor variables for entry into regression models. Because two sample or bivariate tests do not take into account the interactive effects of other variables, and may not be meaningfully interpreted separately, multivariate models were designed for this study. Multivariate models mirror the complex relationships that characterize health outcomes by considering the mutual influence of several independent variables in an interactive manner.

Parametric tests, estimating population parameters, are often used with ordinal level data in health services research (Munro & Page, 1993). Ordinal level outcome variables were treated as interval level data and tested with Pearson's correlation, t-tests, ANOVA, and multiple linear regression in this study. These tests allowed this study to describe the effect of many independent variables on the dependent variable, but also made possible the explanation of the effects of several blocks of variables.

Relationships between ratio level independent variables and ordinal, treated as interval, dependent variables were tested using Pearson's r correlations. In Wesvar's Complex Samples software, correlations were run as linear regressions with one independent and one dependent variable and the square root of R^2 was manually

calculated (by calculator rather than computer) to arrive at the Pearson's r value.

Differences between nominal, dichotomous independent variables and ordinal, treated as interval, dependent variables were tested using t -tests. To further interpret the hypothesis tests, 95% confidence intervals (CI) were calculated.

Differences between ordinal independent variables and ordinal, treated as interval, dependent variables were tested using ANOVA. In Wesvar's Complex Samples software, one-way ANOVAs were run using the linear regression function with one analysis variable and one class variable or factor. Wesvar's software calculates the F test using a vector matrix method rather than a numerator-denominator approach. To calculate the estimates and standard errors, a cross product matrix is computed for the full sample and for each replicate and the inverse of the matrix is derived. Because Wesvar does not provide tests for homogeneity of variance, these were calculated manually (by calculator rather than computer) and F values were checked against critical values of F in standard distribution tables (Munro & Page, 1993) for each ANOVA test.

Separate post hoc F tests for each pair of comparisons were specified in Wesvar with each overall ANOVA to assess which groups contributed to the overall differences indicated by the statistical test. To control for Type I error across all the post hoc tests, Bonferroni correction was used to adjust alpha levels. Bonferroni correction required dividing the overall alpha level by the number of pairs being tested (adjusted alpha = overall alpha / number of tests) (Hair et al, 1995, p.281). In this study, six pairs of census regions were tested for each statistically significant ANOVA. The adjusted alpha was $p \leq .0083$ (i.e., $.05 / 6$) for the post hoc tests. The only post hoc comparisons that were considered statistically significant, therefore, were those with alpha levels of $p \leq .0083$.

Relationships Between Population-at-risk Characteristics and Dependent Variables

Relationships between the five predisposing characteristics, four enabling characteristics, one need characteristic and each of the four health outcome measures were tested using Pearson's correlations, t-tests, or ANOVAs, as appropriate. Correlation results for hypotheses 1a, 1b, 1f, 1j, 2a, 2b, 2f, 2j, 3a, 3b, 3f, 3j, 4a, 4b, 4f, and 4j are presented in Table 4.2. T-test results for hypotheses 1c, 2c, 3c, and 4c are presented in Table 4.3. T-test results for hypotheses 1d, 2d, 3d, and 4d are presented in Table 4.4. Research results for hypotheses 1e, 2e, 3e, and 4e are presented in Table 4.5. Table 4.6 presents t-test results for hypotheses 1g, 2g, 3g, and 4g. Table 4.7 presents research results for hypotheses 1g², 2g², 3g², and 4g². Table 4.8 presents t-test results for hypotheses 1h, 2h, 3h, and 4h. ANOVA results for hypothesis 1i, 2i, 3i, and 4i appear in Table 4.9.

Table 4.2

Relationships Between Population Characteristics and Health Outcomes¹

| Dependent Variables ² | Population Characteristics | | | |
|----------------------------------|----------------------------|-----------|----------|-------------------|
| | Predisposing | | Enabling | Need |
| | Age | Education | Income | Chronic Illnesses |
| General Health | .09** | -.25** | -.16** | .37** |
| BADL | .28** | -.15* | -.10** | .27** |
| HADL | .29** | -.19** | -.13** | .32** |
| AADL | .28** | -.16** | -.08* | .17** |

* $p < 0.0001$ ** $p \leq 0.00005$

Unweighted N for each variable is 7,760, except HADL cases = 7,629 (131 inappropriate).

Weighted N for each variable is 26,456,389, except HADL cases = 26,103,128.

¹ Estimated correlation coefficients for the full sample; $df = 100$ ² All responses were coded so that higher numbers indicated poorer self assessed health.Hypothesis 1a

The data supported hypothesis 1a which stated: older clients would report significantly poorer general health than clients who were younger. A statistically significant, though very weak, relationship was noted between age and health status ($r = .09$, $p < .00005$). As age increased, general health score increased and perceived health status worsened.

Hypothesis 1b

The data supported hypothesis 1b which stated: clients with higher levels of education would report significantly better general health than would clients with lower

levels of education. A statistically significant very weak relationship was noted between education and health status ($r = -.25, p < .00005$). As education level increased, general health score decreased and perceived health status improved.

Hypothesis 1f

The data supported hypothesis 1f which stated: clients with higher incomes would report significantly better general health than would clients with lower incomes. A statistically significant very weak relationship was noted between income and health status ($r = -.16, p < .00005$). As income level increased, general health score decreased and perceived health status improved.

Hypothesis 1j

The data supported hypothesis 1j which stated: clients with more chronic illness conditions would report significantly poorer general health than would clients with fewer chronic illness conditions. A statistically significant weak relationship was noted between number of chronic illnesses and health status ($r = .37, p < .00005$). As number of chronic illnesses increased, general health score increased and perceived health status worsened.

Hypothesis 2a

The data supported hypothesis 2a which stated: older clients would report significantly poorer independent capacity in BADLs than clients who were younger. A statistically significant weak relationship was noted between age and BADLs ($r = .28, p < .00005$). As age increased, BADL score increased and independent capacity in BADLs worsened.

Hypothesis 2b

The data supported hypothesis 2b which stated: there would be a statistically significant relationship between client's education and their independent capacity in BADLs. A statistically significant very weak relationship was noted between education and BADLs ($r = -.15, p < .0001$). Frequencies of mean BADL by education categories revealed that as education level increased, BADL score decreased and independent

capacity in BADLs improved.

Hypothesis 2f

The data supported hypothesis 2f which stated: clients with higher incomes would report significantly better independent capacities in BADLs than would clients with lower incomes. A statistically significant very weak relationship was noted between income and BADLs ($r = -.10, p < .00005$). As income level increased, BADL score decreased and independent capacity in BADLs improved.

Hypothesis 2j

The data supported hypothesis 2j which stated: clients with more chronic illness conditions would report significantly poorer independent capacity in BADLs than clients with fewer chronic illness conditions. A statistically significant weak relationship was noted between number of chronic illness conditions and BADLs ($r = .27, p < .00005$). As number of chronic illnesses increased, BADL score increased and independent capacity in BADLs worsened.

Hypothesis 3a

The data supported hypothesis 3a which stated: older clients would report significantly poorer independent capacity in HADLs than clients who were younger. A statistically significant weak relationship was noted between age and HADLs ($r = .29, p < .00005$). As age increased, HADL score increased and independent capacity in HADLs worsened.

Hypothesis 3b

The data supported hypothesis 3b which stated: clients with higher levels of education would report significantly better independent capacity in HADLs than clients with lower levels of education. A statistically significant very weak relationship was noted between education level and HADLs ($r = -.19, p < .00005$). As education level increased, HADL score decreased and independent capacity in HADLs improved.

Hypothesis 3f

The data supported hypothesis 3f which stated: clients with higher incomes would report significantly better independent capacity in HADLs than clients with lower incomes. A statistically significant very weak relationship was noted between income and HADLs ($r = -.13$, $p = .00005$). As income increased, HADL score decreased and independent capacity in HADLs improved.

Hypothesis 3j

The data supported hypothesis 3j which stated: clients with more chronic illness conditions would report significantly poorer independent capacity in HADLs than clients with fewer chronic illness conditions. A statistically significant weak relationship was noted between number of chronic illnesses and HADLs ($r = .32$, $p < .00005$). As number of chronic illnesses increased, HADL score increased and independent capacity in HADLs worsened.

Hypothesis 4a

The data supported hypothesis 4a which stated: older clients would report significantly poorer independent capacity in AADLs than clients who were younger. A statistically significant weak relationship was noted between age and AADLs ($r = .28$, $p < .00005$). As age increased, AADL score increased and independent capacity in AADLs worsened.

Hypothesis 4b

The data supported hypothesis 4b which stated: clients with higher levels of education would report significantly better independent capacity in AADLs than clients with lower levels of education. A statistically significant very weak relationship was noted between education level and AADLs ($r = -.16$, $p < .00005$). As education level increased, AADL score decreased and independent capacity in AADLs improved.

Hypothesis 4f

The data supported hypothesis 4f which stated: clients with higher incomes would

report significantly better independent capacity in AADLs than clients with lower incomes. A statistically significant very weak relationship was noted between income and AADLs ($r = -.08, p < .0001$). Frequencies of mean AADL by income categories revealed that as income increased, AADL score decreased and independent capacity in AADLs improved.

Hypothesis 4j

The data supported hypothesis 4j which stated: clients with more chronic illness conditions would report significantly poorer independent capacity in AADLs than clients with fewer chronic illnesses. A statistically significant very weak relationship was noted between number of chronic illnesses and AADLs ($r = .17, p < .00005$). As number of chronic illnesses increased, AADL score increased and independent capacity in AADLs worsened.

Table 4.3

Relationships Between Predisposing Characteristic, Gender, and Health Outcomes

| Outcome Measures ^a | Male Mean (SD) | Female Mean (SD) | t ^b | P | 95% CI Lower. Upper |
|-------------------------------|----------------|------------------|----------------|--------|---------------------|
| General Health | 2.74 (1.13) | 2.77 (1.14) | -1.11 | .136 | -.08, .02 |
| BADL | .58 (1.14) | .84 (1.14) | -8.35 | <.0005 | -.32, -.20 |
| HADL | .56 (1.14) | .90 (1.28) | -11.75 | <.0005 | -.40, -.29 |
| AADL | .209 (.57) | .206 (.58) | 0.30 | .382 | -.02, .03 |

Unweighted N for Male cases = 3,220; Female cases = 4,540; Total 7,760

Weighted N for Male cases = 11,010,957; Female cases = 15,445,432

Unweighted N for HADL cases = Male 3,182; Female 4,447 (131 inappropriate).

Weighted N for HADL cases = Male 10,906,817; Female 15,196,311.

^aAll responses were coded so that higher numbers indicated poorer self assessed health.

^bEstimated t scores for the full sample; df= 100

Hypothesis 1c

The data did not support hypothesis 1c which stated: female clients would report significantly better general health than would males. Differences noted, between gender groups, in perceived general health status were not statistically significant ($t = -1.11$, $p = .136$). The results indicated there was no difference between male and female reports of general health status.

Hypothesis 2c

The data supported hypothesis 2c which stated: female clients would report significantly poorer independent capacity in BADLs than would male clients. A statistically significant difference in independent capacity in BADLs was noted between male and female groups ($t = -8.35$, $p < .0005$). Females reported significantly poorer capacity in BADLs than did males. There is 95% confidence that the true population mean difference between male and female Medicare beneficiaries' BADLs lies somewhere between $-.32$ and $-.20$.

Hypothesis 3c

The data supported hypothesis 3c which stated: female clients would report significantly poorer independent capacity in HADLs than would male clients. A statistically significant difference in independent capacity in HADLs was noted between male and female groups ($t = -11.75$, $p < .0005$). Females reported significantly poorer capacity in HADLs than did males. There is 95% confidence that the true population mean difference between male and female Medicare beneficiaries' HADLs lies somewhere between $-.40$ and $-.29$.

Hypothesis 4c

The data did not support hypothesis 4c which stated: female clients would report significantly poorer independent capacity in AADLs than would male clients. Differences noted, between gender groups, in AADLs were not statistically significant ($t = 0.30$, $p = .382$). The results indicated there was no difference between male and female reports

of capacity in AADLs. Ninety-five percent confidence intervals for the estimated mean AADL scores of males (.19 to .23) and females (.19 to .22) suggest the range of population mean score estimates across the replicates.

Table 4.4

Relationships Between Predisposing Characteristic, Marital Status, and Health Outcomes

| Outcome Measures ^a | Not Married Mean (SD) | Married Mean (SD) | t ^b | p | 95% CI Lower, Upper |
|-------------------------------|-----------------------|-------------------|----------------|--------|---------------------|
| General Health | 2.86 (1.16) | 2.69 (1.12) | 6.36 | <.0005 | .12, .23 |
| BADL | .95 (1.46) | .58 (1.24) | 11.35 | <.0005 | .30, .43 |
| HADL | .99 (1.35) | .59 (1.12) | 14.14 | <.0005 | .35, .46 |
| AADL | .26 (.65) | .17 (.52) | 7.58 | <.0005 | .07, .12 |

Unweighted N for Married cases= 3,590; Not Married cases= 4,170; Total 7,760

Weighted N for Married cases= 15,310,410; Not Married cases= 11,145,979

Unweighted N for HADL cases = married 4,122; not married 3,504 (131 inappropriate).

Weighted N for HADL cases = married 15,174,823; not married 10,928,304.

^aAll responses were coded so that higher numbers indicated poorer self assessed health.

^bEstimated t scores for the full sample; df= 100

Hypothesis 1d

The data supported hypothesis 1d which stated: married clients would report significantly better general health than would clients who were not married. A statistically significant difference in general health was noted between married and not married client groups ($t= 6.36$, $p<.0005$). Married clients reported significantly better general health status than did clients who were not married. There is 95% confidence that the true population mean difference between married and not married Medicare beneficiaries' general health status lies somewhere between .12 and .23.

Hypothesis 2d

The data supported hypothesis 2d which stated: married clients would report significantly better independent capacity in BADLs than would clients who were not married. A statistically significant difference in BADLs was noted between married and not married client groups ($t= 11.35, p<.0005$). Married clients reported significantly better independent capacity in BADLs than did clients who were not married. There is 95% confidence that the true population mean difference between married and not married Medicare beneficiaries' BADLs lies somewhere between .30 and .43.

Hypothesis 3d

The data supported hypothesis 3d which stated: married clients would report significantly better independent capacity in HADLs than would clients who were not married. A statistically significant difference in HADLs was noted between married and not married client groups ($t= 14.14, p<.0005$). Married clients reported significantly better independent capacity in HADLs than did clients who were not married. There is 95% confidence that the true population mean difference between married and not married Medicare beneficiaries' HADLs lies somewhere between .35 and .46.

Hypothesis 4d

The data supported hypothesis 4d which stated: married clients would report significantly better independent capacity in AADLs than would clients who were not married. A statistically significant difference in AADLs was noted between married and not married client groups ($t= 7.58, p<.0005$). Married clients reported significantly better independent capacity in AADLs than did clients who were not married. There is 95% confidence that the true population mean difference between married and not married Medicare beneficiaries' HADLs lies somewhere between .07 and .12.

