DO RURAL MEDICARE PATIENTS HAVE DIFFERENT POST-ACUTE SERVICE PATTERNS THAN THEIR NON-RURAL COUNTERPARTS?

By

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Completion of a doctorate signifies the end of one of life’s journeys. It can not be accomplished without enduring sweat, tears, twists and detours in the road and making decisions concerning how fast or slow to travel. There is one additional attribute needed: persistence.

_Nothing in the world can take the place of persistence. Talent will not; nothing is more common than unsuccessful men with talent. Genius will not; unrewarded genius is almost a proverb. Education will not; the world is full of educated derelicts. Persistence and determination alone are omnipotent._

Calvin Coolidge

The journey can not be completed alone without support. There are a great deal of people to whom I will be eternally indebted to and grateful for their support. My dissertation committee chair, Elizabeth “Liz” Madigan encouraged me to apply to the program then challenged, assisted, provoked and encouraged me along the way. Her leadership, mentorship and encouragement allowed me to continue in the most challenging times. Additionally, without the invaluable assistance of my committee members, Dean May Wykle and Drs. Barbara Daly and Robert Binstock, this work would not have been completed.

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This work is dedicated to all the nurses everywhere who spend their entire careers providing direct patient care. They embody the true meaning of what is it to be a nurse.
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Do Rural Medicare Patients Have Different Post-acute Service Patterns Than Their Non-rural Counterparts?

Abstract

by

CINDY L. BOYER

An issue in Medicare redesign is whether beneficiaries have adequate access to health care services. Barriers to care exist for many rural residents in the current delivery system including hospital closures, fewer medical professionals, and a lack of specialty services. The purpose of this study was to determine if elderly rural patients, when controlling for patient-specific characteristics and the structure and availability of services, were more likely to experience different types of post-acute care and clinical and functional outcomes than a comparable nonrural population. The patient population (N = 153) chosen for this study had undergone a primary hip arthroplasty. A convenience sample of retrospective data was identified using databases maintained at the Mayo Clinic Medical Center, Rochester, Minnesota. Organized by an adaptation of the Andersen model, patient characteristics were classified as environmental (market and patient location) and patient/family (predisposing, enabling, and need). The following research questions were proposed: 1. Is there a direct relationship between resource consumption (type of post-acute care received) and clinical and functional outcomes? 2.
Is there a direct relationship between patient/family characteristics and clinical and functional outcomes? and 3. Do environmental factors moderate the relationship between patient/family characteristics and resource consumption? Research question 1, analyzed using analysis of covariance, found no significant relationship between the type of post acute care received and the patient outcome as measured by three dimensions of the Mayo hip score. Research question 2 was tested using bivariate correlation and multiple regression: there was a negative correlation between the need (per-operative hip score) factors and hospital LOS, and a negative relationship between outcomes, as measured by Mayo hip score, and need factors. Regression analysis revealed no significant predictive relationship except when examining the unadjusted Mayo hip score as the dependent variable. Logistic regression was used in question 3: there was no significant moderating effect. Variables that influenced post-acute care utilization were female gender and functional deficits. Conclusions: Patients in rural locations were not significantly different than patients living in non-rural areas. It is possible that patients referred to a referral center are of high socioeconomic and educational levels, despite Medicare insurance.
CHAPTER ONE

Background and Significance

Advancing age is often accompanied by an increased vulnerability to chronic illness and disability. Vulnerable populations are thought to be most at risk for reductions in access to health care because they have fewer alternatives (Trude & Colby, 1997). The estimated number of older people aged 65 and over in the United States is 34.9 million, or 12.4 percent of the total population (United States Bureau of the Census, 2001b). With the increase in the number and proportion of adults aged 65 and older in the past 20 years, there is an increased incidence of serious health problems or chronic illness. As the population of elderly people increases in the United States, access to health care is an issue that affects health policy, research, and nursing practice.

Any changes in access to care may be particularly significant for elders living in rural areas. The population residing in rural areas is older than the metropolitan population (Rogers, 1999). By the year 2000, the older population accounted for a larger proportion of the total population in non-metropolitan counties (14.7 percent) than metropolitan counties (11.9 percent) (United States Bureau of the Census, 2001a). Additionally, changes in state and federal policies have a greater effect on rural elders because Social Security, Supplemental Security Income, and Medicare programs account for a larger portion of their income and also provide critical fiscal support for their local service providers (Rogers, 1999). Research has also shown a disparity in the receipt of health care services between older adults from rural communities and their non-rural counterparts, wherein rural elders have been shown to have limited access to or use of community-based health care as compared to a nonrural population (Coward & Dwyer,
One of the more common surgical procedures among the elderly is joint replacement. Functional losses following orthopedic surgical procedures related to joint arthroplasty necessitate that most patients are discharged to post-acute care providers for continued rehabilitative services (Gage, 1999). For patients undergoing orthopedic surgery, hip replacement is the most common type of joint replacement (Canale, 1997). Post-acute orthopedic care, considered an integral component of achieving positive outcomes postoperatively, can be provided in several settings, including skilled nursing facilities, inpatient interdisciplinary rehabilitation units, outpatient rehabilitation facilities, and with the use of home healthcare services. However, there is mixed evidence on how patients are referred to the various sites of post-acute care and whether there are patient differences in the destination of care following a joint replacement (Forrest, Roque, & Dawodu, 1999; Kane et al., 1994, 1998; Kenney & Dubay, 1992; Kramer et al., 1997; Magilvy, Congdon, & Martinez, 1994; Mahomed, Lin, Levesque, lan, & Bogoch, 2000; Rabiner, 1995; Shwartz, Iezzoni, Moskowitz, Ash, & Sawitz, 1996; Swan & Benjamin, 1993).

As a consequence of dramatic and accelerating changes in the health care environment, the types of post surgical services available or, perhaps most importantly, not available to rural elders may exert a negative effect on their postoperative outcomes. Designed to facilitate access, Medicare provides basic coverage of medical services to elderly people. The Medicare benefit has been at the center of governmental efforts to

Due to the implementation of some of the BBA provisions and heightened efforts to investigate Medicare fraud and abuse, public spending on health care in 1998 exhibited its slowest pace of growth on record since 1960 (Hoffman, Klees, & Curtis, 2000). The overall result of the BBA is that Medicare spending is projected to stabilize. The projected changes in public money spent for healthcare services include a slowdown in the movement of services out of acute care and a significant slowdown in spending growth for nursing home and other post-acute care services (Hoffman et al., 2000). These changes initiated in the Medicare program have significant potential to negatively alter the delivery of post-acute services to patients living in rural areas in the United States, who have been identified as being at particular risk even before the Medicare changes.

An important issue in Medicare redesign is whether beneficiaries have access to health care services, without which the core Medicare benefits guaranteed by law are meaningless (Coburn & Slifkin, 2000). Barriers to care already exist for many rural residents who, on average, are older, less educated, have lower incomes, and are in poorer health than urban residents (Coburn & Bolda, 1999; Stearns, Slifkin, & Edin, 2000). Factors which may further contribute to access problems for rural beneficiaries as a result of the provisions of the BBA include the threat of hospital closures, fewer medical professionals, and a lack of specialty services (Connor, Kralewski, & Hillson, 1994; Knapp, Paavola, Maine, Sorofman, & Politzer, 1999; Rosenblatt & Hart, 1999).
The purpose of this study was to determine if elderly rural patients, when controlling for patient-specific characteristics and the structure and availability of services, were more likely to experience different types of post-acute care and clinical and functional outcomes than a comparable nonrural population.

Statement of the Problem

Total hip arthroplasty (THA) is one of the most common surgical procedures performed in persons over 65 years of age (Canale, 1997). The length of time a patient stays in the acute care setting following surgery has steadily declined, with current protocols calling for discharge on or about the fifth day postoperatively (Coventry, Beckenbaugh, Nolan, & Ilstrup, 1974; Forrest et al., 1999; Harris & Sledge, 1990). With this decrease in hospital stay comes an increase in the importance of post-acute care and rehabilitation when the patient returns to the community. Protocols for care in the post-acute setting assumes that patients will have access to post-acute settings or that there will be informal caregiver resources available upon hospital discharge. This may present a challenge to the rural elderly since they may be less likely to have access to post-acute care.

In addition, contrary to conventional wisdom, rural elders do not have a stronger family network or increased access to more informal care as compared to urban elderly, and may actually have fewer informal sources of care (Coward & Dwyer, 1992; Krout, 1994; Schultz, 1997; Stoller & Lee, 1994). Therefore, any reductions in healthcare services to rural elders may negatively affect their health outcomes if other types of services are not available. Since the effect of changes in Medicare coverage on access to
post-acute care for rural elders is not clear, further empirical evidence was needed to better understand these effects.

Conceptual Framework

An adaptation of Andersen’s behavioral model of health service use was utilized in this study (Andersen, 1995). This conceptual model was originally developed in the late 1960’s to assist in understanding why families use health services to define and measure equitable access to health care, and to assist in developing policies to promote equitable access (Andersen, 1995).

Initial empirical testing and refinement of this model was done using national data collected at the University of Chicago by the Center for Health Administration Studies and the National Opinion Research Center (Andersen, 1995). Since this model was first developed in 1968 (Andersen, 1968), it has been critiqued and used in health services research (Bass & Noekler, 1987; Gilbert, Branch, & Longmate, 1993; Kelley, Perloff, Morris, & Liu, 1992; Mechanic, 1979; Penchansky, 1976; Portes, Kyle, & Eaton, 1992; Rundall, 1981) and revised (Aday & Andersen, 1975; Aday, Andersen, & Fleming, 1980; Andersen, 1995; Andersen, Kravits, & Andersen, 1975; Andersen & Newman, 1973; Andersen, Smedby, & Anderson, 1970; Fleming & Andersen, 1986).

Andersen defines access as the actual use of personal health services and everything that facilitates or impedes the use of health services (Andersen, Rice, & Kominski, 1996). The most recent version of the Andersen Model, Phase 4 (1995), presents a systems approach to understanding a population’s access to care. The framework is divided into four major components: environmental factors, population characteristics, health behaviors, and health outcomes. More specifically, the
environment includes the resources and organizational structure that affect use.

Population characteristics are individual determinants that affect service use, while health behavior encompasses the personal health practices and the use of service by the individual. Finally, outcomes reflect individuals’ perceived and evaluated health status, as well as their satisfaction relative to the amount of health care services consumed. The model also includes several feedback loops. Health behavior may alter people’s need for services. Additionally, outcomes (health status and satisfaction) subsequently might result in changes, in both health behavior and population characteristics (such as predisposing beliefs or perceived need), which affect the use of health care services (Andersen et al., 1996).

A major goal of the behavioral model was to provide measures of access to health care (Andersen, 1995). Using two concepts from the model, the present study relies on two measures of access to define resource consumption. Potential access is defined as the presence of resources while realized access refers to the actual use of services (Andersen, 1995). The model appears below.

![Figure 1. The Andersen Model (1995)](image-url)
While there are no published studies specific to environmental factors and their link to access and utilization of services, there does exist a body of knowledge that used the Anderson behavioral model to explain environmental and provider variables (Phillips, Morrison, Andersen, & Aday, 1998). An analytic study conducted by a research team, including Andersen and Aday, found that while these studies provided insight on how environmental and provider-related variables were used, they also suffered from lack of data, analytical difficulties and conceptual model inconsistencies (Phillips et al., 1998).

Previous research in the post-acute setting used the Andersen Model to examine individual determinants of service (Branch et al., 1981; L. G. Branch et al., 1988; Evashwick, Rowe, Diehr, & Branch, 1984) and the link between home healthcare resource consumption and patient outcomes (Fortinsky & Madigan, 1997). Of particular interest is the adaptation of the Andersen model used by Fortinsky and Madigan (1997) in their home healthcare research.

Fortinsky/Madigan Model Adaptation

A portion of the Anderson “Emerging Model” of Health Services Use (Andersen, 1995) was adapted by Fortinsky and Madigan (1997) for their study of home healthcare resource consumption. The Fortinsky/Madigan version of the model includes specific home healthcare variables previously identified and incorporated by Madigan (1996) who used an earlier version of the Andersen model when conducting home healthcare research. Fortinsky and Madigan adapted the Phase 4 version of model to link home healthcare resource consumption and patient outcomes while acknowledging the role of the patient. They identified home healthcare agency level environmental factors that
were expected to influence relationships between resource consumption and patient outcomes (Fortinsky & Madigan, 1997).

*Model for the Study*

The conceptual framework for this study (Figure 2) was based on a modified adaptation of Fortinsky and Madigans' (1997) Framework for Studying Home Care Resource Consumption and Patient Outcomes. While Fortinsky and Madigans’ work focused on the associations between resource consumption and patient outcomes, this study focused on the type of care delivered and the resultant effects on patient outcomes in the rural patient post-acute care discharge. Therefore, several modifications were needed for the study.

The first modification of the Fortinsky/Madigan model is in relation to outcomes. The model (Figure 2) did not include discharge disposition since this refers to discharge disposition from home health care services, which is not an empirical focus in this study. Another modification to the Fortinsky/Madigan model is the absence of a two-way relationship between resource consumption and outcomes. This is due to a difference in the theoretical definition of resource consumption. Fortinsky and Madigan defined resource consumption as amount of home healthcare provided, the total costs of that care, and the length of stay of the home healthcare episode. Due to the aim of the study, the present study defined resource consumption as the type of post-acute care delivered upon discharge from the acute care setting.

The third modification is the addition of a relationship between the environmental factors present and the type of post-acute resource consumption. The new model
hypothesized that the environmental factors present moderated the effect of patient/family characteristics on post-acute discharge resource consumption.

Figure 2. Proposed Conceptual Model

Research Questions

Based on the conceptual model, the following research questions were proposed:

1. Is there a direct relationship between resource consumption (type of post-acute care received) and clinical and functional outcomes?

2. Is there a direct relationship between patient/family characteristics and clinical and functional outcomes?

3. Do environmental factors moderate the relationship between patient/family characteristics and resource consumption?

Definition of Conceptual Terms

Access to Care

Access to care, as defined by the Institute of Medicine, is “the timely use of personal health services to achieve the best possible health outcomes” (Institute of Medicine, 1993). Access to care, broadly defined as the ability of persons to use services, including factors such as distance, effort, cost, and awareness of services, is a
key issue for rural residents (National Institute of Nursing Research, 1995). Access can be further delineated to include potential access, which is the presence of resources, as well as realized access, which refers to the actual use of services (Andersen, 1995). In the present study, “access” refers to realized access to care.

**Rural**

Rural areas are low-density, sparsely populated nonmetropolitan communities (Rogers, 1999). Definitions of rural are continuum-based with several variables underlying the concept. Population density, distance from health facilities, and other geographical factors are all components of the definition of rural.

**Environmental Factors**

Environmental factors are factors present in the health care marketplace at the time of the study. They include market, provider, and patient location characteristics. Market characteristics are the type and number of post-acute services available in a specific geographical area that may affect service provision. The relevant provider characteristics are ownership status (hospital or health system based vs. freestanding) and the number of patients cared for each year.

**Patient/family Characteristics**

Patient/family Characteristics are attributes of individuals that influence the type and amount of post-acute services ordered upon hospital discharge. These characteristics are divided into three dimensions: predisposing determinants of care, enabling resources, and need characteristics. Predisposing determinants are immutable attributes that exist prior to the onset of illness and may influence service use and include age, gender, and ethnicity. Enabling resources are those attributes that enable or
hinder the use of post-acute services and include the type of Medicare coverage and the amount of informal support available. Need characteristics are the two attributes of the individual’s level of evaluated health status, including the individual’s level of physical function and preexisting health conditions present in a person upon an episode of health-care delivery that are not related directly to the main reason for seeking health-care, but that increase the intensity of resources used or increase the likelihood of a poor outcomes (Elixhauser, Steiner, Harris, & Coffey, 1998).

**Post-Acute Discharge Resource Consumption**

Post-acute discharge resource consumption was defined as the type of formal care received upon hospital discharge. This included hospital discharge to (a) an inpatient rehabilitation unit, (b) a home health agency, (c) a skilled nursing facility, (d) home with no formal services, or (e) home and receiving community-based outpatient services. While patients may move from one post-acute site to another across the continuum of care, the primary interest in the study was the site of care upon the initial hospital discharge following hip arthroplasty. It was not possible to obtain the data on those patients who received community-based outpatient services, although this is one of the possible post-acute sites of care.

**Patient Outcomes**

Patient outcomes were defined as those changes in clinical and functional health, which occurred over time in the post-operative phase of illness, as measured by the level of physical wellness and patient satisfaction.
Significance to Nursing

This study bore significance for the practice and profession of nursing in several ways. Changes in the Medicare reimbursement model have caused a shift in nursing practice in all settings. With a decrease in the average length of hospital stay for patients admitted for total joint replacement (Coventry et al., 1974; Forrest et al., 1999; Harris & Sledge, 1990; Williamson, 1997), nurses are challenged to predict and coordinate patient services beyond the acute care setting while establishing goals for optimum health. Shifts in post-acute reimbursement may influence the way organizations accept patients, the type of care provided, the quantity of care provided, and the types of persons delivering the care. Consequently, nurses require knowledge of the predictors of positive or negative outcomes for the patient who requires care following a discharge from the acute care setting.