Table 4.5

Relationships Between Predisposing Characteristic, Race, and Health Outcomes

| Outcome Measures ^a | White Mean (SD) | Minority Mean (SD) | t ^b | P | 95% CI Lower, Upper |
|-------------------------------|-----------------|--------------------|----------------|--------|---------------------|
| General Health | 2.72 (1.14) | 3.10 (1.15) | -8.39 | <.0005 | -.46, -.29 |
| BADL | .71 (1.34) | .90 (1.51) | -3.32 | <.0005 | -.30, -.08 |
| HADL | .73 (1.20) | 1.00 (1.42) | -4.47 | <.0005 | -.40, -.15 |
| AADL | .20 (.56) | .29 (.71) | -3.58 | <.0005 | -.14, -.04 |

Unweighted N for White cases= 6,805; Minority cases= 955; Total 7,760

Weighted N for White cases= 23,474,214; Minority cases= 2,982,175

Unweighted N for HADL cases = White 6,687; Non-white 942 (131 inappropriate).

Weighted N for HADL cases = White 23,150,632; Non-white 2,952,496

^aAll responses were coded so that higher numbers indicated poorer self assessed health.

^bEstimated t scores for the full sample; df= 100

Hypothesis 1e

The data supported hypothesis 1e which stated: minority clients would report significantly poorer general health than would clients who were white. A statistically significant difference in general health was noted between minority and white client groups ($t = -8.39$, $p < .0005$). Minority clients reported significantly poorer general health status than did clients who were white. There is 95% confidence that the true population mean difference between white and minority Medicare beneficiaries' general health status lies somewhere between -.46 and -.29.

Hypothesis 2e

The data supported hypothesis 2e which stated: minority clients would report significantly poorer independent capacity in BADLs than would clients who were white. A statistically significant difference in BADLs was noted between minority and white client groups ($t = -3.32$, $p < .0005$). Minority clients reported significantly poorer independent capacity in BADLs than did clients who were white. There is 95%

confidence that the true population mean difference between white and minority Medicare beneficiaries' BADLs lies somewhere between -.30 and -.08.

Hypothesis 3e

The data supported hypothesis 3e which stated: minority clients would report significantly poorer independent capacity in HADLs than would clients who were white. A statistically significant difference in HADLs was noted between minority and white client groups ($t = -4.47$, $p < .0005$). Minority clients reported significantly poorer independent capacity in HADLs than did clients who were not white. There is 95% confidence that the true population mean difference between white and minority Medicare beneficiaries' HADLs lies somewhere between -.40 and -.15.

Hypothesis 4e

The data supported hypothesis 4e which stated: minority clients would report significantly poorer independent capacity in AADLs than would clients who were white. A statistically significant difference in AADLs was noted between minority and white client groups ($t = -3.58$, $p < .0005$). Minority clients reported significantly poorer independent capacity in AADLs than did clients who were white. There is 95% confidence that the true population mean difference between white and minority Medicare beneficiaries' AADLs lies somewhere between -.14 and -.04.

Table 4.6

Relationships Between Enabling Characteristic, Additional Medicaid Insurance, and Health Outcomes

| Outcome Measures ^a | No Medicaid Coverage Mean (SD) | Medicaid Coverage Mean (SD) | t ^b | P | 95% CI Lower, Upper |
|-------------------------------|--------------------------------|-----------------------------|----------------|--------|---------------------|
| General Health | 2.67 (1.11) | 3.40 (1.15) | -17.74 | <.0005 | -.81, -.65 |
| BADL | .63 (1.27) | 1.48 (1.76) | -14.60 | <.0005 | -.96, -.73 |
| HADL | .67 (1.16) | 1.45 (1.52) | -14.05 | <.0005 | -.90, -.67 |
| AADL | .17 (.52) | .48 (.87) | -9.88 | <.001 | -.37, -.25 |

Unweighted N for Medicaid coverage cases= 1,081; No Medicaid Coverage cases= 6,679; Total 7,760

Weighted N for Medicaid coverage cases= 3,174,845; No Medicaid coverage cases= 23,281,544

Unweighted N for HADL cases = Medicaid coverage 1,010; no Medicaid 6,619 (131 inappropriate).

Weighted N for HADL cases = Medicaid 2,985,800; no Medicaid 23,117,328.

^aAll responses were coded so that higher numbers indicated poorer self assessed health.

^bEstimated t scores for the full sample; df= 100

Hypothesis 1g

The data did not support hypothesis 1g which stated: clients with additional insurance would report significantly better general health than would clients without additional insurance. A statistically significant difference in general health was noted between client groups with and without additional Medicaid insurance ($t = -17.74$, $p < .0005$). The results indicated the opposite was true (e.g. clients with additional Medicaid insurance reported significantly poorer general health status than did clients without additional Medicaid insurance). There is 95% confidence that the true population mean difference between dual eligible and non-dual eligible Medicare beneficiaries' general health status lies somewhere between $-.81$ and $-.65$.

Hypothesis 2g

The data did not support hypothesis 2g which stated: clients with additional

insurance would report significantly better independent capacity in BADLs than would clients without additional insurance. A statistically significant difference in BADLs was noted between client groups with and without additional Medicaid insurance ($t = -14.60$, $p < .0005$). The results indicated the opposite was true (e.g. clients with additional Medicaid insurance reported significantly poorer independent capacity in BADLs than did clients without additional Medicaid insurance). There is 95% confidence that the true population mean difference between dual eligible and non-dual eligible Medicare beneficiaries' BADLs lies somewhere between $-.96$ and $-.73$.

Hypothesis 3g

The data did not support hypothesis 3g which stated: clients with additional insurance would report significantly better independent capacity in HADLs than would clients without additional insurance. A statistically significant difference in HADLs was noted between client groups with and without additional Medicaid insurance ($t = -14.05$, $p < .0005$). The results indicated the opposite was true (e.g. clients with additional Medicaid insurance reported significantly poorer independent capacity in HADLs than did clients without additional Medicaid insurance). There is 95% confidence that the true population mean difference between dual eligible and non-dual eligible Medicare beneficiaries' HADLs lies somewhere between $-.90$ and $-.67$.

Hypothesis 4g

The data supported hypothesis 4g which stated: clients with additional insurance would report significantly different independent capacity in AADLs than would clients without additional insurance. A statistically significant difference in AADLs was noted between client groups with and without additional Medicaid insurance ($t = -9.88$, $p < .001$). Frequencies of mean AADL score by Medicaid insurance categories indicated that clients with additional Medicaid insurance reported poorer independent capacity in AADLs than did clients without additional Medicaid insurance. There is 95% confidence that the true population mean difference between dual eligible and non-dual eligible

Medicare beneficiaries' AADLs lies somewhere between -.37 and -.25.

Table 4.7

Relationships Between Enabling Characteristic, Additional Private Insurance, and Health Outcomes

| Outcome Measures ^a | No Private Insurance Mean (SD) | Private Insurance Mean (SD) | t ^b | p | 95% CI Lower, Upper |
|-------------------------------|--------------------------------|-----------------------------|----------------|--------|---------------------|
| General Health | 2.97 (1.21) | 2.68 (1.11) | 7.70 | <.0005 | .21, .36 |
| BADL | .90 (1.48) | .67 (1.31) | 5.37 | <.0005 | .14, .31 |
| HADL | .97 (1.38) | .67 (1.16) | 8.18 | <.0005 | .23, .37 |
| AADL | .28 (.67) | .18 (.53) | 6.39 | <.001 | .07, .14 |

Unweighted N for Private Insurance cases= 5,406; No Private Insurance cases= 2,354; Total 7,760

Weighted N for Private Insurance cases= 18,780,248; No Private Insurance cases= 7,676,141

Unweighted N for HADL cases = Private Insurance 5,313; No Private Insurance 2,316 (131 inappropriate).

Weighted N for HADL cases = Private Insurance 18,533,208; No Private Insurance 7,569,920.

^aAll responses were coded so that higher numbers indicated poorer self assessed health.

^bEstimated t scores for the full sample; df= 100

Hypothesis 1g2

The data supported hypothesis 1g2 which stated: clients with additional insurance would report significantly better general health than would clients without additional insurance. A statistically significant difference in general health was noted between client groups with and without additional private insurance ($t= 7.70, p<.0005$). Clients with additional private insurance reported significantly better general health status than did clients without additional private insurance. There is 95% confidence that the true population mean difference between privately insured and not privately insured Medicare beneficiaries' general health status lies somewhere between .21 and .36.

Hypothesis 2g2

The data supported hypothesis 2g2 which stated: clients with additional insurance would report significantly better independent capacity in BADLs than would clients without additional insurance. A statistically significant difference in BADLs was noted between client groups with and without additional private insurance ($t= 5.37, p<.0005$). Clients with additional private insurance reported significantly better independent capacity in BADLs than did clients without additional private insurance. There is 95% confidence that the true population mean difference between privately insured and not privately insured Medicare beneficiaries' BADLs lies somewhere between .14 and .31.

Hypothesis 3g2

The data supported hypothesis 3g2 which stated: clients with additional insurance would report significantly better independent capacity in HADLs than would clients without additional insurance. A statistically significant difference in HADLs was noted between client groups with and without additional private insurance ($t= 8.18, p<.0005$). Clients with additional private insurance reported significantly better independent capacity in HADLs than did clients without additional private insurance. There is 95% confidence that the true population mean difference between privately insured and not privately insured Medicare beneficiaries' HADLs lies somewhere between .23 and .37.

Hypothesis 4g2

The data supported hypothesis 4g2 which stated: clients with additional insurance would report significantly different independent capacity in AADLs than would clients without additional insurance. A statistically significant difference in AADLs was noted between client groups with and without additional private insurance ($t= 6.39, p<.001$). Frequencies of mean AADL by private insurance category indicated that clients with additional private insurance reported better independent capacity in AADLs than did clients without additional private insurance. There is 95% confidence that the true population mean difference between privately insured and not privately insured Medicare

beneficiaries' AADLs lies somewhere between .07 and .14.

Table 4.8

Relationships Between Enabling Characteristic, Metropolitan Residence, and Health

Outcomes

| Outcome Measures ^a | Non Metropolitan Residence Mean (SD) | Metropolitan Residence Mean (SD) | t ^b | P | 95% CI Lower, Upper |
|-------------------------------|--------------------------------------|----------------------------------|----------------|------|---------------------|
| General Health | 2.81 (1.15) | 2.74 (1.14) | 2.05 | .043 | .01, .14 |
| BADL | .73 (1.33) | .74 (1.38) | -0.288 | .774 | -.09, .07 |
| HADL | .77 (1.24) | .75 (1.23) | 0.590 | .557 | -.06, .11 |
| AADL | .211 (.56) | .206 (.59) | 0.333 | .740 | -.02, .03 |

Unweighted N for Metropolitan Residence= 5,585; Non Metropolitan Residence= 2,175; Total 7,760
 Weighted N for Metropolitan Residence cases= 19,423,360; Non Metropolitan Residence cases= 7,033,029
 Unweighted N for HADL = Metropolitan Residence 5,483; Non Metropolitan Residence 2,146.
 Weighted N for HADL = Metropolitan Residence 19,423,360; Non Metropolitan Residence 6,945,334.

^aAll responses were coded so that higher numbers indicated poorer self assessed health.

^bEstimated t scores for the full sample; df= 100

Metropolitan Residence is an indicator of urbanization, metropolitan statistical areas include at least one city of 50,000 or more persons and the surrounding area, including other cities and counties that are socially and economically integrated (U.S. Bureau of Census, 1994).

Hypothesis 1h

The data supported hypothesis 1h which stated: clients residing in metropolitan and non-metropolitan areas would report significantly different general health levels. A statistically significant relationship was noted between metropolitan residence and health status ($t=2.05$, $p=.043$). Frequencies of mean general health by metropolitan residence category indicated that clients residing in metropolitan areas reported better general health status than did clients residing in non-metropolitan areas.

Hypothesis 2h

The data did not support hypothesis 2h which stated: clients residing in metropolitan and non-metropolitan areas would report significantly different independent capacity in BADLs. Differences noted in BADLs between clients residing in metropolitan areas and those residing in non metropolitan areas were not statistically significant ($t = -0.288$, $p = .774$). The results indicate the opposite is true (e.g. clients residing in metropolitan and non metropolitan areas do not report significantly different independent capacity in BADLs).

Hypothesis 3h

The data did not support hypothesis 3h which stated: clients residing in metropolitan and non-metropolitan areas would report significantly different independent capacity in HADLs. Differences noted in HADLs between clients residing in metropolitan areas and those residing in non metropolitan areas were not statistically significant ($t = 0.590$, $p = .557$). The results indicate the opposite is true (e.g. clients residing in metropolitan and non metropolitan areas do not report significantly different independent capacity in HADLs).

Hypothesis 4h

The data did not support hypothesis 4h which stated: clients residing in metropolitan and non-metropolitan areas would report significantly different independent capacity in AADLs. Differences noted in AADLs between clients residing in metropolitan areas and those residing in non metropolitan areas were not statistically significant ($t = 0.333$, $p = .740$). The results indicate the opposite is true (e.g. clients residing in metropolitan and non metropolitan areas do not report significantly different independent capacity in AADLs). Ninety-five percent CIs for the estimated mean AADL scores of non metropolitan residents (.19 to .23) and metropolitan residents (.19 to .22) suggest the range of population mean score estimates across the replicates.

Table 4.9

Relationships Between Enabling Characteristic, Census Region, and Health Outcomes^a

| Outcome Measures | Census Regions | | | | F ^b | P |
|------------------|----------------|-------------------|---------------------|-----------------|----------------|--------|
| | West Mean (SD) | Midwest Mean (SD) | Northeast Mean (SD) | South Mean (SD) | | |
| General Health | 2.56 (1.11) | 2.70 (1.10) | 2.80 (1.13) | 2.86 (1.17) | 43.14 | <.0001 |
| BADL | .69 (1.32) | .75 (1.38) | .72 (1.36) | .75 (1.38) | .61 | .6576 |
| HADL | .69 (1.17) | .74 (1.23) | .70 (1.18) | .83 (1.29) | 3.53 | .0098 |
| AADL | .19 (.55) | .19 (.53) | .21 (.58) | .22 (.62) | 4.17 | .0037 |

For ANOVA, Wesvar Complex Samples Software uses a vector-matrix calculation, not numerator - denominator format, to test the parameters. Omitted reference category is Puerto Rico.

^a All responses were coded so that higher numbers indicated poorer self assessed health.

^b Estimated F values for the full sample.

Unweighted N= 7,760

Weighted N for West cases= 4,727,907, except HADL cases= 4,694,067

Weighted N for Midwest cases= 6,345,197, except HADL cases= 6,222,705

Weighted N for Northeast cases= 5,568,481, except HADL cases = 5,481,740

Weighted N for South cases= 9,501,336, except HADL cases= 9,392,212

Weighted N for Puerto Rico cases= 313,468, except HADL cases= 312,405

Table 4.10

Post Hoc Tests: ANOVA Estimates of the Effects of Census Region on General Health

| Pairs Of Census Regions Tested | F | p | Sig @ p< 0.0083 |
|--------------------------------|-------|--------|-----------------|
| Northeast & West | 19.19 | <.0001 | Significant |
| Northeast & South | 2.26 | .1362 | |
| Northeast & Midwest | 3.04 | .0842 | |
| South & West | 45.05 | <.0001 | Significant |
| South & Midwest | 10.09 | .0020 | Significant |
| Midwest & West | 4.95 | .0284 | |

P< 0.0083 is the corrected alpha level for these post hoc tests. Bonferroni correction factor requires dividing the overall alpha level by the number of pairs being tested (.05 / 6 = .0083).

Table 4.11

Post Hoc Tests: ANOVA Estimates of the Effects of Census Region on HADL

| Pairs Of Census Regions Tested | F | p | Sig @ $p \leq 0.0083$ |
|--------------------------------|------|-------|-----------------------|
| Northeast & West | .01 | .9303 | |
| Northeast & South | 9.74 | .0024 | Significant |
| Northeast & Midwest | .47 | .4963 | |
| South & West | 6.54 | .0120 | |
| South & Midwest | 2.44 | .1216 | |
| Midwest & West | .50 | .4797 | |

$P < 0.0083$ is the corrected alpha level for these post hoc tests. Bonferroni correction factor requires dividing the overall alpha level by the number of pairs being tested ($.05 / 6 = .0083$).