Information is the force that drives quality and improves the level of performance. Empowered nurses with the right information can make decisions that are more timely and more individualized and can take action to better serve health care consumers. Nursing knowledge about a disparity in care can assist nurses in planning patient management strategies. It can provide useful data about geographic differences in post-acute care utilization and provide beneficial information when deploying disease management programs or case management strategies. Similarly, nurse executives and policymakers can use this information when considering geographic fiscal allocations to fund health care initiatives.
Boyer

The Environmental Domain of Nursing Knowledge

Kim (1987) has proposed a typology to systematize research and the ever-cumulating knowledge in nursing. In an attempt to classify the essential concepts in nursing, the four domains of client, client-nurse interaction, practice and environment represent the four spheres of the empirical world of nursing. The present study falls into the domain of environment. Within the environment domain, Kim includes concepts and variables exogenous to the client and the nurse.

Historically, Florence Nightingale knew the needs of the soldiers she cared for during the Crimean War. She was able to identify and examine the effects of the environment in which she practiced. She realized that not only were diseases afflicting the soldiers, but also the care they failed to receive, secondary to limited resources and exposure to unhygienic conditions, affected their recovery (Schultz & Meleis, 1988). Similarly, the present study can be linked to the environmental domain. The environmental influence lies in the availability and types of post-acute services and represents phenomena in the environment, which are important explanatory variables. According to Kim, the environmental variables enrich the understanding of the client, client nurse interaction, and nursing practice (Kim, 1987).

Findings from this study provide nurses in practice with insight related to continuity of care needs of rural elders. It will identify geographic differences in the level and types of health care access that may ultimately affect their post-operative recovery and outcomes.
CHAPTER II

Review of the Literature

Literature topics important to this discussion include work in the area of outcomes of patients who undergo joint arthroplasty, the selected patient population for this study. A summary of the research related to the level of functional status and patient satisfaction following surgery is included since these are key outcome measures. This discussion will be followed by a summary of the relevant literature related to environmental factors, patient/family characteristics, and the accessibility of post-acute services that may influence these outcomes. Finally, a summary of the current literature will be presented as well as a discussion on how the present study will fill some of the current literature gaps.

Patient Outcomes

There is an extensive body of empirical literature on patient outcomes. The concept of outcomes in the orthopedic patient is actually a compilation of both objective and self-reported changes in clinical and functional health, which take place during the post-operative recovery and rehabilitation period. Since the study focused on the patient with major hip arthroplasty, the literature summarized below will address the outcomes of this patient population with an emphasis on outcomes achieved in post-acute settings. A summary of the research findings will be presented at the end of this chapter in Table 2.
The aim of a study conducted by MacWilliam, Yood, Verner, McCarthy, and Ward (1996) was to identify factors associated with poor outcomes after total hip replacement surgery. Using data available from a national database (AMGA Total Hip Replacement Consortium), the study population included 422 patients who were 21 years of age or older, had surgery at one of the 14 participating consortium sites, and had consented to participate. Data were collected preoperatively and at 5 time points: six weeks, three months, six months, one year, and two years postoperatively.

The risk factors chosen for analysis were divided into three categories: demographic risk factors (age, female gender, African-American race, marital status, low household income of less than $20,000/yr, and less than a high school education) medical history risk factors (polyarticular arthritis, number of comorbid conditions, obesity), and preoperative functional status measures (pain and physical function). The outcomes, operationalized as changes in postoperative levels of pain and physical function, were measured using the Health Status Questionnaire (HSQ) pain and physical function scores (Ware, Snow, Kosinski, & Gandek, 1993).

The most significant changes in pain and function occurred in the first six-month postoperative period. Results during this time indicated that, overall, only a lower level of education and African American race was found to have an effect on outcome. Low education was associated with a less improvement in pain and physical function with a decrease of 6.2 points in pain score change (95%CI -16.9, -2.1) and a decrease of 10.9
points in the physical function score change (95% CI -12.3, -0.1) and a decrease of 7.7 points in physical function score change (95% CI - 13.8, -1.6).

After adjustment for all other risk factors, African American race was associated with a difference of 9.5 points in pain score change (95% CI - 18.3, -3.5) at six months indicating less improvement in pain. Interestingly, the researchers chose this variable for inclusion since they concluded there was a higher prevalence of lower socioeconomic status within the African American population. However, they could not account for the specific effect of this variable on the study’s outcomes.

Of the medical risk factors studied, only the number of comorbid conditions was found to have an effect on outcomes at the six-month time point. The comorbid conditions included were heart failure, chronic lung disease, sight deficits, hearing deficits, diabetes, asthma, ulcer or GI bleeding, and sciatica or chronic back problems. For each additional comorbid condition there was a corresponding decrease of 4.6 points in the pain score change (95% CI -7.5, -1.7) and a decrease of 4.7 points in physical function score change (95% CI -7.6, 1.8) indicating that subjects had less decrease in pain and were less functionally able.

Preoperative function was associated with changes in the pain and physical function scores. HSQ scores are reported on a scale of 0 to 100 with a 0 score indicating extremely compromised function and 100 indicating no impairment of function. Patients who were initially more compromised (low preoperative scores) were found to have lower postoperative scores as compared to those patients with better preoperative function. A much higher percentage of patients with low (0-19)
preoperative scores were found to report pain and physical function improvement as compared to the group with high (80-100) preoperative scores.

This study had several limitations. There were too few African American patients and low income patients with these risk factors to adequately analyze these subgroups. Another limitation was that there were large amounts of missing data. The original sample was 848 patients but due to missing data the sample size was reduced to 422. Contributing to the problem of missing data was a high dropout rate due to the length of the data collection forms subjects were asked to complete. Additionally, the researchers reported a problem with missing observations for the variables of obesity and low income (MacWilliam, Yood, Verner, McCarthy, & Ward, 1996).

*The Measurement of Outcomes in Relation to the Type of Post-Acute Setting*

Using a prospective design, Williams, Oberst, and Barry (1994) examined outcomes of women, 60 years of age and older, who underwent repair of a hip fracture at 2, 8, and 14 weeks postoperatively. Outcomes were identified as the mobility and mood states of the women in comparison to their prehospital discharge levels. Functional mobility was measured by the level of assistance needed to achieve ADLs using the ADL subscore measure from the OARS Multifunctional Assessment Questionnaire (Center for the Study of Aging and Human Development, 1975). The short form of the Profile of Mood States (POMS) (Shacham, 1983) was used to measure emotional states.

The researchers compared three groups drawn from four different hospitals: those discharged home from the hospital, those discharged to a skilled nursing facility and staying there ≤ 1 month (NHI), and those staying > 1 month (NHII). The researchers
found that none of the groups attained 100% of their prefracture level of mobility by 14 weeks. The home group had attained 81.5% mobility, the NHI group 80%, and the NHII group 52% by 14 weeks. The NHII group had a significantly greater need for assistance in mobility than both the home and NHI groups in all time periods. Statistically this group was older than the other two groups. The level of functional status, number of secondary medical diagnoses and the hospital length of stay for the NHII group were only statistically different from the home group, but not when compared to the NHI group. Additionally, the home and NHI group were not statistically different from each other in these characteristics, except age at all time points.

The women who were in the NHI group did as well in regaining mobility as did the women who went directly home following surgery. This similarity of recovery between these two groups occurred even though the NHI group was older. The researcher speculated three reasons that may have accounted for this similarity. One reason may have been that the NHI women received more physical therapy sessions than the home group. A second reason was the possibility of the NHI women being discharged to the SNF for non-biomedical reasons such as the lack of caregiver at home. (Of the home group, 66% designated a caregiver available at home, whereas caregivers were available for 26% of NHI and 46% of NHII.) The final reason cited was the possibility that the home group was provided more assistance by caregivers in the home thereby slowing their progress to match that of the NHI group.

This study had several significant limitations. By design, the sample was not typical of the usual mix of persons admitted to hospitals for hip fracture repair (Williams, Oberst, & Bjorklund, 1994). It excluded males and those who were
readmitted to the hospital during the data collection period. Additionally, the researchers did not collect information on whether the home group received any formal home healthcare or outpatient rehabilitation services.

In another study, Myers and associates examined the relationships among prefracture health status, development of complications, mobility outcomes, and disposition at hospital discharge (Myers, Palmer, Engel, Warrenfeltz, & Parker, 1996). There were 100 subjects followed during the hospital stay. Using multiple logistic regression analysis, the researchers found that the amount of assistance needed for mobility tasks at hospital discharge was associated with the prefracture need for ADL assistance, male gender, weight-bearing status, short hospital stays and less in-patient physical therapy. Patients who were older and had shorter lengths of inpatient stays and less physical therapy were more likely to go to a skilled nursing facility than directly home. This study had several limitations. It narrowly defined several important variables-- ADLs were defined as independent or assisted. Comorbid conditions were defined as ≤ 2 or > 2 conditions.

To compare the differences in outcomes of Medicare patients discharged from the hospital to traditional skilled nursing facilities, rehabilitation skilled nursing facilities and inpatient rehabilitation units, Kane and associates studied Medicare patients discharged from 52 hospitals in three cities (Kane, Chen, Blewett, & Sangl, 1996). The sample was derived from data collected for a larger study. The subsample used for this study included 371 hip fracture patients and a comparable number of stroke patients.

Outcomes were defined as the functional status of the patient. This was operationalized by using a weighted sum of seven components of the ADL measure
(incontinence, bathing, dressing toileting, transferring, feeding and walking). The weighted sum was based on a magnitude estimation technique using an expert panel with the scores converted to a 0-100 scale with zero representing no disability and 100 total disability. Independent variables included patients’ functional status before admission and at hospital discharge, speech and hearing deficits, living arrangements, presence of a urinary catheter, city of residence, cognitive status (using the Short Portable Mental Status Questionnaire), income (Medicaid enrollment served as a proxy), and whether informal support had been previously provided. Severity measures included the APACHE II score. Comorbidities were measured using a modification of the Charlson Comorbidity Index (Deyo, Cherkin, & Ciol, 1992).

The researchers found that when controlling for the independent variables, hip patients who had less comorbidity and disability upon hospital discharge achieved more positive outcomes if their post-acute care was received in an inpatient rehabilitation unit than in the traditional skilled nursing facility. Sicker hip fracture patients, however, did not experience different outcomes based on the setting in which they received post-acute services.

The study was limited in that it only included patients in three post-acute inpatient settings. It also relied on data from a larger study so variables such as income and caregiver support were operationalized in a limited manner. This study is also limited in that the data were initially collected between 1988 and 1990 and is therefore somewhat outdated.

Kramer and colleagues (1997) conducted a study to assess whether outcomes and costs differed for elderly patients admitted to rehabilitation hospitals, subacute skilled
nursing facilities, and traditional skilled nursing facilities. A total of 518 patients with hip fractures were enrolled in this study which also included 485 stroke patients who were randomly chosen and followed prospectively for 16 months. The sample was derived from 92 facilities, both hospital-based and freestanding from 17 states.

The outcome measures included recovery to premorbid levels in 5 ADLs (bathing, dressing, transferring out of bed, walking 20 feet and toileting), Medicare costs, and the number of therapy and physician visits. Control variables included the preoperative residence and level of function, caregiver availability, comorbid conditions, admission level of function, cognition, depression, sensory deficits, and mobility impairments.

Rehabilitation patients were more likely to have caregivers and higher levels of cognition and physical function. These patients did not differ from the nursing home patients in returning to the community (adjusted odds ration (OR) 1.3, 95% CI, 0.6-2.6) or in the number of ADLs recovered to premorbid level (difference, 0.09 ADL; 95% CI, -0.27-0.44). There was also no difference in the return to the community for patients who were admitted to the subacute unit versus those admitted to a traditional nursing home setting (adjusted OR, 1.6; 95% CI, 0.7-3.6).

Medicare costs were greater for rehabilitation unit patients than for subacute skilled nursing facility patients, and the costs of subacute patients were greater than traditional skilled nursing facility patients. These differences in reimbursement were the result of substantial differences in the cost per day that were only partially offset by differences in the lengths of stay. The length of stay averaged 19 days for hip fracture patients who were admitted to an inpatient rehabilitation facility, 33 days when admitted to a subacute skilled nursing facility and 39 days when admitted to traditional skilled
nursing facilities. In addition, 18% of the hip fracture patients who were admitted to the inpatient rehabilitation setting were subsequently admitted to the skilled nursing facility. After using the propensity score to control for the confounding variables, the cost differences between inpatient rehabilitation and subacute settings differences remained significant (P<.001), while the cost differences between the subacute and traditional skilled nursing facilities disappeared (Kramer et al., 1997).

The cost-per-day differences resulted, in part, from differences in volume of therapy services. Patients in the inpatient rehabilitation settings received significantly more physical, occupational, speech and recreational therapy visits. Hip fracture patients in the subacute setting received more occupational services than their counterparts in the traditional skilled setting. A higher volume of physician charges in the inpatient rehabilitation setting also contributed to the cost differences between it and the other two settings.

This study is important as it suggests that while the costs of some types of post-acute care following hip arthroplasty are greater than others, there is not appreciable difference in the outcomes. One limitation of this study was the sample size. With a larger sample, it is possible that the adjusted difference between the patients who returned to their community residence at 6 months would persist and might attain greater statistical significance.

The objective of a study by Intrator and Berg (1998) was to examine the benefit of home healthcare services for elderly patients with hip fracture discharged to home after inpatient rehabilitation. The outcomes measured were rehospitalization and any nonskilled nursing facility admission during 12 months after discharge. The results
showed that patients who received additional home healthcare services (27.7%) were less likely to be hospitalized those who received in-patient only (31.1%). They were also more likely to survive the year with no subsequent Medicare claims (65.6 % versus 55%). Propensity scores used to adjust for nonrandom treatment selection. Using a Cox proportional hazards analysis, the researchers found that patients who received home healthcare were significantly less likely to be admitted to a skilled nursing facility (adjusted odds ratio = .42, 95 % CI .21-84) and hospitalization (adjusted odds ratio = .65, 95 % CI .26-1.00) than those who did not (Intrator & Berg, 1998).

This study measured the use of home healthcare after inpatient rehabilitation rather than the present study, which will measure it upon discharge from the acute care setting. It is important to this discussion, however, since it demonstrated the benefit of home healthcare for this patient population.

Mahomed, Lin, Levesque, Lan, and Bogoch (2000) used a retrospective design to study 146 primary total hip and knee replacements. The goal of this study was to evaluate the determinants of the rehabilitation setting (home versus in-patient based) and its influence on early outcomes. The predictors of home healthcare as the site of post-acute care were male gender (adjusted odds ratio = 4.1, 95% CI, 1.7-10.0), more knowledge regarding joint replacement (adjusted odds ratio = 3.3, 95% CI, 1.6-6.7), and home healthcare as a rehabilitation preference (adjusted odds ratio = 34.2, 95% CI, 19.1-61.4). Variables traditionally found to influence the post-acute setting including age, social support and comorbidity (measured with the Charlson Index) were not predictive of discharge in this study (Mahomed et al., 2000).
Functional outcomes measured eight months after hospital discharge found no significant differences in those patients who received home healthcare and those who received inpatient rehabilitation. This points out a limitation acknowledged by the researchers. This study was conducted in Canada where the health systems guarantees equal access to all rehabilitation services. This may have been a confounder that biased results. The other limitation was that all joint replacements--hips and knees--were analyzed together when measuring the functional outcomes at the eight-month point. There may have been a significant difference if the subgroups had been analyzed separately because the trajectories of care are different for patients who have had hip surgery in that they take longer to return to prior function.

The study by Hadley and colleagues (2000) was aimed at estimating the effect of Medicare beneficiaries’ use of home healthcare for 6 months post-hospital discharge and its effect on changes in functional health. Using MCBS data, it contained a nationally representative sample of 2,127 elderly Medicare beneficiaries and defined home healthcare use as the amount of Medicare payments per beneficiary. Based on Grossman’s (1972) conceptual framework on health production and the demand for health, the researchers postulated that people who experienced more health deterioration should use more home healthcare services and that because a change in health and home healthcare service use are influenced by the initial health state, home healthcare users should have poorer health outcomes than non-home healthcare users (Hadley, Rabin, Epstein, Stein, & Rimes, 2000).

This study illustrated that users of home healthcare services were in poorer general health status than nonusers (coefficient estimate = .54, p, 0.01). The changes in
functional status associated with receiving home health care services were significant. The researchers found that a 10% increase in home healthcare use was associated with a more than proportional improvement in functional status of 12.9% (Hadley et al., 2000).

This is one of the few studies on post-acute outcomes that included a theoretical framework in the methods section. The study used Grossman’s health production and the demand for health, which postulates that a person “produces” health by combining medical care and other factors, such as living conditions, nutrition, and exercise, that affect health (Grossman, 1972).

This study did have several important limitations. First, it used ADL and IADL scales that deviated from those used in the original work on weighted scales (Finch, Kane, & Philip, 1995). Also, home healthcare use was defined as the total Medicare payments for home health incurred by each person in the sample in the six-month period following the date of hospital discharge. This type of definition did not allow for subgroups of those who had one episode in the 6-month periods and those who may have incurred multiple episodes of care. It therefore did not separate out short-term versus long-term users of home healthcare, thus limiting its generalizability.

In a series of publications, Kane, Chen, Finch, Blewett, Burns and Moskowitz (1994; 1998; 2000) discussed the results of a study that examined the use and outcomes of post-acute care for Medicare patients. They found that there were differences in outcomes based on the type of post-acute facility the patient used. The study examined four different venues for each of the five different illnesses associated with post-acute care: stroke, chronic obstructive pulmonary disease, congestive heart failure, hip surgical...
procedures and hip fracture. The results presented below will highlight only the outcomes of the patients who underwent a surgical hip procedure. The discharge locations were identified as: home with no formal care, home healthcare, inpatient rehabilitation and skilled nursing facility.

A two-stage regression model was used to first look at the factors associated with discharge and then at the outcomes associated with each location. For the hip procedure patients, the following characteristics were statistically significant among the discharge locations: discharge ADL scores, patient self-expressed health status (ADLs) at six weeks post-hospital discharge, the functional limitations prior to post-acute care (operationalized by summed ADL and IADL scores), age, cognitive status, prior health status, comorbidity score, the percentage of patients who lived alone, the presence of a caregiver, and geographic site of patient residence (Table 2).

A predictive model was then created for each patient to estimate how that person would have fared had he or she been discharged to each type of care. The optimal discharge location was determined as that which produced the greatest improvement in function when the patient characteristics were adjusted. The estimation equations showed that 55.6% of the hip procedure patients were discharged to the model location with 68% correctly classified (p < .001). The predictive power for the second stage: change in function from discharge to six weeks post-hospital discharges showed significant differences between those who received formal post-acute care and those who did not. However, there was only a slight difference based on the site of post-acute care: hip procedure patients going home (no formal services): 0.59 (p < .01), home healthcare: 0.36 (p < .01) and skilled nursing facility 0.38 (p< .01). No data was available on
inpatient rehabilitation services as it was not an option for hip procedure patients in this study.

Table 2

Kane, Chen, Finch, Blewett, Burns and Moskowitz (1994; 1998; 2000)

Patient Characteristics of Patients with Hip Procedures Significant in Each Discharge Location

<table>
<thead>
<tr>
<th>Significant Characteristics</th>
<th>Home health Care</th>
<th>Skilled Nursing Facility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discharge ADL* (range 1-100)</td>
<td>+</td>
<td>++</td>
</tr>
<tr>
<td>Prior ADL/IADL* (range 1-100)</td>
<td>+</td>
<td>++</td>
</tr>
<tr>
<td>Self expected health status* (ADL) (range 0-100)</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Age</td>
<td>+</td>
<td>++</td>
</tr>
<tr>
<td>Cognitive Status ** (range 0-10)</td>
<td>+</td>
<td>++</td>
</tr>
<tr>
<td>Prior health status</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Comorbidity Score</td>
<td>++</td>
<td>+</td>
</tr>
<tr>
<td>Patient lives alone</td>
<td>+</td>
<td>++</td>
</tr>
<tr>
<td>Patient without prior caregiver help</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Geographic residence</td>
<td>+</td>
<td></td>
</tr>
</tbody>
</table>

+ = Significant; ++ = more significant*; Scores: 0 (complete dependency or death) to 100 (completely independent); **Operationalized as the number of errors on the 10 item Short Portable Mental Status Questionnaire (Pfeiffer, 1975): 0 (highest level of functioning) to 10 (most cognitive impairment)

The results of this study indicated that the use of post-acute services, specifically home healthcare, might be more beneficial than discharging to a skilled nursing facility. The study had limitations. First, it was based on a sample in two, largely urban areas. Regional practice patterns and reimbursement differences may hinder generalizability. Additionally, it did not rely on a randomized allocation design but relied on post-hoc statistical techniques to correct for differences among the groups studied (Kane et al., 2000). This study does have importance for the application of a model to predict the most beneficial setting for recovery from a surgical hip procedure.
Patient Self-Reported Satisfaction as an Outcome

Measuring patient satisfaction with joint arthroplasty is important for several reasons. Satisfaction has been linked to an increased patient compliance (Lochman, 1983). Additionally, patients who are satisfied return for follow-up care (Lochman, 1983). One reason major joint arthroplasty is performed is to improve the patient’s quality of life; therefore the patient’s own perspective and level of satisfaction should be central to assessing the outcomes of a procedure (Salmon, Hall, Peerbhoy, Shenkin, & Parker, 2001). There are only a few studies that measure patient satisfaction following hip arthroplasty (Lieberman et al., 1996; Mancuso, Salvati, Johanson, Peterson, & Charlson, 1997; Salmon et al., 2001), yet they represent an important, additional measure of outcome.

Lieberman and colleagues (1996) compared patients’ and physicians’ evaluations of the results of 147 total hip arthroplasty. The patients and physicians independently evaluated pain and overall satisfaction with the outcome of the procedure using a 10.0-centimeter visual analog scale. They also answered a questionnaire in which they assessed general health, functional ability and pain. The mean (and standard deviation) analog rating for overall satisfaction (with 0.0 centimeters indicating poor and 10.0 indicating excellent) was similar when assessed by the patients and assessed by the physicians.

There was a marked disparity between the patients’ and physicians’ scores when the patients assigned a low score to overall satisfaction. The mean analog rating for satisfaction for nineteen patients who rated this parameter as less than 7.0 centimeters...
was 3.8 +/- 2.1 centimeters, while the physician’s mean rating was 6.5 +/- 2.8 centimeters (p< 0.001. linear regression).

There are several explanations for the above discrepancies. First, the patients and physicians may have different expectations with regards to the results of the procedure. Second, patients and physicians may have a different definition of a positive outcome. The patient’s perception, as exemplified in this study, is important to include in order to obtain a complete assessment of the surgical results.

Mancuso and colleagues measured patients’ satisfaction after hip arthroplasty and evaluated the relationships of expectations and overall outcome to the patients’ satisfaction. Using a convenience sample of 180 patients, a survey was conducted over a period of 2 to 3 years following patients THA. Using qualitative techniques, patients cited 45 expectations, which were then grouped into five categories reflecting improvement (pain, walking, psychological state, essential activities, and nonessential activities). Additionally, the researchers used information regarding the patient’s current condition gathered during their 2 to 3 year follow-up examination. This data was gathered using the Medical Outcomes Study Short-form General Health Survey (SF-20) (Stewart, Hays, & Jr, 1988) and the Hip Rating Questionnaire (HRQ) (Johanson, Charlson, Szatrowski, & Ranawat, 1992)

The researchers found that, overall, 89% of the patients were satisfied with the results of the surgery. Among the 11% of the patients who were dissatisfied, the most common complaint was residual pain, which interfered with sleep, activities, work, or recreation. Lower rates of satisfaction were found in those who had a better preoperative physical condition (as measured by the surgeon) and in patients who expected
improvements in nonessential activities (dancing, traveling, swimming, being off medications, hiking, exercising, playing tennis, golfing). Except for lower satisfaction (73%) among those with pulmonary disease, there were no differences when stratified for comorbidity (Mancuso et al., 1997).

This study was important since it demonstrated that satisfaction with hip arthroplasty is complex and affected by expectations and outcomes. The major limitation to this study lies in its design. Although the patient assessment questionnaires were designed to be answered in a written format, they were administered during a telephone interview. Therefore, the interview may have introduced bias (Mancuso et al., 1997). There was also a total reliance on the patients’ recall of expectations. The patients’ expectations were not obtained prospectively which would have strengthened the results.

Another study pertinent to this discussion was one recently conducted by Salmon and others (2001). The objective of this study was to provide detailed descriptions of the patient’s perspectives of recovery following joint arthroplasty and then use this information to test two hypotheses: that knee arthroplasty patients reach the same level of satisfaction as those who undergo hip replacement; and that fatigue is prolonged after major joint arthroplasty.

The relevance of this study to the current discussion lies in the use of a VAS, Cantril’s Life Satisfaction Ladder (Cantril, 1965), to measure overall life evaluation from “best possible” to worst possible” (1-10 scale). The researchers found that there was significant improvement in life evaluation by postoperative day 7 and at one month. This study was important in that it demonstrated the use of a VAS to measure patient satisfaction after joint replacement.
Summary of Patient Outcome Literature

Although this literature is difficult to synthesize since outcomes are defined differently in each study, the empirical findings presented above shed light on the use of post-acute care. It represents an attempt to compare patient outcomes across different sites of post-acute care. The research indicates that older patients (Myers et al., 1996; Williams et al., 1994) and the number of comorbid conditions (Kane et al., 1996; MacWilliam et al., 1996) have an affect on outcomes following hip surgery. Although one study showed that race had an effect on outcomes (MacWilliam et al., 1996), the other studies do not support this finding. Several studies showed that the use of home healthcare can have a positive influence on outcomes of the hip arthroplasty patient (Hadley et al., 2000; Intrator & Berg, 1998; Kane et al., 1994, 1998, 2000; Williams et al., 1994), while others found that the post-acute setting made no difference in the level of outcome achieved (Kramer et al., 1997; Mahomed et al., 2000).

The limitations in this area of research are the lack of a consistent definition to quantify and qualify patient outcomes. Each study presented above defined patient outcomes a little differently. This makes it difficult to synthesize the findings across studies. A hip score is routinely used in the patient undergoing a total hip arthroplasty to assess the change in the clinical and functional status of the patient postoperatively (Harris, 1969; Harris & Sledge, 1990; Kavanagh & Fitzgerald, 1985). These functional rating systems give a good functional assessment of the results of hip arthroplasty. Yet the current literature uses multiple methods to measure functional outcomes.

Another limitation was the lack of studies that cited a conceptual framework. There was also a lack of comparison and/or the inclusion of the rural/nonrural
geographical location variable. The studies did not separate patients into geographic subgroups, therefore, preventing an analysis of comparison between rural to nonrural patient outcomes.
<table>
<thead>
<tr>
<th>Author</th>
<th>Study objective</th>
<th>Data</th>
<th>Sample</th>
<th>Type of Outcomes</th>
<th>Instrument measuring clinical or functional outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Williams, Oberst, and Barry (1994)</td>
<td>Comparison of outcomes after hip fracture among women discharged to three different settings: home, long and short term skilled nursing facilities</td>
<td>Patient supplied information and medical record information</td>
<td>women, 60 years of age and older, who underwent repair of a hip fracture at 2, 8, and 14 weeks.</td>
<td>Outcomes were identified as the mobility and mood states of the women in comparison to their prehospital discharge levels.</td>
<td>Functional mobility: ADL subscore measure from the OARS Multifunctional Assessment Questionnaire Mood states: short form of the Profile of Mood States (POMS)</td>
</tr>
<tr>
<td>MacWilliam, Yood, Verner, McCarthy, and Ward (1996)</td>
<td>Identify factors associated with poor outcome after total hip replacement surgery</td>
<td>Data from a national database (AMGA Total Hip Replacement Consortium)</td>
<td>422 patients who were 21 years of age or older, had surgery at one of the 14 participating consortium sites, with consent.</td>
<td>Postoperative levels of pain and physical function</td>
<td>HSQ pain and physical function scores (Ware, 1993)</td>
</tr>
<tr>
<td>Myers, et al. (1996)</td>
<td>Examine relationships among prefracture status, complication development, mobility outcomes at hospital discharge, &amp; hospital discharge disposition</td>
<td>Data abstracted from medical records</td>
<td>Noninstitutionalized elderly patients hospitalized for hip fractures at two Baltimore hospitals during 1992-93. (N= 100, 50 per hospital)</td>
<td>Mobility outcomes: the amount of assistance needed for mobility tasks at hospital discharge.</td>
<td>Operationalized as supine to sitting, standing, transferring and walking</td>
</tr>
<tr>
<td>Kane, et al. (1996)</td>
<td>Compare the differences in outcomes of patients discharged from the hospital to 3 different inpatient settings: skilled nursing facilities, rehabilitation skilled nursing and inpatient rehabilitation units</td>
<td>Database available from larger study</td>
<td>371 Medicare hip fracture patients from 52 hospitals in 3 cities</td>
<td>Outcomes: the functional status of the patient.</td>
<td>Weighted sum of seven components of the ADL (incontinence, bathing, dressing toileting, transferring, feeding and walking).</td>
</tr>
<tr>
<td>Kramer, et al. (1997)</td>
<td>Assess outcomes and costs differences in elderly patients admitted to rehabilitation hospitals, subacute skilled nursing facilities, and traditional skilled nursing facilities.</td>
<td>Data previously collected for a larger study</td>
<td>518 patients with hip fractures from facilities in 17 states</td>
<td>Outcomes: change in functional status</td>
<td>Seven measures of the ADLs</td>
</tr>
</tbody>
</table>
Table 1 (cont’d)

<table>
<thead>
<tr>
<th>Initiator and Berg (1998)</th>
<th>Examine the added benefit of home health services for elderly patients with hip fractures discharged home after inpatient rehabilitation</th>
<th>Medicare claims data from 1% of the 1986 beneficiaries</th>
<th>Total sample: 324 Medicare beneficiaries. Two groups: those who received home healthcare post rehab hospital (n= 129) and those who did not (n=195)</th>
<th>Outcomes: rehospitalization and any nonskilled nursing facility admission during the 12 months after hospital discharge.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mahomed, et al., (2000)</td>
<td>Evaluation of the determinants of the rehabilitation setting (Home based versus inpatient) after total joint replacement (TJR), and its influence on 8 month outcomes</td>
<td>Retrospective chart review (n=146) and mail survey for outcome analysis (n=98)</td>
<td>146 primary TJR patients (47% hip replacements)</td>
<td>Outcomes: Functional outcomes as self-reported on level of pain, stiffness, functions; Short Form 36 for physical function, bodily pain, role physical; patient satisfaction.</td>
</tr>
<tr>
<td>Hadley, et al., (2000)</td>
<td>Estimate the effect of use of home healthcare for 6 mths after hospital discharge on change in functional status over 1 yr. Period</td>
<td>1991-1994 Medicare Current Beneficiary Survey (MCBS)</td>
<td>2,127 Medicare beneficiaries who were hospitalized within 6 months of their annual in-person interviews</td>
<td>Outcomes: Change in ADLs and cost data for Medicare payments for post-acute care which proxies for resource consumption</td>
</tr>
<tr>
<td>Kane, et al. (1994, 1998, 2000)</td>
<td>Analysis of outcomes of different types of post-hospital care for Medicare patients for up to 1 yr. After hospital discharge</td>
<td>Prospective in-person interviews and self report by subjects and medical records</td>
<td>Convenience sample of 1093 patients with diagnosis of hip fracture (n= 606) or stroke (n= 487)</td>
<td>Outcomes: functional status, operationalized by ADLs and IADLs; rehospitalization and mortality, operationalized by self-report and medical record information</td>
</tr>
</tbody>
</table>

ADLs

IADLs
Environmental Factors

Environmental factors are influences that may affect patient outcomes. The literature on environmental factors contains those factors present in the health care marketplace at the time of the study. One of these factors is the geographic patient location. A body of knowledge exists which examines the differences between the access to care afforded to rural versus nonrural populations. Following a review of the definition of rural to be used in this study, the research relevant to the present study is summarized.

Research Related to Rural/Urban Differences

Population differences exist, depending on the place of residence. The population residing in nonmetropolitan areas is older than the metropolitan population (Rogers, 1999). By 1998 the older population accounted for a larger proportion of the total population in nonmetropolitan counties (18 percent) than metropolitan counties (15 percent) (Rogers, 1999).

The fastest growing segment within the elderly populations is the oldest old (85 years and above). The oldest old population in rural areas is growing rapidly, now accounting for 7 percent of those 60 years and older, as a result of aging-in-place, the outmigration of young persons, and the immigrations of elderly adults from nonrural areas (Rogers, 1999). Research on rural elders reveals a population who experience more medical conditions, more functional limitations, a poor perceived health status, higher poverty rates, lower educational levels, more limited transportation and housing resources than their non-rural counterparts (Congdon & Magilvy, 1998a, 1998b; Coward & Dwyer, 1992; Krout, 1994; Yawn, Bushy, & Yawn, 1994). These differences can be barriers and
restrict access to health care. Nursing research has found strong values of hardiness, independence, and family support present in the rural population; these characteristics can attenuate or exacerbate these barriers to care (Magilvy & Congdon, 2000; Magilvy et al., 1994; Schultz, 1997).

Population-Based Studies

There is a growing body of research comparing rural to nonrural populations in relation to their access and use of healthcare services. Among the utilization studies, the findings on rural populations have been mixed. Three studies (Dansky, Brannon, Shea, Vasey, & Dirani, 1998; Rosenbach, Adamache, & Khandker, 1995; Stearns et al., 2000) used data from the Medicare Current Beneficiary Survey (1994) (MCBS) to study access to care and the use of health services. These studies analyzed access while controlling for a number of factors.