Table 4.12

Post Hoc Tests: ANOVA Estimates of the Effects of Census Region on AADL

| Pairs Of Census Regions Tested | F | p | Sig @ $p \leq 0.0083$ |
|--------------------------------|------|-------|-----------------------|
| Northeast & West | .39 | .5323 | |
| Northeast & South | .88 | .3497 | |
| Northeast & Midwest | .62 | .4340 | |
| South & West | 3.14 | .0793 | |
| South & Midwest | 3.93 | .0502 | |
| Midwest & West | .03 | .8678 | |

$P < 0.0083$ is the corrected alpha level for these post hoc tests. Bonferroni correction factor requires dividing the overall alpha level by the number of pairs being tested ($.05 / 6 = .0083$).

Hypothesis 1i

The data supported hypothesis 1i which stated: clients residing in different census regions would report significantly different general health levels. As shown in Table 4.9, a statistically significant relationship was noted between census region of residence and health status ($F=43.14$, $p < .0001$). Post hoc tests on six different pairs of census regions revealed that clients residing in certain census regions reported significantly better general health status than did clients residing in other regions (Table 4.10). Specifically, those in the Western region had significantly better general health than those in the

Northeast or the South and clients residing in the Midwest had significantly better general health than those in the South.

Hypothesis 2i

The data did not support hypothesis 2i which stated: clients residing in different census regions would report significantly different independent capacities in BADLs. As shown in Table 4.9, differences noted in BADLs between clients residing in different regions were not statistically significant ($F = .61, p = .6576$). The results indicate the opposite is true (clients residing in different census regions did not report significantly different functional status in BADLs).

Hypothesis 3i

The data supported hypothesis 3i which stated: clients residing in different census regions would report significantly different independent capacity in HADLs. As shown in Table 4.9, a statistically significant relationship was noted between census region of residence and HADLs ($F = 3.53, p = .0098$). Post hoc tests on six different pairs of census regions revealed that clients residing in certain census regions reported significantly better functional status in HADLs than did clients residing in other regions (Table 4.11). Specifically, those in the Northeastern region had significantly better functional status in HADLs than those residing in the Southern region.

Hypothesis 4i

The data partially supported hypothesis 4i which stated: clients residing in different census regions would report significantly different independent capacities in AADLs. As shown in Table 4.9, differences noted in AADLs between clients residing in different regions were statistically significant ($F = 4.17, p = .0037$). Post hoc tests on six different pairs of census regions revealed that clients residing in certain census regions reported significantly better functional status in AADLs than did clients residing in other regions (Table 4.12). Specifically, those in the Midwest region had significantly better functional status in AADLs than those in the Southern region ($F = 3.93, p = .0502$). The adjusted

alpha level, however, indicates that the observed difference does not rise to the necessary level of significance ($p \leq .0083$).

Relationships Between Utilization Factors and Dependent Variables

Relationships between the two utilization factors and each of the four health outcome measures were tested using Pearson's correlations. Research results for hypotheses 1k, 1l, 2k, 2l, 3k, 3l, 4k, and 4l are presented in Table 4.13.

Table 4.13

Relationships Between Utilization Factors and Health Outcomes¹

| Dependent Variables ² | Utilization Factors | |
|----------------------------------|--------------------------------|--------------------------|
| | Outpatient Visits and Services | Inpatient Hospital Stays |
| General Health | .20** | .24** |
| BADL | .13** | .27** |
| HADL | .14** | .26** |
| AADL | .05* | .20** |

* significant at $p = 0.0036$; ** significant at $p < 0.0001$.

¹ Estimated correlation coefficients for the full sample: $df = 100$

² All responses were coded so that higher numbers indicated poorer self assessed health. Unweighted N for each variable is 7,760, except HADL cases = 7,629 (131 inappropriate). Weighted N for each variable is 26,456,389, except HADL cases = 26,103,128.

Hypothesis 1k

The data supported hypothesis 1k which stated: there would be a significant relationship between client's number of outpatient visits and their general health. A

statistically significant very weak relationship was noted between outpatient visits and services and health status ($r = .20, p < .0001$). Frequencies of mean general health by outpatient visit categories revealed that as outpatient visits and services increased, perceived health status scores increased and health status worsened.

Hypothesis 1l

The data supported hypothesis 1l which stated: there would be a significant relationship between client's number of hospital stays and their general health. A statistically significant very weak relationship was noted between hospital inpatient stays and health status ($r = .24, p < .0001$). Frequencies of mean general health by inpatient hospital stay categories revealed that as number of hospital stays increased, perceived health status scores increased and health status worsened.

Hypothesis 2k

The data supported hypothesis 2k which stated: there would be a significant relationship between client's number of outpatient visits and their independent capacity in BADLs. A statistically significant very weak relationship was noted between outpatient visits and services and BADLs ($r = .13, p < .0001$). Frequencies of mean BADL by outpatient visit categories revealed that as outpatient visits and services increased, BADL scores increased and independence in BADLs worsened.

Hypothesis 2l

The data supported hypothesis 2l which stated: there would be a significant relationship between client's number of hospital stays and their independent capacity in BADLs. A statistically significant weak relationship was noted between hospital inpatient stays and BADLs ($r = .27, p < .0001$). Frequencies of mean BADL by hospital stay

categories revealed that as number of hospital stays increased, BADL scores increased and independence in BADLs worsened.

Hypothesis 3k

The data supported hypothesis 3k which stated: there would be a significant relationship between client's number of outpatient visits and their independent capacity in HADLs. A statistically significant very weak relationship was noted between outpatient visits and services and HADLs ($r = .14, p < .0001$). Frequencies of mean HADL by outpatient visit categories revealed that as outpatient visits and services increased, HADL scores increased and independence in HADLs worsened.

Hypothesis 3l

The data supported hypothesis 3l which stated: there would be a significant relationship between client's number of hospital stays and their independent capacity in HADLs. A statistically significant weak relationship was noted between hospital inpatient stays and HADLs ($r = .26, p < .0001$). Frequencies of mean HADL by hospital stay categories revealed that as number of hospital stays increased, HADL scores increased and independence in HADLs worsened.

Hypothesis 4k

The data supported hypothesis 4k which stated: there would be a significant relationship between client's number of outpatient visits and their independent capacity in AADLs. A statistically significant very weak relationship was noted between outpatient visits and services and AADLs ($r = .05, p = .0036$). Frequencies of mean AADL scores by outpatient visits categories revealed that as outpatient visits and services increased, AADL scores increased and independence in AADLs worsened.

Hypothesis 4I

The data supported hypothesis 4I which stated: there would be a significant relationship between client's number of hospital stays and their independent capacity in AADLs. A statistically significant very weak relationship was noted between hospital inpatient stays and AADLs ($r = .20$, $p < .0001$). Frequencies of mean AADL by hospital stay categories revealed that as number of hospital stays increased, independence in AADLs worsened.

Two Sample or Bivariate Test Results Summary

The results for 52 subhypotheses on general health, BADL, HADL, and AADL in older adults with one or more chronic illnesses suggested implications for each construct in the theoretical framework. Predisposing variables that were significantly related to all four dependent variables included age, education, marital status, and race. Gender was significantly related to BADL and HADL only. Enabling variables that were significantly related to all four dependent variables included income, private health insurance, and Medicaid insurance. Metropolitan residence was significantly related to general health only. Region of residence was significantly related to general health and to HADL only. The need variable, number of chronic illnesses, was significantly related to all four dependent variables. Utilization variables, outpatient visits and services and inpatient hospital stays, were both significantly related to all four dependent variables. As all independent variables' relationships may be altered in multivariate tests and all may be significant predictors of general health, BADL, HADL, and/or AADL, all were retained for entry into initial multivariate regression models.

Research Hypotheses: Multiple Linear Regression Results

This section discusses the multiple linear regression research hypotheses identified in Chapter III. Multivariate hypotheses examined complex relationships between population-at-risk characteristics, utilization factors, health delivery systems, and the dependent variable, health outcomes. Perceived health outcomes vary by population characteristics, utilization factors, and health delivery systems. Multiple linear regression models mirror the complexity of health outcomes by considering the mutual influence of several independent variables in an interactive manner. Therefore, multiple linear regression analyses were conducted to identify variables that would explain health outcomes in older adult Medicare enrollees with chronic illness.

Multivariate relationships between nominal, ordinal, interval and ratio level independent variables and ordinal, treated as interval, dependent variables were tested using hierarchical multiple linear regression. This approach allowed examination of the effect of health delivery system after the effects of population characteristics and utilization factors had been controlled. In Wesvar's Complex Samples software, each hierarchical regression was run in five steps. The first step was run with one block of predictor variables (predisposing) and one criterion variable. The second step was run with two blocks of predictor variables (predisposing and enabling) and one criterion variable. The third step was run with three blocks of predictor variables (predisposing, enabling, and need) and one criterion variable. The fourth step was run with four blocks of predictor variables (predisposing, enabling, need, and utilization factors) and one criterion variable. The fifth step was run with five blocks of predictor variables (predisposing, enabling, need, utilization, and health delivery system) and one criterion

variable. Separate regression models were run for each of the health status outcome variables: general health, BADL, HADL, and AADL. A block of variables may be significant when some individual variables are not (Hair et.al., 1995).

Regression model fitting required an iterative approach using both SPSS and Wesvar complex samples software. Wesvar complex samples software does not provide residuals (i.e. difference between observed and predicted values for the dependent variable) for use in examining the assumptions of multiple regression. Therefore, models were fitted in SPSS using weighted least squares (WLS) to produce estimated studentized residuals (i.e. observed residuals divided by estimated standard deviation of residuals) and predicted residuals. Residuals produced in SPSS were weighted by the cross sectional full sample weight and then used to check linearity of model (plots), homoscedasticity or constant variance (studentized versus predicted value plots), and normality of the error terms (histograms of residuals). No major violations of the ordinary least squares assumptions were noted in final evaluation of the study variables.

Regression diagnostics produced by SPSS, although inaccurate because the software uses the full sample weighted n as the denominator in its calculations, were examined for studentized and predicted values with expected mean of 0 and standard deviation 1.00 to identify estimated models that were correct. Wesvar Complex Samples software was then used to re-estimate the models, estimate accurate standard errors and test the hypotheses. Wesvar provided, as part of the output for each regression, a table of covariances of estimates. Covariances were assessed for possible pairwise variable collinearity, but not multiple variable collinearity.

Model fitting in both Wesvar and SPSS produced initial regression models that

could be assessed for assumptions of the tests. Residual plots indicated, and collinearity diagnostics suggested, collinearity of the models associated with two variables: income and regions. Income reached total linearity and stopped model processing in Wesvar.

Therefore categorical income dummy variables were used in the general health outcome model. Because income dummy variables were not significant and Medicaid insurance variable was moderately correlated with income status ($r = .50, p < .0001$), the Medicaid insurance variable provided a useful proxy indicator for income status in the BADL, HADL, and AADL outcome models. Regions were estimated to be strongly related to each other ($r = .80$ to $.97; p < .0001$) but not multiple variable collinear. General Health regression models run with and without the regions variables revealed statistically significant partial correlation coefficients without major changes in residual scatter plots.

Several variables failed to reach statistical significance in models and one of these was omitted from all final models: metropolitan residence. Because it was not significant in some models, census regions were omitted. Thus variables were removed from the models, producing regression models with better fit and improved parsimony. Although statistically non-significant, several traditional sociodemographic variables were, however, retained in the final models. The final models are presented in the following results. Table 4.14 presents the results for general health. Table 4.15 presents the results for BADL. Table 4.16 presents the results for HADL. Table 4.17 presents the results for AADL.

Table 4.14

Hierarchical Multiple Regression Estimates of General Health in Older Adults With
Chronic Illness (n=7,760)

| Step Predictor | Step 1 | Step 2 | Step 3 | Step 4 | Step 5 |
|---------------------------|---|-----------|-----------|-----------|-----------|
| | Estimated Partial Regression Coefficients For the Full Sample | | | | |
| 1 Predisposing | | | | | |
| Age | .009*** | .008*** | .003 | .002 | .002 |
| Education | -.072**** | -.049**** | -.043**** | -.043**** | -.043**** |
| Male | -.021 | -.054* | -.030 | -.021 | -.018 |
| Not Married | .067* | .059 | .060 | .067* | .069* |
| White | .168*** | .093 | .085 | .083 | .077 |
| 2 Enabling | | | | | |
| Income: | | | | | |
| lowest to \$10,000 | | .581**** | .491**** | .453**** | .445**** |
| \$10,001 to \$20,000 | | .383**** | .302**** | .276**** | .279**** |
| \$20,001 to \$30,000 | | .246*** | .212** | .199** | .204** |
| \$30,001 to \$40,000 | | .186* | .165* | .142 | .146* |
| \$40,001 to \$50,000 | | .194* | .162* | .110 | .112 |
| No Private Ins. | | .064 | .044 | .069 | .099** |
| West Region | | -.433**** | -.449**** | -.448**** | -.414**** |
| Midwest Region | | -.334*** | -.332** | -.332** | -.321** |
| Northeast Region | | -.246** | -.259** | -.298** | -.277** |
| South Region | | -.258** | -.283** | -.286** | -.275** |
| 3 Need | | | | | |
| Chronic Illnesses | | | .218**** | .187**** | .187**** |
| 4 Utilization | | | | | |
| Outpatient Services | | | | .006**** | .006**** |
| Inpatient Stays | | | | .149**** | .149**** |
| 5 Health System | | | | | |
| Medicare FFS | | | | | .112* |
| F | 75.40**** | 50.26**** | 87.66**** | 83.96**** | 80.97**** |
| R ² Change | | .020 | .112 | .029 | .001 |
| Cumulative R ² | .069 | .089 | .201 | .230 | .231 |

*p< .025 **p< .005 ***p< .0005 ****p<.00005 by one-tailed t-tests on betas, F tests on models (df=100). Omitted reference categories include the following: Gender: female; Marital status: married; Race: minority; Private insurance: yes; Census region of residence: Puerto Rico; Income: \$50,001 and over; Health system: Medicare Managed Care.

Hypothesis 1

The data did not support hypothesis 1 which stated: HMO clients would report poorer general health than FFS clients once characteristics of the population-at-risk and utilization of health services were controlled. As shown in Table 4.14, the overall predictive model for general health was, however, statistically significant ($F = 80.97$, $p < .00005$). As previously stated, all responses were coded so that higher scores indicated poorer health.

In the overall explanatory model, two predisposing variables were significantly related to general health: 1) education and 2) marital status dummy variable. For each year increase in education, general health scores decreased .04 points ($p < .00005$). Higher scores for general health were associated with being not married ($p = .02$).

Nine enabling variables were significantly related to general health: 1) Income dummy variable lowest to \$10,000; 2) income dummy variable \$10,001 to \$20,000; 3) income dummy variable \$20,001 to \$30,000; 4) Income dummy variable \$30,001 to \$40,000; 5) Private insurance dummy variable; 6) West region dummy variable; 7) Midwest region dummy variable; 8) Northeast region dummy variable; and 9) South region dummy variable. Relative to the reference category, \$50,000 and over, higher scores for general health were associated with having incomes of lowest to \$10,000 ($p = .02$), \$10,001 to \$20,000 ($p = .001$), \$20,001 to \$30,000 ($p < .00005$), and \$30,001 to \$40,000 ($p < .00005$). Higher scores, and poorer general health, were associated with not having private insurance ($p = .005$). Relative to the reference census region of residence, Puerto Rico, higher scores for general health were associated with residing in West ($p = .00005$), Midwest ($p = .001$), Northeast ($p = .0025$), South ($p = .003$).