Rosenbach, Adamche, and Khandker (1995) analyzed access, use and satisfaction with care before, during, and after the implementation of the Medicare fee schedule (MFS) between 1991 and 1993. Using regression analysis, the aim of this study was to predict the probability of use (for outpatient visits, physician visits, emergency visits and inpatient stays), probability of satisfaction of care (quality, availability and cost) and the volume of physician visits and consultations received. An urban county indicator included in the regressions was statistically insignificant (p > 0.10) in all regressions except for outpatient department visits where urban beneficiaries reported lower use of these services than their rural counterparts. This finding may be explained, however, by differences in the structure of services between urban and rural areas. Specialty services may not have been available in the physician practices but only available in outpatient
departments in rural areas. The analysis sample was also limited to a subset of the MCBS respondents who were continuously enrolled for the period of 1991 to 1994. This sampling strategy may have excluded those persons who experienced the greatest need to access the health care system, including those who died during the years included in the sample.

Dansky and colleagues (1998) used the 1991 and 1992 MCBS to assess the use of hospital, physician, and home health care services used by elders in rural areas. This study sample was limited to 6,698 people aged 65 years and older, who responded to the 1991 and 1992 survey, were interviewed in the community, and were not enrolled in a Medicare health maintenance organization (HMO). Using survey data, the researchers identified differences in hospital days, home health visits and physician office visits across geographic areas. The geographic locations consisted of three categories of metropolitan counties and two categories of nonmetropolitan counties. The researchers controlled for a variety of patient demographics, functional status, and market factors of provider availability. Provider availability was measured by the ratio of hospital beds, ratio of home health providers, and the ratio of SNF beds to the county population. In all, 18 variables were used as covariates and were based on the Andersen and Aday (1974) framework.

An analysis of the geographic location in relationship to provider availability revealed few consistent patterns of health care use. Adjusting for population density, the most rural areas had fewer hospital beds, fewer physicians but far more SNF beds. While a greater number of hospital beds to population ratio in the largest metropolitan areas corresponded to greater use, the largest use of hospital beds was in the metropolitan
fringe areas where the bed supply was lower. Home healthcare provider availability was
greatest in the nonmetropolitan urban areas, yet the use of home healthcare was lowest in
these areas.

Results showed a greater use of home healthcare ($t = 3.058$, $p < .01$) and less use
of physician office visits ($t = 2.223$, $p < .05$) and inpatient hospital stays ($t = 1.763$, $p <
.10$) in rural counties. Residents in the most sparsely populated rural areas received
approximately 3.5 times the number of home health visits as patients in areas classified as
rural but with adjacent urban areas. The authors concluded that home health care
services might provide a ‘safety net’ in remote rural areas with service use exhibiting
patterns of substitution. This study’s major limitation was that the analysis was limited
to available data and did not include HMO enrollees.

A third study, which used MCBS data and is of importance, was one conducted
of 12,637, these researchers examined variations between urban and rural Medicare
beneficiaries in three measures of access: self-reported access to care, satisfaction with
care received, and the use of health care services (Stearns et al., 2000). Building on the
previous two studies discussed, this study was different in design in that it characterized
rural areas differently and used different inclusion criteria to determine the sample.
While the previous two studies used geographic categories that emphasized the
distinction between large and small metropolitan areas, Stearns and associates based
geographic categorizations on a variation of the 1993 Urban Influence Codes (Butler &
Beale, 1994). Since the available data in the MCBS contained too few observations in
some geographic categories, the codes were collapsed into five categories from the nine
included in the original instrument. According to the researchers, these new codes placed more emphasis on city size within rural counties and the adjacency to metropolitan areas (Stearns et al., 2000). This study also increased the number of explanatory variables used to control for variation in the population characteristics including HMO enrollment. Using 1992 Medicare claims data, a scored instrument was developed which represented an individual’s expected relative costliness (health risk) based on the clinical diagnosis.

The analysis of the data, using odds ratios and regression, revealed that, overall, self-reported access to care and the level of satisfaction with care received was not significantly different between the urban and rural Medicare recipient. There were, however, satisfaction ratings on specific aspects of care, including the costs of care and getting care at the same location, which were markedly lower for patients in more rural areas but the sample size was not sufficient to achieve statistical significance. This points to a major weakness in this study. The five geographic subgroups were not comparable in size. The subgroups classified as rural had small samples (n = 457 and n = 720) compared the other three subgroups (n = 9,225, n = 1,026, n= 1,229). Small cell sizes, therefore, may have led to nonsignificant results.

*Rural/Urban Differences in Post-Acute Care Research*

Over the past ten years there has been a small, but growing, body of empirical literature examining rural/urban differences specific to post-acute care. Most of the research published to-date is specific to home healthcare. The discussion below includes more recent research important to this study.
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Rabiner (1995) hypothesized that older adults from more rural areas would use fewer noninstitutional health care services than their urban counterparts and that access to and use of noninstitutional services would vary by region. Embracing the Andersen theory to guide the study, this study used a longitudinal set of data known as the National Long Term Care Survey (NLTCS). The sample (n = 4,182) included Medicare enrollees who completed instruments in both 1982 and 1984.

Using weighted logistic regression, two medical care utilization outcomes (the probability of having a regular source of care and the probability of wanting care but receiving none) and three home/community outcomes (the likelihood of having formal home healthcare, regularly attending a senior center of adult day care, or attending a congregate meal program) were analyzed. The researcher found that the geographic setting in which the resident lived had very little impact on the probability of having formal home health care. This was most likely due to the fact that the geographic locations in this study were condensed into 5 mutually exclusive categories based on population size. By the author’s own admission, these geographic categories “failed to capture the full range and diversity of settings found in urban and rural America…”(p. 263). This was a major limitation to an otherwise well-constructed study using Andersen’s model.

A research study conducted by Clark and Dellasaga (1998) compared self-reported health status, use of services, and unmet health needs of 106 elderly individuals residing in rural and urban areas to determine if these variables differed in geographic location. This study deviated from the previous studies in design. Using a convenience sample (n = 106) of senior center attendees in both rural (3) and urban locations (1) in
Pennsylvania, data for this study was collected using the Elderly Care Needs Assessment Questionnaire (EHC-NAQ) developed by the author (DC). This 54-item questionnaire (for which the authors provided reliability and validity information) was generated from a literature review on rural aging and from earlier work of Aday and Andersen (Aday & Andersen, 1975).

Study findings revealed that although these two groups were geographically different, they were demographically quite similar (Clark & Dellasega, 1998). They differed in terms of health status with rural subjects self-reporting a lower status of health than their urban counterparts. These differences, however, did not alter the use of healthcare services or lead to a perception of unmet health care needs between the two groups. The researchers concluded that location, in relation to the use of perceived need for health services, was not a significant factor in this sample.

The limitation of this study was its sample size and homogeneity of the sample. Although the hypotheses were not supported, this study reinforced the empirical findings that rural persons were significantly poorer in subjective health as measured by the number of reported symptoms (2.46 ± 2.1, t=224, p=. 02) but did not use significantly more services (3.6 ± 3.63, t=1.16, p= .24) (Clark & Dellasega, 1998).

Shultz (1997) conducted a descriptive, comparative study to assess and evaluate the match between formal and informal resource use with the needs of rural and urban elderly during a 21-day period following hospital discharge to home (Schultz, 1997). Based on the person/environment fit framework (Broadhead et al., 1983), this sample consisted of a convenience sample of 41 rural and 40 urban participants recruited from three rural and one urban hospital discharging patients in two frontier counties and the
largest urban county in a rural state. There were no significant differences between the
two groups in the demographic variables (p< .05).

Using a questionnaire designed for this study, needs and the utilization of
resources were assessed at three days (T1) and then at three weeks (T2) after hospital
discharge. Data were collected using face-to-face interviews at T1 and telephone
interviews at T2. Using repeated measures of analyses of variance, there were
significantly fewer needs identified at the three-week time point. In this study, unlike the
findings of Clark and Dellasega, rural residents had more skilled needs than their urban
counterparts. This finding is supported by earlier research where rural residents reported
more incapacities but fewer days restriction to bed (Coward & Dwyer, 1992).

Magilvy and Congdon (2000) conducted one of the most recent research studies,
which examines the care of rural elders. This qualitative research, using an ethnographic
approach, explored the health care transition experienced by rural elders in Colorado as
they transitioned over a four-year period across differing levels and types of health
care. This study was the final phase in a larger, 10-year, ethnography of this
geographical area (Congdon & Magilvy, 1998a); (Congdon & Magilvy, 1998b).

The sample was comprised of elders (n=49), family members, community leaders,
and health care providers for a total of 175 people. The researchers found that, although
the availability of health services is improving in rural areas, barriers such as distance,
geography, and poor distribution of services still exist. One finding, relevant to this
discussion, was the strength of home health care. The researchers found that some of the
best continuity of care was in the provision of home health care. Home health care
agencies were reported to consistently facilitate seamless transitions across the continuum of care (Magilvy & Congdon, 2000).

**Market Variables**

Market variables include characteristics of home healthcare agencies, skilled nursing facilities, and inpatient rehabilitation facilities present in the environment. The body of work relevant to this study is summarized below and presented in Table 3.

While the research evidence is limited, there is a small body of work that suggests that substitution of home healthcare services for skilled nursing facility services takes place, especially in areas where skilled nursing facility beds are limited (Kenney & Moon, 1997; Kenney & Dubay, 1992; Swan, Black, Benjamin, & Fox, 1995). Researchers have also found a positive relationship between the number of home visits per recipient and the number of home health agencies in the same geographic area (Swan & Benjamin, 1993).

Conversely, there is evidence of an inverse relationship with the supply of skilled nursing facility beds when examining the number of Medicare recipients who use home health care services in specific geographical areas. A seminal work by Kenney and Dubay (1992) showed that patients were more likely to receive post-acute care in a skilled nursing facility if there were more beds available (Kenney & Dubay, 1992).

A study by Gage (1999) confirmed Kenney and Dubay’s findings. Using 1995 Medicare claims data, Gage found that the use of services varied by geographic region of the country. Regional variation in post-acute use revealed that inpatient rehabilitation hospital use was greatest in the West South Central States (Arkansas, Louisiana, Oklahoma, Texas), which, along with the East Central South Central division, had
extremely high home healthcare use. In fact, the home healthcare use in the above divisions were more than two times greater than the national average and 50 percent greater than that of New England, which had the third highest home healthcare use rate. These higher utilization rates were offset by lower than average skilled nursing facility use (Gage, 1999). This could be correlated with the supply of services although the author stated that other geographic differences such as managed care penetration and local practice patterns could account for the differences (Gage, 1999).

The Middle Atlantic States also had a high use of inpatient rehabilitation facilities but lower-than-average SNF and home healthcare use. The author attributed this difference to a substitution of rehabilitation services for SNF and home healthcare services. In contrast, the Pacific and Mountain divisions had lower-than average rates of use of post-acute services overall. The author attributed this to a higher managed care penetration and changing practice patterns although differences in availability could explain this difference (Gage, 1999).

Home healthcare agency-level influences were found significant in previous research including agency ownership and affiliation of the agency with a larger health system (Goldberg & Schmitz, 1994; Kenney & Dubay, 1992; Williams, 1994). It has been shown in a study of ownership, generally measured as not-for-profit versus proprietary, that Visiting Nurse Associations (VNAs) are associated with higher numbers of Medicare beneficiaries as recipients of home health services (Kenney & Dubay, 1992). Proprietary agencies were also associated with a higher use of services per user, higher expenditures and a higher number of visits per week (Kenney & Dubay, 1992; Williams, 1994). Additionally, there is some evidence that hospital-based agencies provide fewer
visits per home healthcare episode than non-affiliated agencies (Goldberg & Schmitz, 1994). For all of the aforementioned research, there are no studies post-PPS implementation, thus it is impossible to draw conclusions for the current era.

*Appraisal of Research in this Area*

The literature related to environmental factors is very mixed and limited to the marketplace characteristics of home healthcare and skilled nursing facilities. Later studies seem to contradict earlier findings since, in the absence of differences in sampling techniques, the cause could be the changing market environment related to home healthcare. As the provision of home healthcare moves to a more fiscally prudent method of delivery, the change in the reimbursement structure may account for the change in market variables. While there is not empirical evidence at this time, the changes in the reimbursement structure have been so dramatic to suggest this as the likeliest scenario.

Table 3

<table>
<thead>
<tr>
<th>Study</th>
<th>Ratio of number of home health visits to number of home healthcare agencies in same geographic area</th>
<th>Increased home healthcare service where skilled using facilities are scare</th>
<th>Proprietary agencies have a higher use of services per patient</th>
<th>Facility-based agencies have a shorter episode of care than free-standing agencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kenney &amp; Dubay (1992)</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>+</td>
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<tr>
<td>Swan, et al. (1993)</td>
<td>+</td>
<td>+</td>
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<td>Goldberg (1994)</td>
<td>+</td>
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<td>Williams (1994)</td>
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<td>Welsh (1996)</td>
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<tr>
<td>Kenney &amp; Dubay (1997)</td>
<td></td>
<td>+</td>
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<tr>
<td>Torrez, et al. (1998)</td>
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</table>

Note: The symbol + indicates a significant positive relationship; - indicates a significant negative relationship; NS means not significant.
Patient/Family Determinants

Patient/family Characteristics

There is a growing body of research that uses the Andersen Model to examine patient/family characteristics (Branch et al., 1981; L. Branch et al., 1988; Evashwick et al., 1984) and the link between home healthcare resource consumption and patient outcomes (Fortinsky & Madigan, 1997; Lui, Wissoker, & Rimes, 1998). An early study by Branch et al. (1981) included the evaluation of characteristics that explained elders’ use of home health care. Using multiple regression analysis, the researchers found that the predisposing determinants of care accounted for only 1.4% of the variance in the number of home services used, with educational level ($\beta = -.07$) and age ($\beta = .08$) being the significant variables ($p = .05$). Enabling characteristics accounted for 4.1% of the variance with Medicaid ($\beta = .07$) and barriers to transportation ($\beta = -0.19$) as significant. Need characteristics accounted for 17.7% of the variances with the ability to climb stairs ($\beta = .07$), perceived health status ($\beta = .07$), and ADLs ($\beta = .36$) significant. The summary total of all significant variables accounted for 23.3% of the variance in the number of home services used (Branch et al., 1981).

The work of Evashwick and colleagues (1984), using the Andersen framework, analyzed the same data as the Branch study but examined the number of services as a continuous variable. For the predisposing variables, being older, having less education, belonging to a racial minority, and being unmarried were associated with a higher correlation of use of home services. Enabling variables, which were associated with a higher correlation of services, included having a lower income, having barriers to transportation, and having Medicaid as the payer. Need characteristic variables of poorer
health status and higher level of functional impairment had higher correlations of service use. Need variables explained 13% of the variance while predisposing and enabling variables explained 3.5% of the variance. Combined variables accounted for 13% in the variance in the number of services used (Evashwick et al., 1984).

These two studies relied on a small sample of home care patients to generalize about the entire State of Massachusetts. While this work is important for the use of the Andersen model as a theoretical basis to guide home health care research, relevance to the present study is limited by the time frame in which it was done and the subsequent change in health care system.

A study by Cummings and colleagues (1988) was aimed at determining whether the presence of social support influenced the recovery of function among patients who suffered hip fractures. A sample of 111 patients with hip fractures was interviewed and underwent a physical examination prior to hospital discharge. Functional status was then assessed at 6 months. The researchers found that patients who had a greater number of social supports had a more complete recovery of their prefracture level of function ($r = 21; p = .04$). This association remained strong even when adjusting for other predictors of recovery: arm strength, mental status, and serum albumin (nutritional variable) (Cummings et al., 1988).

In one of the most recent studies published, Lui, Wissoker, and Rimes (1998) studied the determinants and costs of Medicare post-acute care, specifically care provided by SNFs and home healthcare agencies following hospital discharge. Using the Andersen framework, these researchers built upon previous work in this area. This analysis was based on data from the 1991 Medicare Current Beneficiary Survey of
patient characteristics, and 1992-93 Medicare claims data. They analyzed market
variables with data from the Medicare and Medicaid Automated Certification System
(MMACS). The sample consisted of 3,379 elders (65 and older) and a subsample of
1,195 people for the analysis of SNF versus HHC service use (Lui et al., 1998).

The study found that beneficiaries, who were older, more disabled and had less
informal support were more likely to use formal post-acute services. The researchers
reported that in the total sample, 63.1% had no post-acute services, 13.2% had only SNF
stays, 22.2% had only home healthcare services, and 1.6% had both SNF and home
healthcare services. The study also found that those with more characteristics of “frailty”
were more likely, and appropriately so, to use formal post-acute services (Lui et al.,
1998).

This study’s main limitation lies in the use of an administrative database for the
sample. Additionally, the multivariate analysis for use of post-acute services did not
separate out SNF from home health care even though the aim of the study was to examine
the determinants of each type of service use relative to the others.

In addition to the studies that use Andersen’s framework, a recent study by
Torrez, Estes, and Linkens (1998) examined whether need was predictive of home
healthcare. Data for this study was derived from a larger study funded by the Pew
Charitable trusts and the University of California, San Francisco. Data used for this study
were derived from an initial study whose purpose was to collect agency and client level
data to examine the long-term effects of the home healthcare policies at both the agency
and client level (Torrez, Estes, & Linkens, 1998). The sample for this study was derived
from two of the five original study sites (California, Pennsylvania, Texas, Florida, and
Washington): Philadelphia and San Francisco. From these two geographic locations a subset of eight home health agencies were selected based on the size of the agency. The rationale was that the largest agencies would be able to have the largest portion of representative services. Data on agency-level variables were collected by interviews with agency personnel while the client-based need variables were taken from medical record information.

A regression model examined the client characteristics predictive of care. The model explained 21% of the variance. The only significant characteristic was race ($p<.05$), with whites receiving more home healthcare than non-whites. Age and functional status were not significant predictors of care. This study’s weakness is that it lacked a published theoretical framework. No rationale was given, nor past research cited related to the variables of interest chosen for inclusion. Additionally, the sample was biased by design since the home healthcare agencies chosen for the study were the largest in the two cities. Size alone may not be representative of the home health agencies in those geographic regions.

Other Contributions to the Literature

The studies summarized below are discussed in relation to the specific variables related to the present research study. They are presented in relation to the concepts contained in the Andersen model. They are summarized in a tabular form in Tables 4 (predisposing factors) and 5 (enabling factors).

Predisposing Factors

Age, female gender, and non-white ethnicity have been positively associated with post-acute care use (Branch, Goldberg, Cheh, & Williams, 1993; Coughlin, McBride,
Perozek, & Liu, 1992; Kemper, 1992). The literature is, however, mixed on these
determinants of care (Table 4).

There have been several early studies that have concluded that males and those
identified non-whites are more likely to receive home healthcare (Evashwick et al., 1984;
Kane et al., 1994; Swan et al., 1995). These differences can be explained. In the study
by Kane et al (1994) and Swan et al., (1995) the sample population differed from earlier
studies, which used a national database. These two studies used samples from specific
geographic areas. The findings by Evashwick et al. (1984) may be explained by the
concept of home healthcare use. In the Evashwick study, the concept of home healthcare
use referred to the number of visits, not the number of episodes of home healthcare.

A more recent study by Forrest and associates (1999) was aimed at determining
the rates of referral to inpatient rehabilitation units following a trend of decreasing length
of hospital stay post joint arthroplasty. The data were analyzed using logistic regression
methods to determine which of the independent variables (patient age, the physical status
scale of the American Society of Anesthesiologists (ASA score) and living situation)
affected the outcome defined as the place of hospital discharge (home versus inpatient
rehabilitation unit).

The researchers found that those who were older, lived alone, had higher
comorbidity scores, and less informal support were more likely to be admitted to
inpatient rehabilitation units following joint replacement surgery than younger patients
with greater support networks (Forrest et al., 1999). This study was limited in that it did
not identify rural versus nonrural subgroups. It also used the ASA Physical Status Scale
(Heard & Stevens, 1994) as the measure for comorbidity whose reliability for use as a tool in this setting has not been established.

Table 4

Past Research on Predisposing Factors

<table>
<thead>
<tr>
<th>Study</th>
<th>Type of predetermining factor</th>
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<tbody>
<tr>
<td></td>
<td>Age</td>
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<tr>
<td>Branch (1981)</td>
<td>+</td>
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<tr>
<td>Evashwick (1984)</td>
<td>+</td>
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<td>Branch (1988)</td>
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<td>Kemper (1992)</td>
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<td>Coughlin (1992)</td>
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<tr>
<td>Branch et al. (1993)</td>
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<td>Kane et al. (1994; 1998; 2000)</td>
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<tr>
<td>Swan (1995)</td>
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<tr>
<td>Torrez et al. (1998)</td>
<td>NS</td>
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<tr>
<td>Lui et al. (1998)</td>
<td>+</td>
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<tr>
<td>Forrest et al. (1999)</td>
<td>+</td>
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</table>

Note: The symbol + indicates a significant positive relationship; - indicates a significant negative relationship; NS means not significant.

Enabling Factors

Payor source. Enabling variables include the type of Medicare insurance plan. The amount of empirical literature comparing Medicare to Medicare managed care patients is very small. However, there is evidence to support that those covered by a Medicare managed care product were found to use fewer home care resources (Experton, Li, Branch, Ozminkowski, & Mellon-Lacey, 1997; Holtzman, Chen, & Kane, 1998; Shaughnessy, Schlenker, & Hittle, 1994; Shaughnessy, Schlenker, & Hittle, 1995; Torrez et al., 1998). For example, the Shaughnessy group (1994; 1995) found that Medicare
HMO patients had a lower number of visits and fewer visits per week during the first 60 days. There was also lower case-mix intensity in the HMO patients leading the researchers to suggest that this occurs because the HMOs are not bound by the patient-specific eligibility criteria for Medicare patients. Therefore, less intensively ill patients enter the home healthcare system (Shaughnessy et al., 1995).

Experton and others (1997) examined the impact of payor and provider type on health care use and expenditures in the elderly. This study compared Medicare fee-for-service, Medicare HMOs and dual Medicare-Medicaid enrollment using a convenience sample of 450 elderly patients of a home healthcare agency. There was no difference in expenditures between the fee-for-service and HMO patients. The Experton group reported no difference in access to home health care but did find that the HMO group received significantly fewer visits (71%) than the fee-for-service group and 62% fewer visits for than the Medicare-Medicaid patients. These findings were consistent with the study by Shaughnessy and others (Shaughnessy et al., 1995).

An important study was conducted by Holtman, Chen, and Kane (1998) which compared home healthcare outcomes for HMO and FFS Medicare patients after hospitalization for stroke, pulmonary disease, congestive health disease, hip replacement, or hip fracture while controlling for the site of post-acute care and other patient characteristics. Patients were identified prior to hospital discharge and followed for one year. Outcome measures included weighted ADL scales and hospital readmissions. The independent variables were the site of post-acute care (home with no formal services versus home with formal services versus SNF), HMO status, comorbidity, severity, and demographic factors.
The sample used was a subsample of a larger work (Kane et al., 1994). Using a convenience sample drawn from nineteen acute care hospitals in Minnesota, a total of 970 subjects were studied, 211 of whom were discharged to home healthcare. Two types of data, patient interview and medical record information, were collected. Analysis of the data comparing other discharge sites to home healthcare found that HMO patients were more likely to be discharged to a SNF than to home (OR = 1.7, 95% CI, p = .015), than those discharged to home with no services (OR = 1.39, 95% CI, p = .083), or those discharged to a rehabilitation facility (OR = 1.00, 95% CI). Outcomes results showed that, after controlling for the site of discharge and patient characteristics, there was no statistically significant difference in ADL function at 6 weeks or at 6 months between the FFS and HMO patients. Additionally, there was no statistically significant difference in the rate of rehospitalization between these groups for the same time periods (Holtzman et al., 1998).

While this study concluded that outcomes of Medicare HMO patients discharged to home healthcare are not worse than FFS patients, the study reinforced the earlier studies by the Shaughnessy (1994) and Experton (1997) in that the payor type contributed to the difference in the utilization of home healthcare services. The significant limitation in the Holtzman study is that it was limited to the state of Minnesota and therefore not able to be generalized nationally. The rate of managed care penetration and the types of managed care products vary and may have affected the results.

A study by Torrez, Estes, and Linkens (1998), designed to examine the need characteristics, also found that payor source was positive in predicting the number of home healthcare services received. In this study, traditional Medicare patients received a
higher number of services. This could be explained, however, by the small sample of nontraditional Medicare patients included in the study (5.3%) and the higher intensity of illness reported in the traditional Medicare population (Torrez et al., 1998). The limitation of all three of the studies is that they did not examine differences in initial access to home healthcare following an acute hospitalization.

The recent study, by Angelelli, Wilber, and Myrtle (2000), compared skilled nursing facility rehabilitation treatments and outcomes for Medicare managed care (MCO) to those patients who were under a Medicare fee-for-service (FFS) reimbursement system. The study use a retrospective data set of Medicare MCO patients (n=514) and Medicare FFS patients (n=420) patients age 65 and older who were admitted over a 26 month time period to one of four for profit SNFs owned by a post-acute provider operating in Southern California.

The researchers controlled for time since onset (date of hospital admission until date of admission to the SNF), sociodemographic characteristics (marital status, age) and health status variables (comorbidity, hip fracture or stroke diagnosis). The researchers theorized that the two groups would differ in time since onset, yet not differ in demographic characteristics or health status measures after stratification. They hypothesized that if they controlled for time since onset and other treatment and sociodemographic conditions (age, sex, marital status, comorbidities and diagnosis) the MCO patients would have shorter lengths of stay in SNF-based rehabilitation programs, receive significantly fewer units of therapy per day, and consequently fewer total units of rehabilitation.
Using bivariate and multivariate regression models, the Medicare MCO patients were found to have significantly fewer therapy sessions and shorter lengths of stays than the FFS patients. However, there were no significant differences in the level of function recovery achieved at SNF discharge between the two payment groups (Angelelli, Wilber, & Myrtle, 2000).

This study had some limitations that are significant when interpreting the results. The FFS patients in this study may have been sicker and required more resources as evidenced by the large difference in the time onset between the two groups and the discharge dispositions post SNF (even when controlling for comorbidity). More MCO patients returned home following their rehabilitation in the SNF while the FFS patients had a higher rate of hospital readmissions during the rehabilitation period studied. If some patients were sicker, then this would account for the statistically significant findings previously reported.

*Family support.* The presence and pattern of informal caregiving affects the use and the amount of post-acute healthcare services rendered. But this informal assistance is difficult to measure and has not been extensively examined in relation to home healthcare. There does exist, however, a small body of relevant research in the literature.

There is some evidence that patients with more family support are less likely to use home care services (Coughlin et al., 1992; Kemper, 1992). Kemper (1992) found that living with a spouse resulted in less hours of formal care. Coughlin et al. (1992) similarly found that living with a spouse or a relative resulted in less care by formal providers. A qualitative study by Magilvy, Congdon, and Martinez found that rural cultural norms encouraged and supported family management of caregiving activities when possible.
(Magilvy et al., 1994). The researchers also found that informal caregivers included members of the community as well as the traditional family members.

Table 5

Past Research on Enabling Factors Related to Post-Acute Care Use

<table>
<thead>
<tr>
<th>Study</th>
<th>Low income</th>
<th>Transport barriers</th>
<th>Medicaid as payor</th>
<th>Managed care participant</th>
<th>Lack of family support (caregivers)</th>
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<tr>
<td>Branch (1981)</td>
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<td>Evashwick (1984)</td>
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<td>Shaughnessey et al. (1994)</td>
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<td>Experton et al. (1997)</td>
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<td>Torrez et al. (1998)</td>
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<td>Holtzman et al. (1998)</td>
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<td>Angelelli et. al (2000)</td>
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</table>

Note: The symbol + indicates a significant positive relationship; - indicates a significant negative relationship; NS means not significant.

Need factors

The construct of severity of illness is multidimensional, taking into account disease- and patient-specific characteristics. This construct includes the concepts of severity of the primary diagnosis, number and severity of comorbid diagnoses, acute physiologic stability, functional status, and resource needs (Romano, Roos, & Jollis,
Severity of diagnosis is statistically controlled in this study, therefore the following discussion will focus on the other concepts contained in the construct of severity of illness. Since the need characteristics in the present study are operationalized by the health status measures of the physical function, a hip score, and the level of preexisting health conditions, comorbidity, a review of the literature relevant to these two concepts will be discussed below. Of note, much of this research is dated; it is included here because of its seminal nature.

In the Andersen model, need characteristics may be operationalized with a series of health status measures. The first measure refers to the stability in functional abilities. In general, Medicare beneficiaries in skilled nursing facilities have a higher total number of functional limitations than those who receive home healthcare services (Murray & Shatto, 1999). The first measure refers to the stability in functional abilities.

The functional status is also a factor associated with home care use (Branch et al., 1981; L. Branch et al., 1988; Coughlin et al., 1992; Evashwick et al., 1984). A study by Branch et al. (L. G. Branch et al., 1988) found that the strongest predictors of home healthcare use were functional status measures: the Katz (1963) ADL scale and the Rosow-Breslau scale (Rosow & Breslau, 1966). Persons who needed help in one of the six ADLs had 6.2 times the relative risk of using services. Those persons unable to do one of the Rosow-Breslau tasks, which measure the ability to walk a half-mile, climb stairs and do heavy housework, had a relative risk of 5.5 compared to those who were independent in these tasks. This 1988 study confirmed earlier findings by the same research group (Branch et al., 1981). The limitations of this study were the specific
geographic sample included and the researchers use of analysis of relative risk in the absence of dichotomous variables.

Coughlin and colleagues (1992) used data from the 1982 National Long term Care Survey to examine predictors of home healthcare. Based on interviews with community-dwelling, disabled elderly, the dependent variable of interest was the number of in-home visits per week provided by paid providers during the week prior to the interview. An interesting finding was that as the number of functional limitations in ADLs increased, the probability of in-home formal service use increased (Coughlin et al., 1992). The strength of this study is that it was based on a national sample and highly generalizable. The limitations were that it did not separate out profession from nonprofessional help and since the survey was limited to services used in the previous week, the number of persons identified as using formal services may not be reflective of the percentage population as a whole who use in-home services.

*The Relationship Between Comorbidity and Post-Acute Care*

The physiologic status of the patient is important in determining post-acute needs. While there are several concepts that operationalize physiologic status, the concept of comorbidity is relevant to this study and will be discussed. Very little research directly assesses a patient’s preexisting associated comorbidities in the post-acute care literature. There are, however, several studies that identify specific comorbidity indices used. The first is a study by Kane, et al., (1996) which used a comorbidity score (Iezzoni, Schwartz, & Burnside, 1989), which measured the comorbidities in a study aimed as estimating outcome differences in post-hospital care in Medicare patients. The sample includes several subgroups, including patients who underwent surgical hip procedures. Using a
single score measure with a range of 0 to 20 points, there was a significant correlation between the presence of comorbidity and the post-acute discharge location, whereas those with the lowest comorbidity score went to an inpatient rehabilitation facility, those with middle range scores were discharged to a rehabilitation skilled nursing facility (defined based on staffing levels and the opinion of an expert panel) and those who had the highest comorbidity scores were discharged to a traditional skilled nursing facility.

Two studies, one by Koval and associates (1996) and another by Forrest and his colleagues (1999), used the ASA Physical Status Scale (Heard & Stevens, 1994) to measure comorbidity in joint replacement patients. In both studies, the ASA scale, designed to evaluate general physical condition and level of functioning as an indicator of operative risk, was used as a measure for comorbidity. In the Koval study, the number of comorbid conditions present before the fracture was also collected. Neither the ASA score nor the number of comorbid conditions predicted whether the patient regained independent living status at 3, 6 or 12 months post-hospital discharge. In fact, patients who had 3 or more comorbid conditions were more likely to regain their prefracture independence at all three time points. The researchers attributed this finding to the lack of control of potential cofounders in the multivariate analysis (Koval, Shovron, Polatsch, Aharonoff, & Zuckerman, 1996). Forrest, Roque, and Dawodu (1999) were specifically interested in whether the ASA scale could be a useful indicator of comorbid illnesses that affects the need for rehabilitation services. The main outcome measure in this study was discharge to home or to a rehabilitation unit. The researchers concluded that those with higher ASA scores (i.e. greater comorbid states) required admission to an inpatient rehabilitation unit as opposed to returning home.
Summary of the Literature on Patient/family Characteristics

This area of literature, as related to post-acute research, is very difficult to synthesize. While many studies use patient characteristics as variables, they are often operationalized differently, therefore making any attempts to synthesize the literature difficult.

The research does show that age (Branch et al., 1981; L. Branch et al., 1988; Branch et al., 1993; Coughlin et al., 1992; Evashwick et al., 1984; Forrest et al., 1999; Kane et al., 1994, 1998, 2000; Kemper, 1992; Lui et al., 1998; Swan et al., 1995; Torrez et al., 1998) and female gender (L. Branch et al., 1988; Branch et al., 1993; Coughlin et al., 1992; Kemper, 1992) are a predisposing determinant of care. While low income was significant as an enabling resource for the use of post-acute care in earlier studies (Branch et al., 1981; L. Branch et al., 1988; Coughlin et al., 1992; Evashwick et al., 1984; Kemper, 1992), it was not significant in studies published after 1992.

The frequent use of administrative databases and the lack of qualitative research in this area of research are also a problem. The limitations of survey data are apparent when the objective of many of the studies is to identify characteristics and the interaction between them and the use of post-acute services. An infusion of qualitative research or research using a triangulated approach would bridge the knowledge gap.

Research in this area lacks consistent use of established health status measures, particularly comorbidity measures. This left a large gap in understanding whether these characteristics make a difference in the use of home healthcare and patient outcomes.
The Measurement of Access to Care

Since a major goal of the Anderson behavioral model is to define and measure access to health care, a discussion related to the concept of access is important to include in the review of the literature. Access, for the purposes of this discussion, will refer to realized access (i.e., actual use) since this was a focus of the study.