The need predictor variable, number of chronic illnesses, was significantly related to general health. For each unit increase in number of chronic illnesses, general health scores increased by .19 units ($p < .00005$).

Both utilization variables were significantly related to general health: 1)

outpatient services and visits and 2) inpatient hospital stays. For each additional outpatient service or visit, general health score increased by .01 units ($p < .00005$). For each additional inpatient hospital stay, general health score increased by .15 units ($p < .00005$).

The health system variable , health system dummy variable, revealed that relative to HMO clients, higher scores for general health were associated with being a FFS client. Health system dummy variable was statistically significantly related to general health after adjusting for all other predictor variables in the model ($p = .015$).

The multiple regression results on general health in older adults with one or more chronic illnesses (see Table 4.14) implied: no serious multicollinearity problems with the model; (2) the predisposing block of variables explained about 7% of the variance in general health status; (3) the enabling block of variables explained about 2% of the variance in general health status; (4) the need variable block explained approximately 11% of the health status variance; (5) the utilization block of variables explained approximately 3% of the health status variance; (6) the health system variable block contributed by explaining .1% of the variance accounted for in general health , when controlling for the population characteristics and utilization of health services blocks of variables. In conclusion, general health status appeared to be a function of the predisposing, enabling, need, utilization, and health delivery system blocks of variables.

Table 4.15

Hierarchical Multiple Regression Estimates of BADL in Older Adults With ChronicIllness (n= 7,760)

| Step Predictor | Step 1 | Step 2 | Step 3 | Step 4 | Step 5 |
|---------------------------|---|------------|------------|------------|------------|
| | Estimated Partial Regression Coefficients For the Full Sample | | | | |
| 1 Predisposing | | | | | |
| Age | .0506**** | .0506**** | .0461**** | .0438**** | .0439**** |
| Education | -.0379**** | -.0224**** | -.0169** | -.0161** | -.0160** |
| Male | -.1563**** | -.1344**** | -.1514**** | -.1702**** | -.1714**** |
| Not Married | .0876* | .0145 | .0059 | -.0088 | -.0100 |
| White | -.0998 | .0256 | .0255 | .0111 | .0136 |
| 2 Enabling | | | | | |
| No Medicaid Ins. | | -.6842**** | -.6130**** | -.5263**** | -.5115**** |
| No Private Ins. | | -.0001 | -.0051 | .0143 | .0335 |
| West Region | | .3798**** | .3568**** | .3533**** | .3703**** |
| Midwest Region | | .4460**** | .4429**** | .4181**** | .4222**** |
| Northeast Region | | .3850**** | .3637**** | .3197**** | .3246**** |
| South Region | | .3952**** | .3632**** | .3435**** | .3474**** |
| 3 Need | | | | | |
| Chronic Illnesses | | | .1703**** | .1391**** | .1389**** |
| 4 Utilization | | | | | |
| Outpatient Services | | | | .0007 | .0006 |
| Inpatient Stays | | | | .2829**** | .2833**** |
| 5 Health System | | | | | |
| Medicare FFS | | | | | .0633 |
| F | 129.91**** | 86.27**** | 110.48**** | 117.85**** | 109.87**** |
| R ² Change | | .021 | .049 | .034 | 0 |
| Cumulative R ² | .096 | .117 | .166 | .200 | .200 |

*p< .05 **p< .01 ***p< .001 ****p<.0001 by two-tailed t-tests on betas, F tests on models (df=100). Omitted reference categories include the following: Gender: female; Marital status: married; Race: minority; Medicaid insurance: yes; Private insurance: yes; Census region of residence: Puerto Rico; Health system: Medicare Managed Care.

Hypothesis 2

The data supported hypothesis 2 which stated: there would be no differences in limitations in basic activities of daily living between HMO and FFS clients once characteristics of the population and utilization of health services were controlled. As shown in Table 4.15, the overall explanatory model for BADL in older adults with one or more chronic illnesses was statistically significant (F =109.87, p<.0001). As previously stated, all responses were coded so that higher scores indicated poorer health or more

limitations in functional status.

In the overall predictive model, three predisposing variables were significantly related to BADL: 1) age; 2) education; and 3) male dummy variable. For each year increase in age, BADL scores increased .0439 points ($p < .0001$). For each year increase in education, BADL scores decreased .0160 points ($p = .0031$). Higher scores for BADL were associated with being female ($p < .0001$).

Five enabling variables were significantly related to BADL: Medicaid insurance dummy variable, West region dummy variable, Midwest region dummy variable, Northeast region dummy variable, and South region dummy variable. Higher scores for BADL were associated with having Medicaid insurance ($p < .0001$). Relative to the reference census region, Puerto Rico, higher scores for BADL were associated with residing in West ($p < .0001$), Midwest ($p < .0001$), Northeast ($p < .0001$), and South ($p < .0001$) regions.

The need variable, number of chronic illnesses, was significantly related to BADL. For each unit increase in number of chronic illnesses, BADL scores increased by .1389 units ($p < .0001$).

One utilization variable was significantly related to BADL: inpatient hospital stays. For each additional inpatient hospital stay, BADL score increased by .2833 units ($p < .0001$).

The health system variable, health system dummy variable, suggested that relative to clients in HMO delivery systems, higher scores for BADL were associated with being clients in FFS delivery systems. Health system dummy variable was not, however, statistically significantly related to BADL after adjusting for all other predictor variables in the model ($p = .2050$).

The multiple regression results on BADL in older adults with one or more chronic illnesses (see Table 4.15) implied: (1) no serious multicollinearity problems with the model; (2) the predisposing block of variables explained about 10% of the variance in

BADL; (3) the enabling block of variables explained about 2% of the variance in BADL; (4) the need variable block explained approximately 5% of the BADL variance; (5) the utilization block of variables explained approximately 3% of the BADL variance; (6) the health system variable block did not contribute significantly to the variance accounted for in BADL, when controlling for the population characteristics and utilization of health services blocks of variables. In conclusion, BADL appeared to be a function of the predisposing, enabling, need, and utilization blocks of variables, not health delivery system characteristics.

Table 4.16

Hierarchical Multiple Regression Estimates of HADL in Older Adults With Chronic Illness (n= 7,760)

| Step Predictor | Step 1 | Step 2 | Step 3 | Step 4 | Step 5 |
|---------------------------|---|------------|------------|------------|------------|
| | Estimated Partial Regression Coefficients For the Full Sample | | | | |
| 1 Predisposing | | | | | |
| Age | .047**** | .047**** | .042**** | .041**** | .041**** |
| Education | -.046**** | -.032**** | -.026**** | -.025**** | -.024**** |
| Male | -.241**** | -.231**** | -.249**** | -.266**** | -.268**** |
| Not Married | .106** | .047 | .039 | .025 | .023 |
| White | -.155* | -.029 | -.027 | -.036 | -.031 |
| 2 Enabling | | | | | |
| No Medicaid Ins. | | -.474**** | -.394**** | -.339**** | -.310**** |
| No Private Ins. | | .085* | .077* | .099** | .137** |
| 3 Need | | | | | |
| Chronic Illnesses | | | .188**** | .159**** | .159**** |
| 4 Utilization | | | | | |
| Outpatient Services | | | | .002 | .002 |
| Inpatient Stays | | | | .229**** | .229**** |
| 5 Health System | | | | | |
| Medicare FFS | | | | | .112* |
| F | 191.09**** | 140.28**** | 249.04**** | 229.20**** | 206.57**** |
| R ² Change | | .015 | .072 | .029 | 0 |
| Cumulative R ² | .123 | .138 | .210 | .239 | .239 |

*p<.05 **p<.01 ***p<.001 ****p<.0001 by two-tailed t-tests on betas, F tests on models (df=100). Omitted reference categories include the following: Gender: female; Marital status: married; Race: minority; Medicaid insurance: yes; Private insurance: yes; Health system: Medicare Managed Care.

Hypothesis 3

The data did not support hypothesis 3 which stated: there would be no difference in limitations in household activities of daily living between HMO and FFS clients once characteristics of the population and utilization of health services were controlled. The results indicated the opposite was true. That is, higher scores for HADL were associated with being enrolled in a FFS health system ($p=.0233$). As shown in Table 4.16, the overall explanatory model for HADL in older adults with one or more chronic illnesses was statistically significant ($F = 206.57, p < .0001$). As previously stated, all responses were coded so that higher scores indicated poorer health or more limitations in functional status.

In the overall explanatory model, three predisposing variables were significantly related to HADL: 1) age; 2) education; and 3) male dummy variable. For each year increase in age, HADL scores increased .041 points ($p < .0001$). For each year increase in education, HADL scores decreased .024 points ($p < .0001$). Higher scores for HADL were associated with being female ($p < .0001$).

Two enabling variables were significantly related to HADL: 1) Medicaid insurance dummy variable and 2) private insurance dummy variable. Higher scores for HADL were associated with having Medicaid insurance ($p < .0001$) and not having private insurance ($p = .0016$).

The need variable, number of chronic illnesses, was significantly related to HADL. For each unit increase in number of chronic illnesses, HADL scores increased by .159 units ($p < .0001$).

One utilization variable was significantly related to HADL: inpatient hospital stays. For each additional inpatient hospital stay, HADL score increased by .229 units ($p < .0001$).

The health system variable, health system dummy variable, revealed that relative to clients in HMO delivery systems, higher scores for HADL were associated with being

clients in FFS delivery systems. Health system dummy variable was significantly related to HADL after adjusting for population characteristics and utilization blocks of variables in the model ($p=.0233$).

The multiple regression results on HADL in older adults with one or more chronic illnesses (see Table 4.16) implied: (1) no serious multicollinearity problems with the model; (2) the predisposing block of variables explained about 12% of the variance in HADL; (3) the enabling block of variables explained about 2% of the variance in HADL; (4) the need variable block explained approximately 7% of the HADL variance; (5) the utilization block of variables explained approximately 3% of the HADL variance; (6) the health system variable block was significantly related to HADL but did not contribute to the variance accounted for in HADL, when controlling for the population characteristics and utilization of health services blocks of variables. In conclusion, HADL appeared to be a function of the predisposing, enabling, need, utilization, and health delivery system characteristics.

Table 4.17

Hierarchical Multiple Regression Estimates of AADL in Older Adults With Chronic
Illness (n= 7,760)

| Step Predictor | Step 1 | Step 2 | Step 3 | Step 4 | Step 5 |
|---------------------------|---|-----------|-----------|-----------|-----------|
| | Estimated Partial Regression Coefficients For the Full Sample | | | | |
| 1 Predisposing | | | | | |
| Age | .023**** | .023**** | .022**** | .021**** | .021**** |
| Education | -.018**** | -.012**** | -.011**** | -.010**** | -.010**** |
| Male | .039** | .046** | .042** | .036** | .035** |
| Not Married | .007 | -.019 | -.021 | -.027* | -.028* |
| White | -.055* | -.003 | -.002 | -.007 | -.004 |
| 2 Enabling | | | | | |
| No Medicaid Ins. | | -.227**** | -.211**** | -.189**** | -.173**** |
| No Private Ins. | | .017 | .016 | .017 | .038 |
| 3 Need | | | | | |
| Chronic Illnesses | | | .038**** | .031**** | .030**** |
| 4 Utilization | | | | | |
| Outpatient Services | | | | -.001** | -.001** |
| Inpatient Stays | | | | .097**** | .097**** |
| 5 Health System | | | | | |
| Medicare FFS | | | | | .064** |
| F | 115.79**** | 84.33**** | 98.47**** | 83.67**** | 75.92**** |
| R ² Change | | .014 | .014 | .019 | .001 |
| Cumulative R ² | .095 | .109 | .123 | .142 | .143 |

*p< .05 **p< .01 ***p< .001 ****p<.0001 by two-tailed t-tests on betas, F tests on models (df=100). Omitted reference categories include the following: Gender: female; Marital status: married; Race: minority; Medicaid insurance: yes; Private insurance: yes; Health system: Medicare Managed Care.

Hypothesis 4

The data did not support hypothesis 4 which stated: there would be no difference in limitations in advanced activities of daily living between HMO and FFS clients once characteristics of the population and utilization of health services were controlled. The results indicated the opposite was true. That is, higher scores for AADL were associated with being enrolled in a FFS health system ($p=.0019$). As shown in Table 4.17, the overall explanatory model for AADL in older adults with one or more chronic illnesses was statistically significant ($F = 75.92, p<.0001$). As previously stated, all responses were coded so that higher scores indicated poorer health or more limitations in functional

status.

In the overall explanatory model, four predisposing variables were significantly related to AADL: 1) age; 2) education; 3) male dummy variable; and marital status dummy variable. For each year increase in age, AADL scores increased .021 points ($p < .0001$). For each year increase in education, AADL scores decreased .010 points ($p < .0001$). Higher scores for AADL were associated with being male ($p = .0141$) and with being married ($p = .0302$).

One enabling variable was significantly related to AADL: Medicaid insurance dummy variable. Higher scores for AADL were associated with having Medicaid insurance ($p < .0001$).

The need variable, number of chronic illnesses, was significantly related to AADL. For each unit increase in number of chronic illnesses, AADL scores increased by .030 units ($p < .0001$).

Both utilization variables were significantly related to AADL: 1) outpatient services and visits and 2) inpatient hospital stays. For each additional outpatient visits or services, AADL score decreased by .001 units ($p = .0019$). For each additional inpatient hospital stay, HADL score increased by .097 units ($p < .0001$).

The health system variable, health system dummy variable, revealed that relative to clients in HMO delivery systems, higher scores for AADL were associated with being clients in FFS delivery systems. Health system dummy variable was significantly related to AADL after adjusting for all other predictor variables in the model ($p = .0019$).

The multiple regression results on AADL in older adults with one or more chronic illnesses (see Table 4.17) implied: (1) no serious multicollinearity problems with the model; (2) the predisposing block of variables explained about 10% of the variance in AADL; (3) the enabling block of variables explained about 1% of the variance in AADL; (4) the need variable block explained approximately 1% of the AADL variance; (5) the utilization block of variables explained approximately 2% of the AADL variance; (6) the

health system variable block explained approximately 0.1% of the AADL variance, when controlling for the population characteristics and utilization of health services blocks of variables. In conclusion, AADL appeared to be a function of the predisposing, enabling, need, utilization, and health delivery system characteristics.

Multiple Regression Summary

The results of the four major hypothesis tests on general health, BADL, HADL, and AADL indicated that relative to HMO enrollees, and controlling for all other variables in the models, FFS enrollees had poorer health status and functional status (HADL, AADL). These results are further explored in two sample t-tests with accompanying 95% confidence intervals for the true population differences in health status and functional status (Table 4.18).

Table 4.18

Relationships Between Delivery System Organizational Structure and Health Outcomes

| Outcome Measures ^a | Medicare HMO Mean (SD) | Medicare FFS Mean (SD) | t ^b | P | 95% CI Lower, Upper |
|-------------------------------|------------------------|------------------------|----------------|---------|---------------------|
| General Health | 2.55 (1.08) | 2.79 (1.15) | 5.0 | <.00005 | .14, .33 |
| BADL | .58 (1.19) | .75 (1.15) | 3.8 | <.0005 | .08, .25 |
| HADL | .61 (1.09) | .77 (1.25) | 3.7 | <.0001 | .08, .25 |
| AADL | .14 (.45) | .22 (.59) | 4.9 | <.00005 | .04, .11 |

Unweighted N for Medicare HMO cases= 785; Medicare FFS cases= 6,975; Total 7,760

Weighted N for Medicare HMO cases= 2,766,141; Medicare FFS cases= 23,690,248

^aAll responses were coded so that higher numbers indicated poorer self assessed health.