Dimensions of Access

Access, conceptualized as the ability to use health services, has been operationalized in a variety of ways, including geographic distance to receive health care, the type and extent of barriers to health care (e.g. lack of insurance), and the type of health care services available and/or utilized.

During the 1980s and early 1990s, the measurement of access to care heavily relied on population-based surveys. Surveys of individuals and households have been a key mechanism for evaluating access to care. These survey initiatives, both federally and privately sponsored, provide the seminal work in measuring and monitoring access to care.

Population-based surveys

A number of federally sponsored surveys have provided estimates about Americans’ ability to obtain health care (Adler, 1994; Cohen et al., 1996; Kemper & L. Blumenthal, 1996; National Center for Health Statistics, 1997). The focus of these studies is on entry to systems of care as measured by whether a physician was seen during the year or whether individuals reported a usual source of care. This focus explicitly addresses people “outside the system” and draws attention to the risks of inadequate access to needed care by those without adequate health insurance and for
other vulnerable populations (Kasper, 1998). Vulnerable subgroups have generally been represented in these studies defined by characteristics representing social disadvantage (age, race, and income). By definition, the data in these studies represent the national population with tremendous variability in the samples. Six of the most significant federal population-based survey studies are presented in Appendix A.

In addition to the government-sponsored research on access, several private foundation studies made important contributions to the literature (Berk, Schur, & Cantor, 1995; Donelan, Blendon, & Hill, 1996; Kenney & Moon, 1997; Lake & Peter, 1997) (Table 1). Among these, one of the best known is the Robert Wood Johnson Foundation (RWJF) National Access to Care Survey in 1976, 1982, 1986, and 1994 (Berk et al., 1995). The goal of this survey was to gather information on the ability to obtain health care according to the perceptions of Americans. Interestingly, the 1994 version of the survey used five measures based on Andersen’s behavioral model.

The Kaiser Family Foundation sponsored a survey, Getting Behind the Numbers (GBN) (Donelan et al., 1996). This study, as well as the National Survey of America’s Families (NSAF) (Kenney & Moon, 1997) sponsored by multiple sources under the guidance of the Urban Institute, emphasized identifying those in managed care insurance plans, types of coverage, and limits imposed on the choice of physician or hospital.

The Community Tracking Study (CTS)/Household Survey (1997) conducted by the Center for Studying Health System Change, was also funded by the Robert Wood Johnson Foundation (Lake & Peter, 1997). Unlike the National Access to Care Survey, this survey’s aim was to track changes in the health care system and assess how those changes affected individual and the communities they lived in (Kemper & L. Blumenthal,
Boyer 1996). CTS was an expanded study in comparison to earlier studies since it tracked health system effects on insurance coverage, access, service type and the delivery, cost and quality of care.

Summary of Access Literature

The majority of the research efforts focused on evaluating access to health care have used administrative databases. While these studies have made a valuable contribution in identifying descriptive variables, there are troubling questions about the validity of comparisons. The salient issues surrounding this literature include the variations in the conceptual definitions of access and rurality and the quality of the data used.

There is a lack of a consistent conceptual definition of access. The concept of access has evolved over time and shifts according to health policy concerns. Traditional access frameworks are invaluable in focusing on the historical measures of access, like insurance coverage and other barriers to system entry (Gold, 1998). In the literature presented above, which is summarized in Appendix A, the definition of access was not always clearly defined. This created a disadvantage in the interpretation of the research since the concept was not always clearly defined.

Summary of the Relevant Literature for the Study

There is evidence that differences exist between rural and nonrural patients with literature based largely on samples taken from administrative databases. This type of research is valuable in gaining knowledge about systems of care and the structure or process of care. It allows for insights into barriers to access for subgroups defined by gross measures of socioeconomic or insurance status. Yet survey data and the use of
administrative databases for research purposes has limitations. It does not provide specific information to enable the researcher to examine access to care within these systems while controlling for practice patterns or specific market variables that may be present in the population. The use of this data also makes replication of the studies with different or even the same populations difficult because so much of it is tied to claims data which many times does not hold information on patient or family characteristics. The most significant gap in the literature was that there was no current research in the post-acute setting which takes into account geographical differences while controlling for patient/family characteristics including attributes that enable or hinder the use of post-acute home healthcare services and attributes of the individual’s level of evaluated health status. The present study was intended to fill this gap. As well, the present study provides new information for comparison with studies conducted prior to the change in reimbursement for home healthcare services, skilled nursing services, and inpatient rehabilitation facilities. Much of the literature presented in the preceding discussion was based on the data from the 1980s and early 1990’s. With the changes in the cost and regulatory provisions related to post-acute healthcare, the present study was designed to add to the post-PPS healthcare knowledge base.
CHAPTER III

Methodology

The purpose of this study was to determine if elderly rural patients, when controlling for patient-specific characteristics and the structure of availability of services, were more likely to experience different types of post-acute care and clinical and functional outcomes than a comparable nonrural population. This chapter presents the methodology made for the study.

Study Design

The design chosen for this study was a non-experimental, exploratory correlational design. The main objective of an exploratory design is to discover relationships (Polit & Hungler, 1999). This study was exploratory and correlational in design since it sought to discover and describe the relationship between the site of post-acute services and outcomes in a sample of elderly subjects who had undergone major hip arthroplasty.

Sample

Sample Selection

The nonprobability sample used for this study was a convenience sample using retrospective data. The sample was chosen from eligible subjects who were identified using patient databases maintained at the Mayo Clinic Medical Center, Rochester, Minnesota. Subjects with hospital admission dates of October 1, 2001 or after were included to reduce the influence of reimbursement changes that were happening in post-acute care. The database lists every person with a Mayo Clinic medical record and whether they have authorized the use of their medical record information for research
purposes. Only those eligible subjects registered in the patient registration system who had authorized use of their medical record information for research studies were included. Those patients whose research status code equated to ‘No’ were not included in the data.

Setting

The Mayo Clinic Medical Center in Rochester, Minnesota is an integrated medical center. Mayo's two Rochester hospitals have more than 1,800 beds for patients needing hospitalization. Extensive programs in medical research and education support patient care. The Department of Orthopedics is a multispecialty, interactive group practice that provides care for over 66,000 patients annually. Within this department, the Division of Adult Reconstruction specializes in the surgical treatment of bone and joint disorders.

Inclusion Criteria

Patient inclusion criteria for this study were: a primary diagnosis of major hip arthroplasty, age 65 and older with Medicare as the primary insurer. Patients discharged from the institution during the study timeframe, who met the payer, state of residence, and diagnostic criteria, and had medical record research authorization were included.

Subjects with a commercial primary source of insurance were excluded since private insurance eligibility criteria/benefits for post-acute care vary widely between insurance plans and may have introduced elements that could confound the findings. Those who were dually eligible for Medicare and Medicaid were included. Subjects with Medicare as their primary source of health insurance were selected since 61% of total hip replacement surgeries (ICD-CM 815) are performed on those age 65 and older and
accounted for over $3 billion dollars in Medicare reimbursement nationally in 2000 (Centers for Medicare and Medicaid Services, 2000).

Only subjects with primary surgical procedures, as opposed to arthroplasty revisions, were included in the sample since those with previous operative treatment are prone to more extensive surgery and post-operative complications (Canale, 1997; Weber, Berry, & Harmsen, 1998). Additionally, persons with terminal conditions whose care was primarily palliative were excluded because of the difference in focus between restorative and palliative health care.

To identify the geographic location of the patient’s primary home residence, the US Department of Agriculture (USDA) classification of rurality, the rural-urban continuum code (RUCC), was used (Beale & Johnson, 1995; Butler & Beale, 1994). RUCC classifies all U.S. counties into ten categories. RUCC allows county data to be broken into sub-groups beyond the basic metropolitan/nonmetropolitan classification. The nonmetropolitan levels described by the USDA are urbanized, less urbanized, and thinly populated (Ricketts, Johnson-Webb, & Taylor, July 1 1998). This method improves the identification of specific location that would not be identified in the simple designation of counties as either metropolitan or nonmetropolitan. RUCC defines small towns as rural locations, based on the argument that small towns are more like rural areas than they are like heavily populated urban areas.

**Determination of the Sample Size**

Calculating sample size requires knowledge of the level of significance, power, and effect size. Cohen (1988) has identified four parameters of power: significance level,
or alpha; sample size, effect size, and power. By estimating each of these parameters prior to conducting a study, power can be controlled by the researcher (Cohen, 1988).

The sample size estimate for this study was determined using G* Power Analysis (Faul & Erdfelder, 1992). This is a software program that performs statistical analysis based on Cohen (Cohen, 1988). A sample size of 68 in each group was necessary for a statistical power of .80, using an $\alpha$ of .05 and a medium effect size of .20 (Faul & Erdfelder, 1992) for statistical analysis using ordinal logistic regression based on 14 predictors. Therefore, at least 136 subjects were required, approximately half from a rural area and half from a non-rural area.

Data Collection

Data Preparation

An information support statistician assigned to the study from the Mayo Foundation Department of Health Services Research sequentially extracted the data according to the above inclusion criteria until sufficient numbers in each group were obtained. These data were supplied to the investigator in an electronic common tab-delimited file that could be entered directly into the Statistical Package for the Social Sciences (SPSS). Once subjects were identified, non-electronic medical record information was requested from the medical records department at Mayo Clinic Medical Center, Rochester.

The Area Resource File (ARF) was purchased from Quality Resources Systems, Incorporated (QRS), which maintains the file system under contract to the Office of Research and Planning, Bureau of Health Professions within the Health Resources and Services Administration of the U.S. Government. The file, which uses a SAS definition,
was modified for use with SPSS. The ARF provided the variables for the geographic availability of post-acute services.

Variables and Measures

This section discusses the variables chosen for the study. Under each of the constructs, concepts are identified and each corresponding variable is defined and operationalized by its empirical indicator. A schematic model of the conceptual framework, including the operationalized variables and the location sources of the data collected is presented in Figure 3 below.

Figure 3. Schematic Model of Present Study
Post-Acute Discharge Resource Consumption

Type of post-acute care received. Level of post-acute care received was categorized as: (a) admitted to a skilled nursing facility; (b) admitted to an inpatient rehabilitation unit; (c) discharged to a home health agency; or (d) discharged to home with no formal services. Although patients may have had sequential use of post-acute care services, the first post-acute care service was the focus of interest for the present study.

Environmental Factors

Market. Market variables included the number of skilled nursing facilities, inpatient rehabilitation facilities, and home healthcare agencies present in the environment. While the research evidence is limited, there is a small body of work that suggests that substitution of home healthcare services for skilled nursing facility services takes place, especially in areas where skilled nursing facility beds are limited (Kenney & Moon, 1997; Kenney & Dubay, 1992; Swan et al., 1995). Researchers have also found a positive relationship between the number of home visits per recipient and the number of home health agencies in the same geographic area (Swan & Benjamin, 1993). Conversely, there is evidence of an inverse relationship with the supply of skilled nursing facility beds when examining the number of Medicare recipients who use home health care services in specific geographical areas. A seminal work by Kenney and Dubay (1992) showed that patients are more likely to receive post-acute care in a skilled nursing facility if there are more beds available in the geographic area (Kenney & Dubay, 1992).

Variables for patient site of post discharge care were measured two ways: using the unadjusted number of service providers as well as the adjusted number of service
providers per 1000 patients age 65 and older residing in a particular county. More specifically, SNF services were measured as the number of SNF beds per 1000 population aged ≥ 65 years old in each county. Inpatient rehabilitation services were measured by the number of inpatient rehabilitation beds per 1000 population aged ≥ 65 years old in each county. Home health service supply was measured as the number of Medicare-certified home health agencies (per 1000 population 65 and older) that serve each county of the State of Minnesota. The source of data for the SNF and home health variables was the national Area Resource File (ARF), updated annually by the U.S. Health Resources and Services Administration. Using the 2001 ARF, each subject’s county of residence served as the link to data on market factors in that county. Since inpatient rehabilitation data was not available using the ARF file, the Commission on Accreditation of Rehabilitation Facilities (CARF) provided a data file listing each certified inpatient facility in the State of Minnesota (Commission on Accreditation of Rehabilitation Facilities, 2003).

Patient location. Research has shown a disparity in the receipt of health care services between older adults from rural communities and their non-rural counterparts, wherein rural elders have been shown to have limited access to or use of community-based health care as compared to a nonrural population (Coward & Dwyer, 1992; Krout, 1994; Schoenberg & Coward, 1998; United States Senate Special Committee on Aging, 1992). It has been speculated that imposed payment caps and individual beneficiary limits may cause home healthcare agencies that serve rural areas to close, leaving those beneficiaries without formal home health care (Rural Policy Research Institute, 1999). Furthermore, per beneficiary limits may force agencies to restrict the type of patients they
serve, avoiding high cost patients (Rural Policy Research Institute, 1999). In order to identify the relationship between geographic place of residence and the availability of post-acute care, the zip code identified on the patient records in the inpatient setting was used to determine if the patient resided in a rural or nonrural location.

Patient location, rural or nonrural, was determined using the Rural/Urban Continuum Codes available in the ARF files. The U.S. Department of Agriculture compiles these codes, Rural/Urban Continuum Codes for Metropolitan and Nonmetropolitan Counties. All U.S. counties and county equivalents are grouped according to the official metropolitan status announced by the Office of Management and Budget in June 1993. The codes form a classification scheme that distinguishes metropolitan counties by size and nonmetropolitan counties by degree of urbanization or proximity to metropolitan areas. The codes available in the 2001 ARF files are a revised version of the 1993 Rural/Urban Continuum Codes and are defined as outlined in Table 6.

Table 6
1993 Rural/Urban Continuum Codes

<table>
<thead>
<tr>
<th>CODE</th>
<th>METROPOLITAN COUNTIES (0-3)</th>
<th>NONMETROPOLITAN COUNTIES (4-9)</th>
</tr>
</thead>
<tbody>
<tr>
<td>00</td>
<td>Central counties of metropolitan areas of 1 million population or more</td>
<td></td>
</tr>
<tr>
<td>01</td>
<td>Fringe counties of metropolitan areas of 1 million population or more</td>
<td></td>
</tr>
<tr>
<td>02</td>
<td>Counties in metropolitan areas of 250,000 / 1,000,000 population</td>
<td></td>
</tr>
<tr>
<td>03</td>
<td>Counties in metropolitan areas of less than 250,000 population</td>
<td></td>
</tr>
<tr>
<td>04</td>
<td>Population of 20,000 or more, adjacent to a metropolitan area</td>
<td></td>
</tr>
<tr>
<td>05</td>
<td>Population of 20,000 or more, not adjacent to a metropolitan area</td>
<td></td>
</tr>
<tr>
<td>06</td>
<td>Population of 2,500 to 19,999, adjacent to a metropolitan area</td>
<td></td>
</tr>
<tr>
<td>07</td>
<td>Population of 2,500 to 19,999, not adjacent to a metropolitan area</td>
<td></td>
</tr>
<tr>
<td>08</td>
<td>Completely rural (no places with a population of 2,500 or more) adjacent to a metropolitan area</td>
<td></td>
</tr>
<tr>
<td>09</td>
<td>Completely rural (no places with a population of 2,500 or more) not adjacent to a metropolitan area</td>
<td></td>
</tr>
</tbody>
</table>
Using this classification, subjects were designated as rural or nonrural by attaching the corresponding code to their residential zip code.

Patient/Family Characteristics

Predisposing factors. Predisposing determinants are immutable attributes that exist prior to the onset of illness but may influence service use. Age, female gender, and non-white ethnicity have been positively associated with home care use (Branch et al., 1993; Coughlin et al., 1992; Kemper, 1992). Therefore, demographic information, collected from inpatient records, included the following items: information on the subject’s age in years and gender (male or female). Although ethnicity (White, Black; Hispanic; Asian; Native American; other or unknown) is an important variable, it is not available in the Mayo databases.

Enabling factors. Enabling variables include the type of Medicare insurance plan and the availability of a family member as an informal caregiver. There is evidence to support that those covered by a Medicare managed care product were found to use fewer home care resources (Shaughnessy et al., 1994). Patients with more family support are less likely to use home care services (Coughlin et al., 1992; Kemper, 1992). Variables included: (a) type of Medicare coverage, categorized as either Medicare fee-for-service or Medicare managed care plan; (b) amount of formal support at home, classified as a 7 category ordinal variable ranging from frequent assistance during the day and night to no informal caregiver available and (c) whether the patient lived alone (yes or no). The amount of support available (Table 2) to the patient ranged from frequent assistance during the day and night (scored as 0) to no caregiver available (scored as 6). This score
was a clinical determination made by the nurse, social worker or physical therapist as part of the patient’s discharge planning initiative and was recorded in the medical record.

*Need factors.* This was operationalized with a series of health status measures. The first measure refers to functional abilities. In general, Medicare beneficiaries in skilled nursing facilities have a higher total number of functional limitations than those who receive home healthcare services (Murray & Shatto, 1999). The first measure refers to the level of functional abilities. The plan was to use the Katz-Index of Activities of Daily Living (ADLs) (1964), personal ADL functional scores as determined from inpatient records. However, the clinical records most often did not include the Katz score and this variable was not included in the analysis (see Chapter IV).

While functional status is the most salient factor associated with home care use (Coughlin et al., 1992; Fortinsky & Madigan, 1997; Kemper, 1992), the physiologic status of the patient is important in determining post-acute needs. Physiologic status was operationalized by measuring comorbidity. Comorbidity can be defined as conditions present in a person upon an episode of health care delivery that are not related directly to the main reason for seeking health care, but that increase the intensity of resources used or increase the likelihood of a poor outcomes (Elixhauser et al., 1998). These conditions are not related causally to the principal disease process, but increase the patient’s total burden of illness. Comorbidities differ from complications, which are linked causally to the natural history or treatment of the principal diagnosis (Shwartz et al., 1996).

The Charlson Comorbidity Scale was used to classify and weigh comorbidity (Charlson, Pompei, Mckenzie, & Ales, 1987). Conditions and assigned weights are
summarized in Appendix B. Psychometric testing of this instrument revealed a reliability test/retest performed using two cohorts of patients where the weighted index was significant predictor (p<0.0001) of 1-year survival. There were also stepwise increases in the cumulative mortality (log rank $\chi^2 = 165; p<0.0001$). Validity testing showed that age and comorbidity had evidence of content validity. Adjusted relative risks were calculated from beta coefficients. Relative risk for each increase in level of index was 2.3 (95% C.I. limit: 1.9-2.8); the relative risk for age was 2.4 (95% confidence: 2.0-2.9).

Since coded ICD 9-DM information was available, the adapted version of the Charlson index was used. Deyo and colleagues adapted the Charlson Index for use with ICD-9CM administrative data (Deyo et al., 1992). Identifying specific ICD-9-CM codes to represent each of the individual comorbid conditions in the original Charlson index while maintaining the Charlson weights, this adapted index performed well and has been shown to successfully translate ICD 9-DM codes into Charlson comorbidity scores (Deyo et al., 1992). In a study by Ghali and colleagues, a comparison of the Deyo and Dartmouth-Manitoba (Romano et al., 1993) adaptations showed that these two adaptations assigned identical Charlson comorbidity scores to 90% of the cases, and specific comorbidities were largely found in the same cases ($\kappa$ values of 0.72-1.0 for 15 of 16 comorbidities) (Ghali, Hall, Rosen, Ash, & Moskowitz, 1996). To avoid double counting of closely related comorbidities recorded in the medical record, the highest comorbidity weight was recorded as a single score. This adaptation has been useful in studies that rely on administrative recorded data (Elixhauser et al., 1998).

**Patient Outcomes**
Change in clinical and functional health. In the evaluation of patients who have undergone MHA it is customary to use a hip score to assess the change in the clinical and functional status of the patient postoperatively (Kavanagh & Fitzgerald, 1985). This study used the clinical assessment subscale of the Mayo hip score (Kavanagh & Fitzgerald, 1985) to measure these changes. The Mayo hip score is a modification of the Harris hip score (Harris, 1969). In the Mayo version, the clinical history and evaluation of functional mobility account for 80 of 100 total points. The roentgenographic examination of the hip accounts for the remaining 20 points (Kavanagh & Fitzgerald, 1985). The roentgenographic scale is designed to be used for longitudinal tracking with this type of information collected on yearly intervals. The authors of this instrument state, however, that it is possible to use the clinical subscore separately. Since the clinical subscore is collected preoperatively and again at 3 months postoperatively, this information was used for analysis. The components of the clinical score are summarized in Appendix C.

Each patient in the sample had two clinical scores collected from the medical record. The first score was the preoperative score (considered a need characteristic) and the second was taken from the planned 3-month postoperative visit notes. Reliability testing of the Mayo hip score compared to the Harris score showed an excellent correlation between the two scores of each patient (> 0.99 correlation coefficient). There was also a good correlation in the categorical result reports between these two instruments (Kavanagh & Fitzgerald, 1985).

Patient satisfaction defined as the patient’s perception of improvement 3 months post hospital discharge was included as an outcome. This variable was operationalized
by collecting the answer to a question as to whether the patient feels his/her condition has improved since the surgery. It was recorded as a “Yes” or “No” answer.

Reliability of Data Collection Techniques

Interrater reliability was performed. Ten percent (15 medical records) were reabstracted by the investigator and there was 100% agreement on all the variables.

Research Involving Human Subjects

Institutional Review Board (IRB) approval was obtained from both the Mayo Foundation and Case Western Reserve University. No invasive diagnostic or treatment procedures were performed on subjects as part of this study. Sources of research material included data collected from patient records, which were entered into electronic or paper files. The information for this study included physical and functional health status, the amount of assistance received from family and friends, and the sociodemographic characteristics of the patient, such as gender and place of residence.

Subjects were not excluded on the basis of gender, race or ethnicity. The composition of the study was a convenience sample of those with a primary diagnosis of major hip arthroplasty, 65 years of age or older with Medicare/Medicaid as a payer and care that is not primarily palliative. Since the study is aimed at subjects 65 years of age and older, children were not eligible. All study results were reported as aggregate information with no patient identified individually.
CHAPTER IV

This chapter presents data exploration including a description of the sample, the preliminary examination of all study variables for assumptions of statistical tests and the analyses for the research questions. The purpose of this study was to determine if elderly rural patients, when controlling for patient/family characteristics and the structure and availability of services (market variables), were more likely to receive different types of post-acute care (resource consumption) and have different clinical and functional outcomes than a comparable nonrural population. The sample was chosen from eligible subjects who were identified using patient databases maintained at the Mayo Clinic Medical Center, Rochester, Minnesota from October 1, 2001 or later.

Data Exploration

The initial sample contained 159 patients. Secondary to missing medical record data for the follow-up postoperative Mayo Hip score, 6 cases were eliminated. Thus the final sample contained 153 patients. During the data collection process it was noted that the Katz ADL scores were not available or were incomplete in the majority of the medical records. Thus, this variable was deleted from the data set.

Description of the Sample

Patient/family characteristics. The description of the sample is presented in Table 7. Patients ranged in age from 65 to 93 years with a mean of 75.2 years (SD = 6.20). Approximately half of the sample (55%) was female. Ethnicity was not collected in the medical record and cannot be reported. The average length of hospital stay was 5 days (SD = .93, range 3-7). Almost all patients had Medicare fee-for service (97%) as their primary insurer.
Table 7

Description of the Sample

<table>
<thead>
<tr>
<th>Variables</th>
<th>Range</th>
<th>M</th>
<th>SD</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>65-93</td>
<td>75.2</td>
<td>6.20</td>
<td></td>
</tr>
<tr>
<td>Hospital LOS</td>
<td>3-7</td>
<td>5.0</td>
<td>.93</td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>female</td>
<td></td>
<td></td>
<td></td>
<td>84(55)</td>
</tr>
<tr>
<td>male</td>
<td></td>
<td></td>
<td></td>
<td>69(45)</td>
</tr>
<tr>
<td>Medicare type</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Traditional</td>
<td></td>
<td></td>
<td></td>
<td>148(96.7)</td>
</tr>
<tr>
<td>Managed</td>
<td></td>
<td></td>
<td></td>
<td>5 (3.3)</td>
</tr>
<tr>
<td>Lives alone</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
<td>38 (24.8)</td>
</tr>
<tr>
<td>No</td>
<td></td>
<td></td>
<td></td>
<td>115 (75.2)</td>
</tr>
</tbody>
</table>

The amount of support available (Table 8) to the patient ranged from frequent assistance during the day and night (scored as 0) to no caregiver available (scored as 6) with a mean score of 1.1 (SD= 1.86), indicating relatively frequent assistance was available. This score was a clinical determination made by the nurse, social worker or physical therapist as part of the patient’s discharge planning initiative and was recorded in the medical record.

Comorbidities present at hospital discharge were derived using the Charlson comorbidity score (Table 9). Specific diagnoses receive a numeric rating ranging from 0 (no comorbidities) to 6 (metastatic tumor/AIDS). Consistent with the literature, the highest comorbidity weight was recorded rather than a summed score. This avoided double counting of closely related comorbidities recorded in the medical record.
The mean score was 1.1 (SD =1.20), indicating relatively few comorbid conditions. The preoperative Mayo hip clinical scores were quite variable ranging from 3 (severely functionally impaired) to 80 (no functional deficits) with a mean of 36.9 (SD= 19.71), indicating moderate impairment. The follow-up hip score was also quite variable ranging from 11 to 80 with a mean of 62.5 (SD = 12.42), indicating mild impairment.

Table 8

Amount of Support

<table>
<thead>
<tr>
<th>Amount of Support</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequent assistance during the day and night (0)</td>
<td>105</td>
<td>68.6</td>
</tr>
<tr>
<td>Frequent assistance at night (1)</td>
<td>6</td>
<td>3.9</td>
</tr>
<tr>
<td>Frequent assistance during the day (2)</td>
<td>13</td>
<td>8.5</td>
</tr>
<tr>
<td>Occasional assistance during the day and night (3)</td>
<td>8</td>
<td>5.2</td>
</tr>
<tr>
<td>Occasional assistance during the night (4)</td>
<td>5</td>
<td>3.3</td>
</tr>
<tr>
<td>Occasional assistance during the day (5)</td>
<td>7</td>
<td>4.6</td>
</tr>
<tr>
<td>No informal/formal caregiver (6)</td>
<td>9</td>
<td>5.9</td>
</tr>
</tbody>
</table>

Table 9

Charlson Comorbidity Score

<table>
<thead>
<tr>
<th>Assigned Weight</th>
<th>Comorbid Conditions</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No comorbidity</td>
<td>45</td>
<td>29.4</td>
</tr>
<tr>
<td>1</td>
<td>Myocardial infarction, congestive heart failure, peripheral vascular disease, dementia, chronic pulmonary disease, rheumatologic disease, peptic ulcer disease, mild liver disease, diabetes</td>
<td>74</td>
<td>48.4</td>
</tr>
<tr>
<td>2</td>
<td>Hemplegia, Leukemia, Tumor, Mod/severe Renal disease, Diabetes with organ involvement, lymphoma</td>
<td>28</td>
<td>18.3</td>
</tr>
<tr>
<td>3</td>
<td>Moderate or sever liver disease</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Metastatic solid tumor, AIDS</td>
<td>6</td>
<td>3.9</td>
</tr>
</tbody>
</table>

*Post-acute care consumption.* The type and frequencies of post-acute care consumption were as follows: more than half of the patients returned home with no
formal care (N= 76, 55%). Of those who did receive formal care, skilled nursing facilities constituted the next highest group (N=48, 31%), followed by home healthcare (N=16, 10%) and finally the inpatient rehabilitation settings (N=13, 8%).

**Environmental factors**

*Patient location.* Slightly more than 50% of the sample resided in rural areas postoperatively. A more detailed breakdown of geographic location is presented in Table 10.

**Table 10**

Patient Location by County According to Rural-Urban Continuum Codes

<table>
<thead>
<tr>
<th>Location Description</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central counties of metropolitan areas of 1 million or more</td>
<td>16</td>
<td>10.5</td>
</tr>
<tr>
<td>Fringe counties of metro areas of 1 million or more</td>
<td>2</td>
<td>1.3</td>
</tr>
<tr>
<td>Counties in metropolitan areas of 250,000/1,000,000 population</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Counties in metro areas of less than 250,000</td>
<td>33</td>
<td>21.6</td>
</tr>
<tr>
<td>Urban population of 20,000 or more, adj. to metro area</td>
<td>22</td>
<td>14.4</td>
</tr>
<tr>
<td>Urban population of 20,000 not adj. to metro area</td>
<td>3</td>
<td>2.0</td>
</tr>
<tr>
<td>Population of 2,500 to 19,999, adj. to metro area</td>
<td>23</td>
<td>15.0</td>
</tr>
<tr>
<td>Population of 2,500 to 19,999, not adj to metro area</td>
<td>40</td>
<td>26.1</td>
</tr>
<tr>
<td>Completely rural, adj. to metro area</td>
<td>9</td>
<td>5.9</td>
</tr>
<tr>
<td>Completely rural, not adj. to metro area</td>
<td>5</td>
<td>3.3</td>
</tr>
</tbody>
</table>

* Shaded areas are defined as rural by USDA definition

**Geographic availability of post-acute settings.** The number of skilled nursing facilities available per county ranged from 1 to 257 (M=30.9, SD= 46.29). Home health agencies available per county ranged from 0 to 64 (M=7.4, SD= 11.73) while inpatient rehabilitation facility availability ranged from 0 to 10 in any given county (M=1.2, SD=1.99). A variable was created to adjust for the number of service providers per 1000 patients age 65 and over residing in a particular county by using the 2000 Census data. The adjusted number of skilled nursing facilities ranged from 0 to 6.54 (M = 3.0, SD = 1.13). Home health agencies available ranged from 0 to 2.54 (M = .66, SD = .35) while...
inpatient rehabilitation facility availability ranged from 0 to less than 1 (M = .08, SD = .096).

Patient perception in improvement. A variable was collected from the medical record, which measured the patient’s perception of improvement in clinical and functional status at the time of the follow-up postoperative visit. When the physician asked the patient if there was an improvement 91.4% reported that they were much better, 7.1% reported they were better, less than 1% reported that they were the same and less than 1% reported they were worse. Since this was overwhelmingly favorable, this variable was not included in further analysis.

Preliminary Data Examination

In preparation for further statistical analysis, the data were examined for accuracy and normality. The purpose of this examination was to understand the nature of the study variables, the extent of the differences between the groups, and to examine the assumptions for regression analyses. Distribution and the normality of the continuous variables such as age in years, hospital length of stay, amount of support available, and the Mayo hip summary score preoperatively were examined. The shapes of the distributions were examined visually using histograms. Statistics of normality were also calculated. Taking into account the sample size, the assumption was met.

Two new variables (delta hip and change in hip score) were created to measure the change in the Mayo Hip score. Subtracting the preoperative hip score from the post-operative hip score and dividing by the weeks post-operatively created the delta hip score. This was necessary because some patients had their post-operative appointment at 2.5 weeks postoperatively while others had their post-operative appointment at week 37
(M = 9.4, Median = 8.71, SD = 4.06). This outcome variable accounts for the change in the score measured preoperatively with the same patient score measured postoperatively, taking into account the number of post-operative weeks for the second time measure.

The change in hip score variable was created by subtracting the preoperative hip score from the post-operative hip score. For this variable, the time for the follow-up appointment was not taken into account—as noted above, the timing for the follow-up appointment was actually closer to 9 weeks, on average. However, the advantage of this variable is that there is better spread of the distribution of scores than with the delta hip score, which had a more restricted range. To fully examine the possible outcomes, all three measures were used in the analysis—the raw follow-up hip score, the delta hip score and the change in hip score.

**The Assumptions of Regression**

The assumptions of multiple regression are: all variables are measured without error, the effects of the independent variables are additive, the relationship between the expected value of the dependent variable and the independent variables is linear, the residual mean is zero, the residual variance is equal at all points in the predicted dependent variable, the residuals are normally distributed, the residuals indicate the independent variables have a fixed distribution, the residuals show no evidence of departure from linearity, and the residuals are independent. However, only two assumptions are critical—the residual mean is zero and the residuals are independent.

The first critical assumption is that the residual mean is zero. Residual analyses for all equations were examined and the residual mean was approximately zero. The other important assumption of regression is that the residuals are independent with no
autocorrelation. This violation is found in time-series studies or in studies in which there is inherent nesting of data. For example, in the present study, because there were multiple patients cared for by the same surgeons, the assumption of residual independence could have been violated. The Durbin-Watson statistic indicates if this assumption is met. The acceptable range is from 1.5 to 2.5. For the three regressions done in the present study, there was no violation of the assumption. Durbin-Watson scores ranged from 1.85 for the delta hip score to 1.95 for the other outcome measures. In summary, the assumptions for the regression analyses in this study were met.

Another examination generally performed with the use of regression is for multicollinearity. A problem with multicollinearity occurs when independent variables are so highly related that they are duplicative. This can be detected by examination of the tolerance for each independent variable, which is 1 – R² with the other independent variables serving as the test variables. A tolerance level less than .10 indicates the other independent variables explain 90% of the independent variable in question and there is multicollinearity. In all three regression analyses, the tolerance was not below .65 for any of the independent variables.

**Outliers**

A significant outlier was identified in sample. Those patients who underwent a hip arthroplasty as a result of a traumatic fracture (n=13) had very different Mayo hip scores preoperatively and at the postoperative time periods than the rest of the sample. They had optimal functional score (80) preoperatively and a decrease in function at the postoperative time period attributable to the operative procedure. This was the opposite of those with preoperative deficits and an improvement in function postoperatively.
Therefore, patients who underwent an arthroplasty secondary to a traumatic event were removed from the sample during data analysis. This resulted in a final sample size of 140.