^bEstimated t scores for the full sample; df= 100

As shown in Table 4.18, a statistically significant difference in general health and functional status (BADL, HADL, AADL) was noted between clients enrolled in

Medicare HMOs and clients enrolled in Medicare FFS delivery systems. Clients in Medicare aHMOs reported significantly better health and functional status outcomes than did clients in FFS systems. There is 95% confidence that 1) the true population mean difference between HMO and FFS Medicare beneficiaries' general health status lies somewhere between .14 and .33; 2) the true population mean difference between HMO and FFS beneficiaries' BADL status lies somewhere between .08 and .25; 3) the true population mean difference between HMO and FFS beneficiaries' HADL status lies somewhere between .08 and .25; and 4) the true population mean difference between HMO and FFS beneficiaries' AADL status lies somewhere between .04 and .11.

CHAPTER V

SUMMARY AND IMPLICATIONS

This chapter reviews and discusses the bivariate relationships and hypothesized model results. This study's implications for health policy, urban services, clinical practice and future research are also discussed. Health outcomes are a complex issue and bivariate or two-sample test relationships do not account for the interactive effects of other variables and therefore interpretation of such tests may not be meaningful. Multivariate models, on the other hand, consider the mutual influence of several independent variables in an interactive manner. This is the reason multivariate models were used for this study.

Summary Overview

This study provides new information in two areas where there are limited published studies: 1) the impact of health delivery system organizational structure on perceived health status outcomes in a nationally representative older adult population with chronic illnesses; and 2) the impact of population (and community) characteristics, and utilization factors on health outcomes in a nationally representative older adult population with chronic illnesses. The results of this research were based on data for individual Medicare beneficiaries starting entitlement in 1994 or before. The data were further stratified based on the limits of the data set and the focus of this study. The study excluded those under 65 years of age, those who were not diagnosed with one or more of twelve chronic illnesses analyzed in this study, those who were disabled, and those who resided in facilities/institutions. In summary, the enrollees in this study are a specific category of older adult Medicare clients with chronic illnesses living in the community. The probability sampling methods used by HCFA in collecting the data that were used in

this study, and the special data analysis procedures this study employed allowed point and interval estimates representative of the Medicare FFS and HMO population with chronic illnesses residing in the community. Inferential statistical analysis allowed for generalization of the findings from this study to the population of Medicare FFS & HMO recipients 65 and over with one or more chronic illnesses residing in the communities of the United States, District of Columbia, and Puerto Rico.

This study examined organizational structure of delivery systems which reflects coordination & control of triage and treatment. It was not designed to examine delivery system management of entry and resource variables. The study examined utilization site/type only to the extent that outpatient visits and services as well as inpatient hospital stays were included. A high quality data set, the MCBS provides indicators of HMO and FFS systems while measures of health delivery systems have been apparently lacking in some data sets. To the extent that factors such as provider practice guidelines, organizational management practices, special programs for chronic illnesses, preventive services, cultural beliefs, social networks, lifestyle behaviors and others play a role in determining outcomes, quantification may be difficult.

This study has focused on client-centered health outcomes since outcomes have become a central area of concern to managed care constituencies such as the older adult population, HMO delivery systems and government agencies. It should be recognized however, that the performance of an HMO or FFS organization cannot be adequately measured by any single indicator. Nor can causality be ascribed in a cross-sectional study design.

General Health, BADLs, HADLs, and AADLs, composed the health outcomes

classification system of choice in this study. These perceived health outcomes measures' strengths include: 1) being in accordance with the community health care outcome measures of the theoretical model, which posits that indicators of outcome might include self-reported perceptions; 2) being client-focused; and 3) being meaningful to health care providers, with an orientation towards various providers. These measures each help to define the client's perceived health outcome. Weaknesses include the lack of statistical reliability indicators for the single-item measure General Health. Furthermore, the classification of functional status items is subject to different interpretations. For example, this study classified activities of daily living as BADLs, HADLs, and AADLs, whereas some studies have used the general classification of ADLs and IADLs.

In contrast to previous studies, the current research indicated that FFS delivery system was significantly associated with poorer general health and more limitations in HADLs and AADLs. The reader should exercise caution when considering the effects of health delivery system on health outcomes presented in regression tables. For example, respondents rated their health at the time of MCBS interview, while health delivery system refers to the system they were enrolled in for six or more months during the year (1994-1995). Respondents may plausibly select health delivery systems because their health status is poor rather than the reverse. The large sample size and skewness of variables in this study, cross sectional design and single item measure of the delivery system variable, as well as the lack of other outcome studies using comparable measures, suggest findings should be interpreted with caution. Similarly, caution is encouraged when considering the effect of utilization measures on health outcomes presented herein. Potential questions of respondent accuracy, weak effect size of the outpatient visits and

services variable, and lack of other outcome studies using combined Medicare covered and non-covered services measures, make it difficult to provide conclusive evidence.

The Andersen and Aday Health Systems Model showed some utility in this study. The model's strengths included flexibility in variable selection, consideration of both demand (population-at-risk and patient outcome) and supply (health delivery system) factors (Aday & Andersen, 1974), previous use as a health care utilization model, and inclusion of external environment (community) and outcome measures. It suggests the utility of considering individual economic and organizational factors together in efforts to evaluate the success of existing health policy (Aday & Andersen, 1974). The model is flexible, combining perspectives of diverse disciplines. Weaknesses include its long term focus and tendency for some variables to be duplicated (i.e., not mutually exclusive). For example, health status may be used as a need variable or as an outcome variable. This is however consistent with policy and research literature that indicates that health status may be viewed as both a predictor of service need and an outcome measure of access to services (Patrick & Erickson, 1993).

It is recommended that the Andersen and Aday Health System Model continue to be used in future studies of health delivery systems and that the studies continue to explore the use of MCBS variables in the design of the research, to include determinants of health outcomes. Researchers should keep in mind that the categorization of a variable as population characteristic or perceived outcome is subject to different interpretations depending on study purpose and design. Consideration should be given to the inclusion of enabling attributes of both the community and the individual, utilization measures, and additional measures of health delivery system organizational structure. For example,

community resources might include specific community resources available to the population that directly (e.g. clinical preventive and medical management health services; health education and counseling) and indirectly influence health outcomes (e.g. housing, food, water, transportation, environment). Managed care market saturation, population density, and population to provider ratio may be some of the urban characteristics reflected in the differences in general health and BADL outcomes owing to census region effects. Frequencies showed larger percentages of HMOs in the West and South and older populations in the South. Individual enabling resources should continue to include additional insurance variables. Both perceived and evaluated (e.g. laboratory tests, provider assessments) health status outcome measures should be examined in future models.

Health System Model: Older Adults With Chronic Illness in the Community

This study focused on client-centered health outcomes. Four different outcome measures were examined to describe and explain factors that need to be considered in determining health outcomes among older adult populations living in the community. A total of 14 independent variables were included in the current study. As previously stated, metropolitan residence was omitted from all regression models due to failure to attain significance at any step of the models. This variable may not be sufficient to capture the essence of urban community resources influencing health status directly (e.g. clinical preventive and management services, health education and counseling, psychosocial and cultural influences) or indirectly (e.g. housing, food, water, transportation, environment). Income was omitted from all three ADL regression models due to failure to attain significance at any step of the models. Income is an important determinant of health

status, but results of this study indicate that income is not directly related to limitations in physical function such as BADL, HADL and AADL. Similarly, insignificance resulted in the omission of census region variables from the models for HADL and AADL. In the current study, needing help with household chores, managing money, using the telephone and eating are not associated with the region of the country in which an older adult lives. Analysis will proceed in order of the 5 blocks of hierarchically ordered variables in the causal priority for accounting for variance in general health and functional health. Each of the 5 sets of independent variables included in this research will be discussed for general health and for functional health (BADL, HADL, and AADL) outcome measures briefly below. A brief summary of hypothesis testing results is presented in Appendix A.

In this research, explanatory models were developed using multiple linear regression analysis. These models tested the relative contribution of population-at-risk characteristics (predisposing, enabling, and need), utilization factors, and health delivery system factors to explaining perceived health status outcomes. The R statistic was interpreted as the magnitude of contribution of individual blocks of variables to explaining the dependent variable, health status (Hair et al., 1995). This statistic is an index of the correlation between each block of variables and the dependent variable. Small contributions to the models are indicated by smaller values of the R statistic.

General Health Outcomes

Population Characteristics: Predisposing

Age, was not significantly related to general health status when included in a model which controlled for enabling and need factors. Other factors such as education and number of chronic illnesses emerged as significant.

These findings are consistent with previous research. For example, Ferraro (1993), found age only was not related to perceived health when predisposing (gender by race interaction terms) and enabling or need (functional status and health promotion) variables were controlled in LISREL models using the 1984 supplement to the Health Interview Survey. However, when gender-by-race interaction terms were used, black females and black males reported poorer health status than white males and white females (Ferraro, 1993).

Gender, was not significantly related to general health scores. In no stage of the multiple regression analysis did gender attain significance. Other predisposing factors such as education appear to explain general health in this study. This finding supports Ferraro (1993) who concluded perceived health was not related to gender only in models that controlled for both predisposing and enabling variables.

Race, was not significantly related to general health when considered in a model which controlled for predisposing and enabling variables. Income and private insurance emerged as significant. This finding is consistent with that of Johnson & Wolinsky (1993) who found no race only differences in multivariate models of perceived health that used the six year follow-up to the 1984 Longitudinal Survey on Aging.

Marital Status, was not significantly related to general health when considered in models that controlled for enabling factors, enabling and need factors, or enabling, need, and utilization factors together. Although marital status was significant in the final model of health status, its direction reversed, suggesting that married clients had poorer health than those who were not married. Frequencies indicated marital status was related to education and income. Therefore, it appears that some of the association between marital

status and health status is a function of enabling (socioeconomic) characteristics.

The current research supports the findings of Mutchler & Burr (1991) who used the 1984 panel of the Survey of Income and Program Participation to explain relationships between socioeconomic status and general health among adults aged 55 and over. Researchers found that being married was associated with better health in two sample tests, but once socioeconomic factors (e.g. education, income, insurance) were included in models this effect was reversed.

Education, was significantly related to general health in that clients with higher levels of education reported significantly better general health than those with lower levels of education. Education's zero order correlation ($r=.25$) with general health indicates that education alone explains approximately 6% ($r^2=.063$) of the variance in general health.

This finding supports previous research (Johnson & Wolinsky, 1993; Mutchler & Burr, 1991). Both studies concluded that those with more years of education reported significantly better health. Mutchler & Burr (1991) further concluded that the effects of education on health status may reflect social class effects (i.e. higher income providing greater accessibility to services) or the effects of knowledge of good health behaviors.

Population Characteristics: Enabling

Income, was significantly related to general health such that clients with higher incomes reported significantly better general health than those with lower incomes. Income's zero order correlation ($r=.16$) with general health indicates that income alone explains approximately 3% ($r^2=.026$) of the variance in general health. The current research supports Mutchler & Burr's (1991) findings that adult 55 and over respondents

to the 1984 panel of the Survey of Income and Program Participation who reported higher incomes and those who had additional private insurance consistently ranked their general health status as better.

Additional Private Insurance, was significantly related to general health in that clients with private insurance reported significantly better general health than those without. Frequencies indicate that clients in HMO systems (24%) are less likely than clients in FFS systems (76%) to have additional private insurance. As previously stated, this is consistent with the findings of previous research (Mutchler & Burr, 1991).

Additional Medicaid Insurance, was not significantly related to general health in models that included low income levels, possibly due to a strong relationship ($r = .50$, $p < .0001$) between poverty and Medicaid eligibility. Relationships between Medicaid coverage and general health have not been reported in the literature.

Census Region of Residence, was significantly related to general health such that relative to Puerto Rico, all four regions reported better health. As need, utilization and health system blocks entered the model, slight variations in coefficients reflected associations between disease prevalence, use of services, availability of HMO systems and census regions.

In general, the current research supports Mutchler & Burr's (1991) findings regarding regional differences in health status. While explaining relationships between socioeconomic status and general health, the researchers found that Southern residents reported poorer health than Northeastern, Western, or Midwestern residents (Mutchler & Burr, 1991). In that study, however, Midwest was the reference category because Puerto Rico was not sampled.

Population Characteristics: Need

Chronic illnesses, were significantly related to general health in that clients with more chronic illnesses reported significantly poorer general health. Chronic illnesses' zero order correlation ($r=.37$) with general health indicates that it alone explains approximately 14% ($r^2 = .136$) of the variance in general health.

These findings are generally consistent with a study of the New Haven sample of longitudinal data for 1982 to 1988 from the Yale Health and Aging Project (Idler, 1993). Idler (1993) concluded that general health was poorer for persons who reported the presence of heart conditions, stroke, diabetes, arthritis, cancer, liver disease, Parkinson's disease or angina than for persons without chronic illnesses.

Health Service Utilization

Outpatient visits and services, were related to general health in that more visits were associated with poorer health. Outpatient visits and services' zero order correlation ($r=.20$) with general health indicates that it alone explains approximately 4% ($r^2 = .04$) of the variance in general health. Inpatient hospital stays, were related to general health in that more hospital stays were associated with poorer health. Hospital stays' zero order correlation ($r=.24$) with general health indicates that it alone explains approximately 6% ($r^2 = .06$) of the variance in general health.

Relationships between utilization (outpatient visits and hospital stays) and general health outcomes have not been reported in the literature. Ware et al., (1996) explained differences in four-year health outcomes of elderly chronically ill clients (hypertension, diabetes, congestive heart failure, myocardial infarction, and depressive disorder) treated in HMO and FFS systems using change scores from pre- and post-test MOS 36-item

short form health survey results in logistic regression models. Models adjusted for age, poverty and health status change scores, but not utilization (Ware et al., 1996).

In general, the current study supports relationships between hospital stays and functional health that have been reported. Retchin et al., (1992) explained functional health outcomes (ADLs and IADLs) and access to care (utilization) for Medicare HMO and FFS enrollees in the MCD using logistic regression models to adjust for baseline differences between groups. Results indicated that a history of hospitalization in the previous 12 months was significantly related to functional health declines.

Health Delivery System

Health system organizational structure, was significantly related to general health in that poorer general health was associated with being enrolled in a FFS delivery system as opposed to being enrolled in a HMO delivery system. Simple linear regression of general health on delivery system indicates that it alone explains 0.4% ($r^2 = .004$; $F = 25.09$; $p < .00005$) of the variance in general health.

The current study does not support the findings of previous studies regarding the relationship between delivery system and health outcomes (Retchin et al., 1992; Ware et al., 1996). For example, outcomes for older and low income clients with hypertension, diabetes, myocardial infarction, congestive heart failure and depressive disorder were explained in a four-year follow-up to the MOS using change scores on the SF-36. Researchers concluded that clients in HMO delivery systems were nearly twice as likely to have declines in health outcomes over time as were those in FFS systems (Ware et al., 1996). In contrast, functional status outcomes and access to care (utilization) for Medicare HMO and FFS enrollees in the MCD were explained using ADLs and IADLs.

Researchers concluded that FFS enrollees were not more likely to experience functional health declines (defined as ADLs) than were HMO enrollees at the end of one year (Retchin et al., 1992). The current study explored differences in outcomes for Medicare enrollees in FFS and HMO systems with a minimum of 6 months exposure to the HMOs. The shorter exposure time may explain differences in results between the current study and the MCD (1 year) or the MOS (4 years).

Functional Health Outcomes

Population Characteristics: Predisposing

Age, was significantly related to BADL, HADL and AADL outcomes in that older clients reported poorer functional status than those who were younger. Age's zero order correlation ($r=.28, .29, .28$) with BADL, HADL and AADL respectively indicates that age alone explains approximately 8% ($r^2=.078, .084, .078$) of the variance in BADL, HADL and AADL respectively.

Gender, was significantly related to BADL and HADL in that female clients reported poorer functional status than males. Although gender was significant in AADL models, the direction of the relationship reversed, suggesting poorer AADLs for males. Frequencies indicate females are older (75.9 years) than males (74.6 years) and the inclusion of gender increased the variance accounted for in AADL by suppressing some of the variability in age that is not associated with AADL.

Race, was not significantly related to BADL, HADL, or AADL. Frequencies suggest differences in mean education levels between white (11 years) and minority (8.5 years) groups and mean incomes for white (\$24,000) and minority (\$14,000) groups.

Therefore it appears that other predisposing and enabling variables more directly relate to

functional status outcomes.

Marital status, was not significantly related to BADL or HADL. Although marital status was significant in AADLs, the direction reversed suggesting married clients had poorer AADL outcomes than not married clients. Frequencies indicate the not married group generally has lower income (\$14,000 versus \$29,000) and more dual-eligible persons covered by Medicaid (74% versus 27%) than the married group. Therefore it appears that enabling variables more directly relate to functional status outcomes.

Education, was significantly related to BADLs in that clients with higher levels of education reported better BADL status than those with lower levels of education. Education's zero order correlation ($r = .15, .19, .16$) with BADL indicates that education alone explains approximately 2%, 4%, and 3% ($r^2 = .023, .036, .026$) of the variance in BADL, HADL and AADL respectively.

In general, the current research supports the findings of previous research (Mutchler & Burr, 1991). Relationships between socioeconomic status and functional outcomes were examined using the 1984 panel of the Survey of Income and Program Participation. Researchers concluded that advancing age and female gender were associated with more limitations in ADLs (a count of activities for which assistance was required) once socioeconomic factors (e.g. education, income, insurance coverage) were controlled in Tobit regression models. They further concluded that the association between black race and more limitations in ADLs changed and the race variable lost significance as socioeconomic variables (education, private insurance, income, net worth) were controlled in models. Interestingly, Mutchler & Burr (1991) found that being married was associated with better ADL health, but once socioeconomic factors (e.g.

income, insurance coverage) were controlled in regression models, this effect reversed and marital status became non-significant. These researchers likewise found that those with more years of education reported less need for assistance with ADLs.

Population Characteristics: Enabling

Income, was not related to BADL, HADL, or AADL when considered simultaneously with Medicaid insurance and census regions in regression models. Two sample tests indicated a strong relationship between Medicaid ($r = .50, p < .0001$) and the two lowest levels of income. Therefore it appears that other enabling variables better explain BADL, HADL, and AADL outcomes.

Private insurance, was not significantly related to BADL or AADL. It was related to HADL in that clients with private insurance reported better HADL outcomes than those without private insurance. The relationship between gender and household chores represented by HADLs is suggested in this finding.

Medicaid insurance, was significantly related to BADL, HADL, and AADL outcomes in that clients with Medicaid insurance reported significantly poorer functional status (i.e. higher scores) than those without Medicaid insurance.

Census region of residence, were not statistically significant for HADL and AADL. A spurious significant relationship with BADLs was noted: relative to Puerto Rico residents, capacity for BADLs was poorer for residents in other regions when census regions were entered into the model with Medicaid insurance (a proxy income variable). The inclusion of the census regions may have increased the variance accounted for in BADL by suppressing (or removing the influence of) some of the variability in Medicaid insurance that is uncorrelated with or irrelevant to BADL.

Relationships between functional health outcomes and Medicaid insurance have not been reported in the literature. As previously mentioned, Medicaid correlates fairly strongly with the income variable in the current study. Since Medicaid appears to operate as a proxy for income in the functional health (BADL, HADL, AADL) models, the current research might be seen as supporting Mutchler & Burr (1991) who found that higher income and private insurance were associated with better ADL outcomes. The researchers further found that Southern residents reported poorer ADL function (Mutchler & Burr, 1991).

Population Characteristics: Need

Chronic illnesses, were significantly related to BADL, HADL and AADL outcomes in that clients with more chronic illnesses reported significantly poorer functional status. Chronic illnesses' zero order correlation ($r=.27, .32, .17$) with BADL, HADL, AADL indicates that it alone explains approximately 7%, 10%, 3% ($r^2 = .07, .10, .029$) of the variance in BADL, HADL, and AADL respectively.

Relationships between chronic illnesses and BADL, HADL, AADL health outcomes have not been reported in the literature. In this research each additional chronic illness had a negative impact on BADL, HADL and AADL health. In general, the current research supports the findings of a study that found significant relationships between chronic illnesses and ADLs. ADLs include bathing, dressing, getting out of bed, walking, toileting (BADLs) and eating (one AADL). Verbrugge et al., (1990) examined the net effect of individual chronic conditions on ADLs among adults aged 55 and over respondents to the 1984 National Health Interview Survey. Regression models for each condition indicated that the presence of each chronic illness was associated with poorer

capacity for ADLs.

Health Service Utilization

Outpatient visits and services, were not significantly related to BADLs or HADLs. A spurious relationship between outpatient visits and AADLs was significant in regression models. Outpatient visits appear to suppress a portion of the variance in other predictor variables that are irrelevant to AADLs. Frequencies indicate differences in mean outpatient visit rates for those with and without private insurance (17 visits versus 14 visits/year), those with and without Medicaid insurance (19 visits versus 16 visits/year), and those in different census regions (northeast 19 visits, Puerto Rico 15 visits, others 16 visits/year). These enabling variables may explain some of the association between outpatient utilization and functional status outcomes.

Inpatient hospital stays, was significantly related to BADL, HADL, and AADL in that an increase in hospital stays was associated with worsening functional health status. Inpatient hospital stays' zero order correlation ($r=.27, .26, .20$) with BADL, HADL, and AADL indicates that it alone explains approximately 7%, 7%, 4% ($r^2=.07, .068, .04$) of the variance in BADL, HADL and AADL respectively.

Relationships between outpatient visits and services and BADL, HADL and AADL outcomes have not been reported in the literature. The current study found no significant association between outpatient visits and services and functional health outcomes. Ware et.al., (1996) explained differences in four-year health outcomes of elderly chronically ill clients (hypertension, diabetes, congestive heart failure, myocardial infarction, and depressive disorder) treated in HMO and FFS systems using change scores from pre- and post-test MOS 36-item short form health survey results in logistic

regression models. Models adjusted for age, poverty and health status change scores, but not utilization.

The current study found an association between inpatient hospital stays and poorer BADL, HADL, and AADL outcomes. This is consistent with Retchin et al., (1992) who explained functional health outcomes (ADLs and IADLs) and access to care (utilization) for Medicare HMO and FFS enrollees in the MCD using logistic regression models to adjust for baseline differences between groups. Researchers concluded that a history of hospitalization in the previous 12 months was significantly related to functional health declines (defined as ADLs).

Health Delivery System

Health delivery system, was significantly related to HADL and AADL outcomes in that being enrolled in a FFS delivery system, as opposed to being enrolled in a HMO delivery system, was associated with poorer functional health outcomes. BADL was not significantly related to delivery system. Simple linear regression of BADL, HADL, and AADL on delivery system indicates that it alone explains 0.1%, 0.2%, and 0.2% ($r^2 = .001, .002, \text{ and } .002$; $F=14.49, 13.66, \text{ and } 24.25$; $p < .0001, .0002, \text{ and } .0001$) of the variance in BADL, HADL, and AADL respectively.

The current research found that being enrolled in a FFS delivery system was associated with poorer functional health outcomes as measured by HADL and AADL. These findings contrast and compare with those of previous researchers (Retchin et al., 1992; Ware et al., 1996). Ware et al., (1996) explained outcomes for older and low income clients with hypertension, diabetes, myocardial infarction, congestive heart failure and depressive disorder in a four-year follow-up to the MOS using change scores from

the SF-36. Researchers concluded that clients in HMO delivery systems were nearly twice as likely to have declines in health outcomes over time as were those in FFS systems after controlling for other factors. As previously stated, the difference between findings of the MOS and the current study may be due to the shorter exposure time to HMO delivery systems (minimum of 6 months) employed in this study.

The current research found no association between FFS delivery system and poorer capacity in BADLs once other variables were taken into account. This supports the findings of Retchin et al., (1992), who explained differences in functional outcomes (ADLs and IADLs) and access to care (utilization) for Medicare HMO and FFS enrollees in the MCD using logistic regression models to adjust for baseline differences in age, pre-test general health, and functional status between groups. Their results indicated FFS enrollees were no more likely to have functional health declines than HMO enrollees. It is possible that the results in the current study reflect the nature of BADL, personal activities, as differing from the HADL and AADL activities. The personal activities may be less sensitive than HADL or AADL to the influence of delivery system interventions, particularly in cases of relatively short term exposure to the system. Medicare HMO clients in the current study were defined as having a minimum of 6 months enrollment.

Impact of Organizational Structure

A comparison of this study's findings in multivariate models illustrates the importance of delivery system organizational structure in evaluations of health status outcomes. Table 5.1 includes results from regressions of each of the four health status measures on the population characteristics, utilization factors, and health delivery system variables. Self-ratings of health were analyzed using multiple regression models.

Coefficients for this analysis reflect the impact of each independent variable on the self-reported health, while controlling for all other variables. The final model for each dependent variable is presented in the table. Summary discussion will consider the effects of blocks of variables across all health outcome measures.

Table 5.1

Regressions of Health Status Indicators on Predisposing, Enabling, Need, Utilization, and Health Delivery System Variables, Older Adults With One or More Chronic Illnesses

Living in the Community

| Variable Blocks | Health Status Indicators ^a | | | |
|---------------------------------------|---------------------------------------|---------|--------|--------|
| | General Health | BADL | HADL | AADL |
| Predisposing | | | | |
| Age | .002 | .0439* | .041* | .021* |
| Education | -.043* | -.0160* | -.024* | -.010* |
| Male | -.018 | -.1714* | -.268* | .035* |
| Not Married | .069* | -.0100 | .023 | -.028* |
| White | .077 | -.0136 | -.031 | -.004 |
| Enabling | | | | |
| <u>Income</u> | | | | |
| \$0 to \$10,000 | .445* | | | |
| \$10,001 to \$20,000 | .279* | | | |
| \$20,001 to \$30,000 | .204* | | | |
| \$30,001 to \$40,000 | .146* | | | |
| \$40,001 to \$50,000 | .112 | | | |
| No Medicaid Insurance | | -.5115* | -.310* | -.173* |
| No Private Insurance | .099* | .0335 | .137* | .038 |
| <u>Census Regions</u> | | | | |
| West | -.414* | .3703* | | |
| Midwest | -.321* | .4222* | | |
| Northeast | -.277* | .3246* | | |
| South | -.275* | .3474* | | |
| Need | | | | |
| Number of Chronic Illnesses | .187* | .1389* | .159* | .030* |
| Utilization | | | | |
| Outpatient Visits and Services | .006* | .0006 | .002 | -.001* |
| Inpatient Hospital Stays | .149* | .2833* | .229* | .097* |
| Health Delivery System | | | | |
| Medicare FFS | .112* | .0633 | .112* | .064* |
| Cumulative Model R² | .233 | .200 | .239 | .143 |

* p < .05

^a Estimated partial regression coefficients for the full sample.

Considering the predisposing block of variables first, the same general results hold across all the health measures considered. In each of the models, education is consistently associated with better health regardless of the manner in which health is measured. For example, having more years of education is associated with better health, above and beyond the effects of other predisposing, enabling, need, utilization and delivery system controls. Older persons consistently reported more limitations in all functional health measures (i.e. BADL, HADL, AADL). However, age was not associated with general health. General health may be more strongly conditioned by education level and number of chronic illnesses. Females reported more limitations in BADLs and HADLs. However, gender was not associated with general health. General health may be more influenced by economic resources. Being married was associated with better general health. However, marital status was not associated with any ADLs. ADLs may be more influenced by economic resources or insurance. All health measures may be more strongly conditioned by enabling (economic) variables than by race.

The enabling block of variables illustrates the importance of considering personal and community resources in evaluating health outcomes. Income showed an association with health. For example, having less income was associated with poorer health, above and beyond the effects of other predisposing, enabling, need, utilization and delivery system controls. However, income was not associated with reports of ADL health. This provides some support for the notion that general health may be more strongly conditioned by income than are the functional health measures. Medicaid and/or private insurance appeared to operate in a consistent and similar manner in ADL models, where the income variable was not significant. The regional effects, while less consistent,

highlight substantial regional differences in reported general health. Respondents in Puerto Rico reported the poorest health ratings relative to all 5 regions. One might speculate that enabling characteristics of the local community or selectivity of the regional populations not otherwise captured in the model might explain these effects.

The need variable's, chronic illness conditions, results held across all health measures considered. The coefficients for chronic illnesses were significant and positive, indicating that persons with more chronic illness conditions reported worse health regardless of the health measure used. Zero order correlations for each health measure indicated that number of chronic illnesses alone explain 14%, 7%, 10%, and 3% of the variance in general health, BADL, HADL, and AADL respectively.

One utilization block variable, hospital stays, indicated results that were consistent across all health measures examined. The coefficients for hospital stays were significant and positive, indicating that persons with more hospital stays report worse health regardless of the health outcome measure used.

Interestingly, the effect of outpatient visits and services changes substantially as economic effects are considered. In the model with income levels and private insurance, outpatient visits are associated with poorer general health. However, in models where income is not significant but proxy economic measures such as Medicaid or private insurance are present, this effect either reverses or becomes non significant for 3 of the 4 health measures. This suggests that low income may not necessarily be a detriment to good health among the 65 and over chronically ill community dwelling population who have additional economic resources (i.e. Medicaid or private insurance). This further suggests possible mitigating effects of additional insurance on cost-sharing arrangements.

The effects of the delivery system block are generally consistent across models. Medicare FFS system's coefficient is positive for all, and significant for 3 of the 4 health measures, indicating poorer general health and more limitations in HADLs and AADLs after controlling for all other population and utilization characteristics. It is likely that many intercorrelations in the matrix were statistically significant due to the large sample size. It appears that there may be other predictors which may yield stronger relationships with the outcome variables than did this one. These findings would indicate however, that it is desirable to include delivery system organizational structure variables in studies that seek to explain the effect of other variables on health outcomes.

Multiple Outcome Measures

The current study considered several outcome measures of health to take into account factors that are relevant to different constituencies. Different conclusions may be drawn using different measurement schemes. This highlights the need to examine multiple indicators of health status when comparing and contrasting HMO and FFS clients' outcomes. Perceived health status is recognized as an outcome of health service utilization by participants in the development of the Andersen framework. Empirical testing of the Health System Model however, has been largely neglected to date. The current study evaluated the utility of the framework in explaining outcomes in the presence or absence of managed care. Perceived health outcome measures included general health, BADL, HADL, and AADL.

Outcome indicators used in the current study were limited to perceived health measures. That is, client's self-reported perceptions were measured rather than health professional's evaluated outcomes. The current study supports that of Wolinsky et al.,

(1984) to the extent that it provides evidence to indicate that the general health measure and the functional status measures represent two distinct dimensions of the health status construct. As previously stated, the general health measure appeared more strongly conditioned by level of education and number of chronic illnesses than did the functional health status measures. An older adult's global summary of their general health as compared to others their age may be influenced by unmeasured self-assessment or self-esteem perceptions that are likewise influenced by educational background, associated income level, and the number of chronic illnesses being managed. Functional status measures, on the other hand, appear to be more strongly conditioned by age, gender, and additional insurance coverage. These findings suggest that self-report of physical limitation may be less influenced by unmeasured self-esteem factors than general health perceptions. The current study supports the findings of Wolinsky & Johnson (1991) to the extent that internal consistency reliability of the BADL (.85), HADL (.83), and AADL (.65) further validates the .83, .83, and .64 Cronbach's alphas identified in their research with older adult respondents to the Longitudinal Survey on Aging..

As Table 5.2 shows, the Health Systems Model was useful in explaining health outcomes, regardless of which measure of health was used. The explanatory power of the Health System Model was generally consistent across regression models. Predisposing, enabling, need, utilization, and health system blocks of variables explained varying proportions of the different health outcome measures. Predisposing, enabling, and utilization blocks were the most consistent across all outcome measures. Relative to all other blocks, predisposing blocks explained the largest proportion of variance in most health outcome measures. Interestingly, the need block of variables had greater

explanatory power than the predisposing block only for the general health measure. The health delivery system block, while somewhat less consistent, exhibited explanatory power in health outcomes. The limited explanatory power of the health delivery system block (i.e. 0.1%) provides support for the notion that more than one indicator of organizational structure is needed if the model is to explain more than the 14% to 24% of variance in health outcomes explained in the current study.

Table 5.2

Explanatory Power (R^2) of Health Systems Model In Older Adults With Chronic Illness

| Model Construct | General Health | BADL | HADL | AADL |
|------------------|--|------|------|------|
| | % Variance Explained In Multiple Regression Models | | | |
| Predisposing | 7% | 10% | 12% | 10% |
| Enabling | 2% | 2% | 2% | 1% |
| Need | 11% | 5% | 9% | 1% |
| Utilization | 3% | 3% | 3% | 2% |
| Health System | 0.1% | 0 | 0 | 0.1% |
| Cumulative R^2 | 23% | 20% | 24% | 14% |

Comparison With Other Recent Studies

Comparison of the current study with other recent studies suggests additional conclusions. Table 5.3 outlines the variables controlled in each of the studies. The table is organized according to the Health System model although the previous studies did not

explicitly test the model. The specific studies of interest include the MOS (Ware et al., 1996) and the MCD (Retchin et al., 1992). Discussion follows the table.

Table 5.3

Comparison of Variables Controlled In Regression Models

| CONSTRUCT | CURRENT STUDY | WARE et al., 1996 | RETCHIN et al., 1992 |
|-----------------|---|--|---|
| Predisposing | Age Gender Race Marital Status Education | Age \geq 65 Gender Race | Age \geq 80 Gender Marital Status |
| Enabling | Income Medicaid Insurance Private Insurance Census Region | Per Capita Income | Monthly Income |
| Need | <u>Chronic Illnesses:</u> Osteoarthritis, Hypertension, Other heart conditions (CHF), Myocardial infarction, Cancer, Diabetes, COPD, Rheumatoid arthritis, Stroke, Parkinson's disease. | <u>Chronic Illnesses:</u> Hypertension, Diabetes, CHF, Myocardial infarction, Depressive disorder. Baseline health status. Symptoms(e.g. back pain) | <u>Health symptoms:</u> Abdominal pain, arthralgias, bleeding, chest pain, diarrhea, weight loss, cough, syncope, dyspnea. Baseline health status (fair or poor); functional status (> 1 ADL) |
| Utilization | # Outpatient visits and services # Hospital stays | Physician specialty | History of hospitalization in past year |
| Delivery System | HMO, FFS | HMO, FFS | HMO, FFS |
| Outcome | General health BADL HADL AADL | Same, better, worse on SF 36. | Decline in \geq one IADL |

As Table 5.3 shows, there are relevant differences between the current study and other recent studies. It is possible that the difference between this study and previous studies can be explained by the following:

- 1.) The current study included more extensive chronic illness conditions. The primary strength of this study is the use of a comprehensive expanded model (including community enabling, utilization factors, and multiple outcome measures) and controls for measured selection bias. In addition, in contrast to previous studies that focused on specific geographic regions (see Table 2.3), this study analyzed a sample representative of the population of Medicare clients with chronic illnesses enrolled in Medicare FFS and HMO health systems during 1995, making it a national study.
- 2.) Previous studies controlled for baseline health status or functional status whereas the current study provides cross-sectional description and explanation of health status and functional status. Previous studies explored differences in outcomes over time (MCD 1 year; MOS 4 years). In the current study HMO enrollees had a minimum of 6 months exposure to the delivery systems. This highlights the need for future studies to validate the current study's findings. It further suggests the need for longer term studies to evaluate outcomes.

Previous studies showed both a relationship and temporal sequence indicating a cause and effect relationship between delivery systems and outcomes. The current study describes outcomes, but due to the cross-sectional design is only able to infer causal relationships. At the same time, previous studies' results were only generalizable to populations from which their samples were drawn. The current study allows generalization to the 65 and over community-dwelling population nationwide.

Although the current research suggested a statistically significant difference in outcomes between FFS and HMO delivery systems, there appeared to be no vitally important health consequences. The current study controlled for differences between older adult clients of FFS and HMO systems in statistical models. Conclusions could be biased however, if FFS clients were different from HMO clients in ways that were not captured by the variables controlled in the regression models.

Implications for Chronic Illness-Related Health Policy

Health outcomes of older adults with chronic illnesses in urban FFS and HMO health delivery systems is an issue of great complexity. A wide variety of factors interrelate in determining health outcomes of older adults with chronic illnesses. In this research, the Health Systems Model was used to construct models that explained health outcomes in FFS and HMO delivery systems. The model provided guidance for the identification and testing of various factors that relate to health outcomes in Medicare FFS and HMO delivery systems in urban communities across the United States.

Reports of the current study were provided and several recommendations were made to administrators at HCFA. While a variety of population-at-risk characteristics and utilization factors were studied, results indicated that Medicare clients enrolled in HMO delivery systems reported significantly better general health and functional health (HADL, AADL) outcomes than Medicare clients enrolled in FFS delivery systems in 1995. Results further indicated no differences in BADL outcomes between clients in the two delivery systems.

First, these findings provide limited support for the present policy endorsing increased enrollment in managed care programs. Additional research is needed to validate

these findings. For example, a smaller random sample of 1995 beneficiaries could be selected based on a power analysis specifying a larger effect size than the small one used in this study. Inferential statistics applied to this smaller sample would limit statistically significant differences to moderate sized delivery system impacts on the outcomes of interest, thereby avoiding the possibility that significant differences between groups are merely the result of large sample sizes. Use of focus groups, for older adults in different age groups, would provide a useful strategy for exploring BADL outcomes further. Personal interviews or focus groups may offer a viable approach for eliciting feedback from older adults regarding reasons for their selected ratings of general health outcomes.

Study findings have limited implications for individual client's choices. Although the study found HMO clients' had better health outcomes, these results were based on averages across groups. Older adults with chronic illnesses should carefully consider the benefit packages offered by the health care delivery system they may choose to enter. This study did not examine individual health care organizations, their policies and procedures, nor their care management programs for specific chronic illnesses. The notion of health delivery systems with special expertise in managing chronic illness warrants more attention.

Second, this study found that living in particular census regions was related to different levels of health outcome. Residents of Puerto Rico and the Southern region of the country reported poorer health status relative to other regions. Frequencies indicated that a majority of managed care organizations are concentrated in the Western region. It will be important for federal agencies to develop strategies and resources to ensure balanced development of health delivery systems across the country, as well as policies

geared to support regional and local health delivery systems. Resources should be targeted towards the vulnerable population of older adults with chronic illnesses and not just geographic places.

Third, federal and accrediting agencies' efforts to identify and develop a minimum data set of quality care measures to represent the health of the population are on-going. The measures of general health, BADL, HADL, and AADL used in the current study should be considered for inclusion in the minimum data set. These health outcome measures will be useful for assessing outcomes of the growing older adult population with chronic illnesses. These measures would be cost effective to implement in private, public, and community health care settings, thus bridging the full continuum of care settings. If all settings were reporting the same outcome measures it would be possible to more thoroughly evaluate costs and outcomes across the full spectrum of health services. For example, client outcomes from physician office, community clinic, hospital outpatient department, hospital inpatient, and long term care could be linked and compared. It will be important to follow the health status outcomes of this vulnerable population as health delivery systems continue to evolve.

Fourth, HCFA is encouraged to continue to provide the MCBS, a high quality data set, for use in health services research. Additional suggestions regarding information that would be useful for such efforts are offered. While organizational structure contributed to the explanation of health outcomes in this study, this single indicator was not sufficient to measure the performance of Medicare HMO and FFS systems. Additional indicators of these systems' coordination and control of triage and treatment (e.g. entry guidelines and process measures) are needed to adequately reflect the organizational structure. Indicators

of constraints and initiatives for providers (e.g. utilization management, pre-authorization, financial bonuses) and clients (e.g. cost-sharing, benefits, and special programs) are needed to define the degree of managed care within the organizations. Factors such as provider types and specialties, provider practice guidelines, and others are needed to provide indicators of delivery system resources.

Although the current study explored general health, BADL, HADL, and AADL, these measures are not representative of the variety of constructs included in other measures. For example, this study's hypotheses on BADLs were based on findings from ADLs and IADLs due to limited research on the newer classification system. Because of the recent use of the MOS Short Form -36 and Short Form -12 measures of health status, and the use of ADL and IADL scales to measure disability, it is unclear if the results of this study will or should generalize to other definitions of health status. HCFA administrators might wish to consider the addition of other health status and quality of life instruments to the existing MCBS items to tap the larger variety of constructs.

This research did not control for baseline health status of clients in FFS and HMO delivery systems. It may also be years before the health effects of the organization, if any, were observable. The MCBS data is not amenable to longitudinal studies. Changes in the panel surveyed, the oversampling of different groups each year, and the associated weighting factors preclude linking one year's data with another. For example, HCFA does not recommend the MCBS 1995 Cost and Use file be linked to the MCBS 1996 Cost and Use file to examine changes over time. Future multivariate analyses using the MCBS Cost and Use file could be strengthened by the addition of the previous year's health status report as an additional variable in the data set. A measure of baseline health

status would permit researchers to establish statistical controls that would resolve some of the ambiguity present in the current analysis.

Implications for Urban Health Services

Urban services posits that metropolitan communities are areas in which the physical, social, and economic status of inner cities and suburban and rural regions are inextricably interrelated (Caves, 1995). Policy directly affects organizations and directly or indirectly affects the population to bring about changes in metropolitan areas. Similarly, the Health Systems Model posits that health policy directly affects characteristics of the health delivery system and directly or indirectly affects characteristics of the population-at-risk to bring about changes in the use of health care services and in consumer's health outcomes from those services.

The current study provides support for the use of the Health Systems Model in studies of the older adult population with chronic illnesses living in metropolitan communities across the United States. Specifically, this study found support for the use of the model in studying outcomes among a vulnerable population in metropolitan communities: Medicare clients in HMO and FFS health delivery systems. As Medicare policy and health delivery system organizations evolve, health outcomes of vulnerable populations in metropolitan communities will continue to be a central area of concern. It remains important for urban health services and other researchers to continue to investigate how older adults with chronic illnesses fare in evolving systems. The Andersen and Aday model provides a useful framework for the design and analysis of future urban health services studies.

While a variety of population (and community) characteristics and utilization

factors were studied, this research found that the enabling factors block of variables was significant regardless of which health status outcome measure was used (Table 5.2).

Enabling characteristics of the community included metropolitan residence and census region of residence for older adults with chronic illness. Metropolitan residence, though significantly related to better general health in two sample tests, was omitted from multivariate models due to failure to attain significance. Census regions, although somewhat inconsistent in multiple linear regression models, highlighted substantial differences in general health status and BADLs for older adults residing in different regions. These findings demonstrated some support for the notion that characteristics of the urban community of residence are related to health outcomes in older adult populations and should therefore be considered in future explanatory models.

Future investigations might further explore the relationships between certain variables of known interest to community health and urban services. For example, metropolitan residence did not appear significant in multiple regression models in this study. Because enabling variables were entered into initial models simultaneously, income (or Medicaid insurance) and in some cases census regions attained significance while metropolitan residence did not. These findings support the notion that socioeconomic factors and predisposing factors (i.e. education, race) of vulnerable populations in metropolitan areas are interconnected in such a manner that their shared variance results in one variable's failure to attain significance.

The relatively small contribution of the enabling factors block further suggests that a variety of other enabling characteristics of the urban, suburban, and rural community not otherwise captured in this study's models may explain health outcomes.

For example, although socioeconomic, education, race, and community residence factors were included, this study did not examine social, cultural, or lifestyle factors known to affect health status. In addition, more specific measures of community resources known to effect health (e.g. food, water, housing, transportation, environment) and availability, supply, and access to services in the client's community of residence should be examined. Future investigations will need to consider these urban health domains.

Implications for Clinical Practice

Health outcomes of older adults with chronic illness conditions cared for in FFS and HMO delivery systems is an issue of concern to health professionals. Chronic illness presents a major challenge to health professionals. In this research, the Health Systems Model was used to describe the chronically ill older adult population and the prevalence of a variety of chronic illnesses in this population. The model provided guidance for identification and testing of factors related to health outcomes in this vulnerable population. Findings from this study can be used to focus clinical assessments, plan for services, predict staffing needs, and evaluate outcomes.

Implications for Clinical Practice: Health Outcomes

This study explained health outcomes using measures of general health, BADL, HADL, and AADL. Commonly used in community health settings, these measures are less familiar in public and private health care environments. Managed care organizations have implemented and begun to evaluate special care programs targeted at vulnerable covered populations. This, coupled with the current search, by accrediting and federal agencies, for health measures to include in a national minimum data set provide support for the use of such measures across the continuum of clinical settings. Clients in all

clinical settings could be assessed for general health perceptions as well as functional limitations on entry. Subsequent evaluations could also employ the general and functional health measures. As previously indicated, the validity and reliability of the measures for a wide variety of clients has been established in the literature.

Implications for Clinical Practice: Utilization Factors

This study described and explained the impact of utilization type/site factors, including outpatient visits and services, on health outcomes of a chronically ill older adult population. Description indicated that 1 million community dwelling older adults with chronic illnesses had no outpatient visits, services, or procedures in 1995. Clinicians are likely to agree, and clinical practice recommendations suggest, that optimal management of any of the twelve chronic illnesses included in this study requires at least an annual preventive screening visit. These findings indicate a need to assure that clients are aware of the need for preventive visits and a need to further assess the possible lack of access to services suggested by this study.

In the current study, explanatory power of the utilization block of variables was limited to approximately 3% regardless of the outcome measure used. While the MCBS included provider type information, data set properties did not allow analysis of this variable. Because of the method by which medical provider events were collected and input into the data set, it was not possible to link provider type with individual service or visit data at the individual client level. For example, nurses and nurse practitioners were among the providers visited or providing services, yet their relative contribution to health outcomes could not be identified in this study. Future studies need to assess and analyze the relative contribution of diverse health care providers to the health outcomes of the

chronically ill population.

Additional research is needed to delineate utilization factors not included in the current study. The purpose of the service provided (i.e. preventive, illness related, or custodial care) needs to be analyzed in future studies. While the MCBS provides utilization indicators for outpatient and hospital services, the purpose of each utilization event is not identified. Many HMOs have implemented disease management programs for selected chronic illnesses so that the attention they pay to each of the selected conditions might vary. A better understanding of the influence of specific services on health outcomes, in the care of older adults with specific chronic illness conditions, would be useful to clinical practitioners and health care administrators.

Implications for Clinical Practice: Predisposing Characteristics

Description of the 65 and over population of adults with chronic illnesses indicated that those aged 80 and over represent an estimated 26% of the population. These results provide evidence of the projected rapid growth in the number and proportion of the population in this older group. Furthermore, nearly 60% of adults 65 and over are female and their functional health status was reported to be significantly poorer than that of males in the population. As the population ages, and the incidence and prevalence of chronic illness increase, the need for clinicians with expertise in assessing, treating and evaluating health outcomes among this vulnerable population increases. Health care administrators in clinical settings will need to consider these population changes as they address present and future staffing patterns. Managed care organizations planning special care management programs targeting adults with specific chronic illnesses will need to consider the multidisciplinary services necessary for optimal

management of these clients. For example, medical, nursing, social, counseling, educational and support services, a sustained provider-client partnership, and understanding of client beliefs, psychosocial and cultural needs are recommended (Bierman & Clancy, 1999).

Implications for Research

The major purposes of this study were to describe and explain health outcomes of older adult Medicare clients with chronic illnesses enrolled in HMO or FFS health delivery systems and to evaluate the utility of the Health System Model in explaining health outcomes in this population. Additional research is needed to address each of these purposes and to further identify population-at-risk characteristics, utilization factors and health delivery system factors that may explain health outcomes.

Factors that were not included in the current study warrant investigation. For example, it is known that cultural beliefs, social networks and lifestyle behaviors are important determinants of health status. Perceptions of health status could be influenced by self esteem, sick role behavior, and perceived control (Mutchler & Burr, 1991). These variables would be considered population-at-risk characteristics. Similarly, regular source of care, convenience of care, and distance from client residence to care services are important to health outcomes. These variables would be considered enabling characteristics. Delivery system factors requiring study include organizational entry and volume and distribution of health care resources. The processes by which clients gain entrance into the systems and continue treatment is an example of entry factors. Need variables related to chronic illnesses should be included as morbidity measures in future research efforts. For example, a specific symptom or burden of illness index could be

included. Research is needed to assess and analyze chronically ill clients' observed health status. This research would not focus on their perceptions, but, rather, on what is observed and demonstrated by provider assessments, laboratory tests, and other test results.

Additional research is needed for factors that were included in the current study. A health system variable deserving greater definition and study is organizational structure. For example, process measures and characteristics of the delivery system that determine who the client sees and how they are treated following entry into the system need to be delineated. Similarly, the influence of community enabling factors such as population density, population to provider ratio, and delivery system market saturation on health outcomes should also be investigated. In this study, community enabling factors included metropolitan residence and census region of residence.

The other purpose of this research was to evaluate the utility of the Health System Model in explaining health outcomes in older adults with chronic illnesses. To validate the utility of the model demonstrated in this study, additional research is needed. A better understanding of the influence of specific chronic illnesses on health status outcomes would be useful. Total number of chronic illnesses was a useful summary measure in this study, but it may have understated the importance of conditions that result in more morbidity and disability (Patrick & Erickson, 1993). The effects of some chronic illness conditions will depend on stages of the illness (Johnson & Wolinsky, 1993). Research is needed to assess and analyze statistical models for each individual chronic illness diagnosis to further explain health outcomes.

Research is needed to identify the actual entry procedures of the various delivery

systems. Long term studies are needed to elicit health status data on entry into the health delivery system. These studies would also investigate the health status data after management in the delivery system for one to four years. This data would further outcomes knowledge by demonstrating the client's health status changes over time.

In future studies, comparisons can be made between MCBS data collected at different times and used to assess trends in the population's health outcomes (Korn & Graubard, 1999). That is, MCBS from subsequent years could be analyzed using the same multivariate methods employed in this study and results from the current and subsequent studies could be compared to assess trends in health outcomes over time. Matched data sets would not be necessary since each MCBS data set is collected and can be analyzed in a manner that makes it representative of the population of interest. For the same reason it would not be necessary to link the data sets or run pretest- posttest type analyses. Because the results are representative of the population, they can be directly compared from one year to the next. This approach could be most efficient in an environment of rapidly changing systems.

The Health System Model exhibited utility in explaining health outcomes for older adult Medicare clients with chronic illnesses in HMO and FFS delivery systems. The power of delivery system organizational structure in explaining health outcomes of Medicare clients was demonstrated. Information from this study can be used to monitor outcomes of health care in this vulnerable population, inform development of chronic illness health policy, and encourage use of high quality public data resources available for health services research.

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APPENDIX A**Summary of Hypothesis Testing Results**

Summary of Hypotheses Testing Results For Population-at-Risk Characteristics and General Health

| Bivariate Hypotheses | Bivariate Results | Multivariate Results |
|---|---|--|
| <u>Predisposing</u> | | |
| 1a. Older clients will report significantly poorer general health than clients who are younger. | Supported | Not Supported |
| 1b. Clients with higher levels of education will report significantly better general health than will clients with lower levels of education. | Supported | Supported |
| 1c. Female clients will report significantly better general health than will male clients. | Not Supported | Not Supported |
| 1d. Married clients will report significantly better general health than clients who are not married. | Supported | Opposite direction supported |
| 1e. Minority clients will report significantly poorer general health than will white clients. | Supported | Not Supported |
| <u>Enabling</u> | | |
| 1f. Clients with higher incomes will report significantly better general health than will clients with lower incomes. | Supported | Supported |
| 1g. Clients with additional insurance will report significantly better general health than will clients without additional insurance. | Supported for private insurance; Opposite direction supported for Medicaid insurance | Opposite direction supported for private insurance; (Medicaid not supported-omitted) |
| 1h. Clients residing in metropolitan and non-metropolitan areas will report significantly different general health levels. | Supported | Not Supported (omitted) |
| 1i. Clients residing in different census regions will report significantly different general health levels. | Supported | Supported |

| | | |
|--|------------------|------------------|
| <p><u>Need</u> lj. Clients with more chronic illness conditions will report significantly poorer general health than will clients with fewer chronic illness conditions.</p> | <p>Supported</p> | <p>Supported</p> |
|--|------------------|------------------|

Summary of Hypotheses Testing Results For Population-at-Risk Characteristics and BADL

| Bivariate Hypotheses | Bivariate Results | Multivariate Results |
|--|--|--|
| <u>Predisposing</u> | | |
| 2a. Older clients will report significantly poorer independent capacity in basic activities of daily living than clients who are younger. | Supported | Supported |
| 2b. There will be a statistically significant relationship between client's education and their independent capacity in basic activities of daily living. | Supported | Supported |
| 2c. Female clients will report significantly poorer independent capacity in basic activities of daily living than will male clients. | Supported | Supported |
| 2d. Married clients will report significantly better independent capacity in basic activities of daily living than will clients who are not married. | Supported | Not Supported |
| 2e. Minority clients will report significantly poorer independent capacity in basic activities of daily living than will white clients. | Supported | Not Supported |
| <u>Enabling</u> | | |
| 2f. Clients with higher incomes will report significantly better independent capacities in basic activities of daily living than will clients with lower incomes. | Supported | Not Supported (omitted) |
| 2g. Clients with additional insurance will report significantly better independent capacities in basic activities of daily living than clients without additional insurance. | Supported for private insurance; opposite supported for Medicaid | Supported for private insurance; opposite supported for Medicaid |

| | | |
|---|----------------------|--------------------------------|
| <p>2h. Clients residing in metropolitan and non-metropolitan areas will report significantly different independent capacities in basic activities of daily living.</p> | <p>Not Supported</p> | <p>Not Supported (omitted)</p> |
| <p>2i. Clients residing in different census regions will report significantly different independent capacities in basic activities of daily living.</p> | <p>Not Supported</p> | <p>Not Supported (omitted)</p> |
| <p><u>Need</u> 2j. Clients with more chronic illness conditions will report significantly poorer independent capacity in basic activities of daily living than clients with fewer chronic illness conditions.</p> | <p>Supported</p> | <p>Supported</p> |

Summary of Hypotheses Testing Results For Population-at-Risk Characteristics and HADL

| Bivariate Hypotheses | Bivariate Results | Multivariate Results |
|---|---|---|
| <p><u>Predisposing</u></p> | | |
| <p>3a. Older clients will report significantly poorer independent capacity in household activities of daily living than clients who are younger.</p> | Supported | Supported |
| <p>3b. Clients with higher levels of education will report significantly better independent capacity in household activities of daily living than clients with lower levels of education.</p> | Supported | Supported |
| <p>3c. Female clients will report significantly poorer independent capacity in household activities of daily living than will male clients.</p> | Supported | Supported |
| <p>3d. Married clients will report significantly better independent capacity in household activities of daily living than will clients who are not married.</p> | Supported | Not Supported |
| <p>3e. Minority clients will report significantly poorer independent capacity in household activities of daily living than will white clients.</p> | Supported | Not Supported |
| <p><u>Enabling</u></p> | | |
| <p>3f. Clients with higher incomes will report significantly better independent capacities in household activities of daily living than clients with lower incomes.</p> | Supported | Not Supported (omitted) |
| <p>3g. Clients with additional insurance will report significantly better independent capacities in household activities of daily living than clients without additional insurance.</p> | Supported for private insurance; Opposite supported for Medicaid | Supported for private insurance; Opposite supported for Medicaid |

| | | |
|---|----------------------|--------------------------------|
| <p>3h. Clients residing in metropolitan and non-metropolitan areas will report significantly different independent capacities in household activities of daily living.</p> | <p>Not Supported</p> | <p>Not Supported (omitted)</p> |
| <p>3i. Clients residing in different census regions will report significantly different independent capacities in household activities of daily living.</p> | <p>Supported</p> | <p>Not Supported (omitted)</p> |
| <p><u>Need</u> 3j. Clients with more chronic illness conditions will report significantly poorer independent capacity in household activities of daily living than clients with fewer chronic illness conditions.</p> | <p>Supported</p> | <p>Supported</p> |

Summary of Hypotheses Testing Results For Population-at-Risk Characteristics and AADL

| Bivariate Hypotheses | Bivariate Results | Multivariate Results |
|--|---|---|
| <u>Predisposing</u> | | |
| 4a. Older clients will report significantly poorer independent capacity in advanced activities of daily living than clients who are younger. | Supported | Supported |
| 4b. Clients with higher levels of education will report significantly better independent capacity in advanced activities of daily living than will clients with lower levels of education. | Supported | Supported |
| 4c. Female clients will report significantly poorer independent capacity in advanced activities of daily living than will male clients. | Not Supported | Opposite direction supported |
| 4d. Married clients will report significantly different independent capacity in advanced activities of daily living than will clients who are not married. | Supported | Opposite direction supported |
| 4e. Minority clients will report significantly poorer independent capacity in advanced activities of daily living than will white clients. | Supported | Not Supported |
| <u>Enabling</u> | | |
| 4f. Clients with higher incomes will report significantly different independent capacities in advanced activities of daily living than will clients with lower incomes. | Supported | Not Supported (omitted) |
| 4g. Clients with additional insurance will report significantly different independent capacities in advanced activities of daily living than will clients without additional insurance. | Supported for private insurance; Opposite direction supported for Medicaid | Supported for private insurance; Opposite direction supported for Medicaid |

| | | |
|---|----------------------|--------------------------------|
| <p>4h. Clients residing in metropolitan and non-metropolitan areas will report significantly different independent capacities in advanced activities of daily living.</p> | <p>Not Supported</p> | <p>Not Supported (omitted)</p> |
| <p>4i. Clients residing in different census regions will report significantly different independent capacities in advanced activities of daily living.</p> | <p>Not Supported</p> | <p>Not Supported (omitted)</p> |
| <p><u>Need</u> 4j. Clients with more chronic illness conditions will report significantly poorer independent capacity in advanced activities of daily living than will clients with fewer chronic illness conditions.</p> | <p>Supported</p> | <p>Supported</p> |

Summary of Hypotheses Testing Results For Utilization Factors and General Health, BADL, HADL, AADL

| Bivariate Hypotheses | Bivariate Results | Multivariate Results |
|---|-------------------|------------------------------|
| 1k. There will be a significant relationship between client's number of outpatient visits and their general health. | Supported | Supported |
| 1l. There will be a significant relationship between client's number of inpatient stays and their general health. | Supported | Supported |
| 2k. There will be a significant relationship between client's number of outpatient visits and their independent capacity in basic activities of daily living. | Supported | Not Supported |
| 2l. There will be a significant relationship between client's number of inpatient stays and their independent capacity in basic activities of daily living. | Supported | Supported |
| 3k. There will be a significant relationship between client's number of outpatient visits and their independent capacity in household activities of daily living. | Supported | Not Supported |
| 3l. There will be a significant relationship between client's number of inpatient stays and their independent capacity in household activities of daily living. | Supported | Supported |
| 4k. There will be a significant relationship between client's number of outpatient visits and their independent capacity in advanced activities of daily living. | Supported | Opposite direction supported |
| 4l. There will be a significant relationship between client's number of inpatient stays and their independent capacity in advanced activities of daily living. | Supported | Supported |

Summary of Hypothesis Testing Results for Delivery System and General Health, BADL, HADL, AADI.

| Multivariate Hypotheses | | Multivariate Results |
|-------------------------|--|------------------------------|
| 1. | HMO clients will report poorer general health than will FFS clients once characteristics of the population-at-risk and utilization of health services are controlled. | Opposite direction supported |
| 2. | There will be no difference in limitations in basic activities of daily living between HMO and FFS clients once characteristics of the population-at-risk and utilization of health services are controlled. | Not Supported |
| 3. | There will be no difference in limitations in household activities of daily living between HMO and FFS clients once characteristics of the population-at-risk and utilization of health services are controlled. | Not Supported |
| 4. | There will be no difference in limitations in advanced activities of daily living between HMO and FFS clients once characteristics of the population-at-risk and utilization of health services are controlled. | Not Supported |

APPENDIX B

Permission to Print Modified Version of Theoretical Framework

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Development Manager
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VITA

Christine Ann Elnitsky received her Bachelor of Science in Nursing degree , Summa Cum Laude, in May 1991 and her Master of Science in Nursing Degree, Community Health Nurse Specialist, in August 1995 from Old Dominion University in Norfolk. Academic honors include induction into Sigma Theta Tau, International Nursing Honor Society and the Honor Society of Phi Kappa Phi in 1991, Kaufman Honors Recipient in 1991, Alumni Association Outstanding Scholar Fellowship in 1994-1995 and 1997-1998, Outstanding Teaching Assistant Award for College of Health Sciences in 1997, and Applicant for Agency for Health Care Policy and Research Dissertation Grant (total budget \$26,000) in 1998.

Christine has worked as a graduate research assistant, a graduate teaching assistant, and adjunct faculty at Old Dominion University. She has taught a variety of courses in the RN to BSN program, the BSN program and the MSN program as well as the School of Nursing's distance education program televised to 15 sites across Virginia. Other positions held previously include various clinical nursing roles in critical care, medical-surgical and surgical office environments.

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