*Exercising Group Differences*

In order to understand how patient factors were distributed compared to location (rural or non-rural) and post-discharge site of care, examination of the patient factors was done by location and post-discharge site of care. This analysis was performed to understand the distribution for each location and discharge disposition group and examine if there were significant differences between groups to support further statistical testing. A series of t tests (Table 11) were performed to compare means and percentages of the patient variables and the rurality of the location in which the patient resided postoperatively, coded rural or non-rural. There were no significant differences between the rural and non-rural patients on any of the patient factors. A Chi-square test was done on rurality by gender and also was not significant ($\chi^2 = .61, p = .44$).

Table 11

Means Comparing Patient Factors by Rural Versus Nonrural

<table>
<thead>
<tr>
<th>Variables % (SD)</th>
<th>Nonrural</th>
<th>Rural</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n = 65</td>
<td>n = 75</td>
</tr>
<tr>
<td>Age in years</td>
<td>74.7 (5.89)</td>
<td>74.29 (5.65)</td>
</tr>
<tr>
<td>Hospital LOS</td>
<td>4.9 (.92)</td>
<td>4.9 (.89)</td>
</tr>
<tr>
<td>Amount of Support</td>
<td>.94 (1.73)</td>
<td>.91 (1.80)</td>
</tr>
<tr>
<td>Charlson comorbidity score</td>
<td>.95 (.91)</td>
<td>1.15 (1.36)</td>
</tr>
<tr>
<td>Mayo hip subscore preop</td>
<td>32.0 (15.11)</td>
<td>33.6 (15.58)</td>
</tr>
<tr>
<td>Mayo hip subscore at 3 mths</td>
<td>63.8 (11.48)</td>
<td>61.6 (13.52)</td>
</tr>
</tbody>
</table>
A series of Chi-square (Table 12) and one-way ANOVA tests were then performed to compare the means and percentages of the patient variables and the post discharge site of care (Table 13). The Chi-square test was used to test the differences in percentages of the variables of rural/nonrural, gender and lives alone between the post discharge sites of care. The results of the chi-square test showed that more females than expected were discharged to SNFs and that those who lived alone were more likely to be discharged to a formal site of care as compared to returning home without post-acute care.

Table 12

Summary of Patient Factors by Post Discharge Site of Care

<table>
<thead>
<tr>
<th>Variables</th>
<th>No formal care</th>
<th>Home health</th>
<th>Inpatient rehabilitation</th>
<th>SNF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rural/nonrural (n, %)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nonrural</td>
<td>34 (52.3)</td>
<td>8 (12.3)</td>
<td>5 (7.7)</td>
<td>18 (27.7)</td>
</tr>
<tr>
<td>Rural</td>
<td>41 (54.7)</td>
<td>7 (9.3)</td>
<td>5 (6.7)</td>
<td>22 (29.3)</td>
</tr>
<tr>
<td>Gender (n, %)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>43 (67.2)</td>
<td>7 (10.9)</td>
<td>3 (4.7)</td>
<td>11 (17.2)</td>
</tr>
<tr>
<td>Female</td>
<td>32 (42.1)</td>
<td>8 (10.5)</td>
<td>7 (9.2)</td>
<td>29 (38.2)</td>
</tr>
<tr>
<td>Lives Alone (n, %)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>68 (62.4)</td>
<td>13 (11.9)</td>
<td>4 (3.7)</td>
<td>24 (22.0)</td>
</tr>
<tr>
<td>Yes</td>
<td>7 (22.6)</td>
<td>2 (6.4)</td>
<td>6 (19.4)</td>
<td>16 (51.6)</td>
</tr>
</tbody>
</table>

One-way ANOVA was performed to compare the means of continuous variables (Table 13). The variables of age in years, hospital LOS, amount of support available, Charlson comorbidity score, the Mayo hip score preoperatively and the Mayo hip score postoperatively between the four sites of care. The Scheffe Test was selected for post hoc comparisons because it is the most conservative and does all the possible comparisons between groups (Ott, 1993). The only significant result was for the amount of support available—there was much more support available for the group that was
discharged to routine (no formal) care (mean = .15) as compared to the other sites of care.

Using one way analysis of variance, when examining the three outcomes there were no significant differences by site for the hip score and the delta hip score.

Table 13

One Way ANOVA Multiple Comparisons

<table>
<thead>
<tr>
<th></th>
<th>No Formal Care (n = 75)</th>
<th>Home Health Care (n = 15)</th>
<th>Inpatient Rehabilitation (n = 10)</th>
<th>Skilled Nursing Facility (n = 40)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M (SD)</td>
<td>M (SD)</td>
<td>M (SD)</td>
<td>M (SD)</td>
</tr>
<tr>
<td>Age in years</td>
<td>73.4 (5.50)</td>
<td>76.6 (4.56)</td>
<td>75.8 (6.92)</td>
<td>75.3 (6.07)</td>
</tr>
<tr>
<td>Hospital LOS</td>
<td>4.76 (.75)</td>
<td>5.00 (.75)</td>
<td>5.1 (.99)</td>
<td>5.2 (1.12)</td>
</tr>
<tr>
<td>Amount of support*</td>
<td>.15 (.80)</td>
<td>1.4 (2.16)</td>
<td>2.7 (2.40)</td>
<td>1.7 (2.02)</td>
</tr>
<tr>
<td>Charlson comorbidity score</td>
<td>1.01 (1.24)</td>
<td>1.07 (.70)</td>
<td>1.10 (.57)</td>
<td>1.1 (1.30)</td>
</tr>
<tr>
<td>Mayo Hip score preoperatively</td>
<td>34.6 (15.17)</td>
<td>32.4 (15.24)</td>
<td>40.7 (18.88)</td>
<td>27.8 (13.69)</td>
</tr>
<tr>
<td>Mayo Hip score at 3 months</td>
<td>64.6 (13.63)</td>
<td>65.8 (6.57)</td>
<td>63.1 (8.43)</td>
<td>57.5 (12.00)</td>
</tr>
<tr>
<td>Differences in delta hip score by site a</td>
<td>3.6 (2.31)</td>
<td>3.7 (2.31)</td>
<td>2.7 (2.60)</td>
<td>3.6 (2.47)</td>
</tr>
<tr>
<td>Difference in change in hip score by site b</td>
<td>29.9 (15.10)</td>
<td>33.3 (17.45)</td>
<td>22.4 (18.60)</td>
<td>29.7 (16.20)</td>
</tr>
</tbody>
</table>

\* p<.05, F = .410  \* p<.05, F = .934

Data Analysis

Research Questions and Method of Analysis

The research questions were tested using analysis of covariance, multiple regression and logistic regression analysis techniques. There were three dependent variables—the follow-up hip score, the change in the hip score and the change in the hip score taking into account the time to the follow-up appointment (delta hip). In the analyses that follow, because the preoperative hip score was used to create both change in hip score and delta hip, the preoperative hip score is not included as a covariate. In
analyses where the 3-month hip score was used, the preoperative hip score is used as a covariate.

This study addressed the following research questions:

1. **Is there a direct relationship between resource consumption (type of post-acute care received) and clinical and functional outcomes?**

   Question number 1 was analyzed using analysis of covariance (ANCOVA). In the first analysis, the dependent variable was the change in Mayo hip score taking into account the time of the follow-up appointment (Delta Hip). The independent variable was the type of post-acute care received. Covariates included age, gender, hospital LOS, lives alone, amount of support and comorbidity. There was no relationship between the type of post-acute care and the delta hip score ($F = .410, p = .93$).

   In the second analysis, the dependent variable was the change in hip score. In this analysis, there was a significant relationship between the type of post-acute care and change in hip score ($F = 2.08, p = .04$). In this case, the addition of the covariates, as compared to the one-way ANOVA, lead to statistical significance.

   The third analysis was use of the follow-up hip score, with the addition of the preoperative hip score as a covariate. This analysis was also significant ($F = 4.45, p < .001$). However, for both analyses, when examining post hoc tests comparing routine care with the other sites of care, there were no significant differences between the sites of care. This is likely because of the relatively small sample sizes for inpatient rehabilitation and home health care ($n = 13$ and $n = 16$, respectively).

2. **Is there a direct relationship between patient/family characteristics and the change in the Mayo hip score?**
Question number 2 was tested using bivariate correlation (Pearson) of the hip scores and patient family characteristics. Pearson’s product moment correlations were used for all correlations except gender. Because of its dichotomous nature, a phi correlation was used. There was a significant negative correlation between the change in hip score and hospital LOS \((r = -0.25, p = .001)\). Additionally, there was a significant negative correlation between the 3-month hip score and the Charlson comorbidity score \((r = -0.27, p = .001)\) and a positive relationship with the preoperative hip score \((r = 0.34, p < .001)\) (Table 14).

Table 14

Pearson Correlation Between the Three Dependent Variables and All Independent Variables

<table>
<thead>
<tr>
<th></th>
<th>Delta hip score</th>
<th>Change in Hip Score</th>
<th>3 month hip score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preoperative hip score</td>
<td>-----</td>
<td>------</td>
<td>.34**</td>
</tr>
<tr>
<td>Gender</td>
<td>.01</td>
<td>-.04</td>
<td>-.08</td>
</tr>
<tr>
<td>Age in years</td>
<td>.02</td>
<td>-.03</td>
<td>-.12</td>
</tr>
<tr>
<td>Hospital LOS</td>
<td>-.05</td>
<td>-.25**</td>
<td>-.21</td>
</tr>
<tr>
<td>Lives alone</td>
<td>.07</td>
<td>.09</td>
<td>-.03</td>
</tr>
<tr>
<td>Amount of support</td>
<td>-.05</td>
<td>-.11</td>
<td>-.10</td>
</tr>
<tr>
<td>Charlson comorbidity score</td>
<td>.009</td>
<td>-.06</td>
<td>-.27**</td>
</tr>
</tbody>
</table>

* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).

Multiple regression then was performed with the dependent variable being the change in the Mayo hip score measured three ways: as the delta hip score, the change in hip score, or the 3 month hip score. Measures of the patient’s predisposing factors, enabling factors and physiologic status were entered to determine the influence of each set of variables. Specifically, the predictors entered were as follows: Predisposing factors of gender and age; Enabling factors of the amount of support available; the hospital length
of stay and whether the patient lived alone; and the Need factor including the Charlson comorbidity score. Regression analysis revealed that there was no significant predictive relationship for the delta hip score and the change in hip score. For the 3 month hip score, the overall equation was significant, with 19% explained variance and three significant independent variables—hospital length of stay ($\beta = -.20$), Charlson comorbidity ($\beta = -.22$) and preoperative hip score ($\beta = .34$) (Table 15).

3. **Do environmental factors moderate the relationship between patient/family characteristics and resource consumption?**

   Question number 3 was answered using logistic regression techniques to analyze whether there was an interaction between the environmental factor of rural location and functional ability, which was hypothesized to moderate the relationship between patient/family characteristics and resource consumption. A dichotomous variable for resource consumption (Yes/No) was used. This was done because of the small cell sizes of inpatient rehabilitation services and home health care ($n = 13$ and $n = 16$, respectively). To analyze this question, market variables and patient location and family characteristics were added hierarchically in two steps. Step one consisted of the environmental factors. Step two added the patient/family characteristics. The third step was to add the interaction terms for location and the preoperative hip score. The analysis was performed two ways: using the unadjusted number of service providers as well as the adjusted number of service providers per 1000 patients residing in a particular county (Table 16).
Table 15

The relationship between patient/family characteristics and change in the Mayo hip score

<table>
<thead>
<tr>
<th></th>
<th>β</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delta Hip score</td>
<td></td>
</tr>
<tr>
<td>Hospital LOS</td>
<td>-.05</td>
</tr>
<tr>
<td>Charlson comorbidity score</td>
<td>.02</td>
</tr>
<tr>
<td>Lives alone</td>
<td>.13</td>
</tr>
<tr>
<td>Amount of support</td>
<td>-.10</td>
</tr>
<tr>
<td>Age in years</td>
<td>.03</td>
</tr>
<tr>
<td>Male/female</td>
<td>-.02</td>
</tr>
<tr>
<td>Change in Hip score</td>
<td>β</td>
</tr>
<tr>
<td>Hospital LOS</td>
<td>-.23</td>
</tr>
<tr>
<td>Charlson comorbidity score</td>
<td>-.05</td>
</tr>
<tr>
<td>Lives alone</td>
<td>.21</td>
</tr>
<tr>
<td>Amount of support</td>
<td>-.17</td>
</tr>
<tr>
<td>Age in years</td>
<td>.03</td>
</tr>
<tr>
<td>Male/female</td>
<td>-.05</td>
</tr>
<tr>
<td>3 month Hip score</td>
<td>β</td>
</tr>
<tr>
<td>Hospital LOS</td>
<td>-.20*</td>
</tr>
<tr>
<td>Charlson comorbidity score</td>
<td>-.22***</td>
</tr>
<tr>
<td>Lives alone</td>
<td>.09</td>
</tr>
<tr>
<td>Amount of support</td>
<td>-.12</td>
</tr>
<tr>
<td>Age in years</td>
<td>-.02</td>
</tr>
<tr>
<td>Preoperative hip score</td>
<td>.34***</td>
</tr>
<tr>
<td>Male/female</td>
<td>-.08</td>
</tr>
</tbody>
</table>

Note. Delta hip score Adjusted R2 = -.03, F = .37, p = .90; for Change in Hip score Adjusted R2 = .06, F = 2.43, p = .03; for 3 month hip score Adjusted R2 = .19, F = 5.74, p < .001.
Table 16
The Relationships between Environmental, Patient/Family Characteristics
And Receipt of Formal Care

<table>
<thead>
<tr>
<th>Variable</th>
<th>Odds Ratio (Unadjusted)</th>
<th>Odds Ratio (Adjusted)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GeoSNF</td>
<td>1.030</td>
<td>1.104</td>
</tr>
<tr>
<td>GeoInpt</td>
<td>.834</td>
<td>.059</td>
</tr>
<tr>
<td>GeoHHA</td>
<td>.931</td>
<td>1.202</td>
</tr>
<tr>
<td>Nonrural Location</td>
<td>.853</td>
<td>1.096</td>
</tr>
<tr>
<td>Step 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GeoSNF</td>
<td>1.031</td>
<td>1.185</td>
</tr>
<tr>
<td>GeoInpt</td>
<td>.622</td>
<td>.015</td>
</tr>
<tr>
<td>GeoHHA</td>
<td>.968</td>
<td>1.034</td>
</tr>
<tr>
<td>Nonrural Location</td>
<td>.784</td>
<td>1.201</td>
</tr>
<tr>
<td>Gender (female)</td>
<td>2.96*</td>
<td>.363</td>
</tr>
<tr>
<td>Age</td>
<td>.982</td>
<td>.956</td>
</tr>
<tr>
<td>Hospital LOS</td>
<td>.739</td>
<td>.680</td>
</tr>
<tr>
<td>Lives alone</td>
<td>1.158</td>
<td>1.039</td>
</tr>
<tr>
<td>Amount of support</td>
<td>.395***</td>
<td>.435***</td>
</tr>
<tr>
<td>Charlson comorbidity score</td>
<td>.786</td>
<td>.760</td>
</tr>
<tr>
<td>Mayo preoperative hip score</td>
<td>1.023</td>
<td>1.008</td>
</tr>
<tr>
<td>Step 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GeoSNF</td>
<td>1.195</td>
<td>1.008</td>
</tr>
<tr>
<td>GeoInpt</td>
<td>9.967</td>
<td>10.542</td>
</tr>
<tr>
<td>GeoHHA</td>
<td>.344</td>
<td>.074</td>
</tr>
<tr>
<td>Nonrural Location</td>
<td>.723</td>
<td>1.824</td>
</tr>
<tr>
<td>Gender (female)</td>
<td>2.706*</td>
<td>.346</td>
</tr>
<tr>
<td>Age</td>
<td>.982</td>
<td>.969</td>
</tr>
<tr>
<td>Hospital LOS</td>
<td>.753</td>
<td>.665</td>
</tr>
<tr>
<td>Lives alone</td>
<td>1.162</td>
<td>1.148</td>
</tr>
<tr>
<td>Amount of support</td>
<td>.377***</td>
<td>.405***</td>
</tr>
<tr>
<td>Charlson comorbidity score</td>
<td>.797</td>
<td>.776</td>
</tr>
<tr>
<td>Mayo preoperative hip score</td>
<td>1.039</td>
<td>1.020</td>
</tr>
<tr>
<td>Home health agency supply multiplied by the preop hip score—interaction term</td>
<td>1.030*</td>
<td>1.005*</td>
</tr>
<tr>
<td>Skilled nursing facility supply multiplied by the preop hip score—interaction term</td>
<td>.996</td>
<td>1.000</td>
</tr>
<tr>
<td>Inpatient rehab facility supply multiplied by the preop hip score—interaction term</td>
<td>.920*</td>
<td>.959*</td>
</tr>
<tr>
<td>Rural location multiplied by the preop hip score--interaction term</td>
<td>.999</td>
<td>.998</td>
</tr>
</tbody>
</table>
Results indicated that there was no significant moderating effect for rural location. There was a mixed moderating effect for the influence of the number of home healthcare agencies and the number of SNFs by preoperative hip score. In addition, the only variables that influenced the use of post-acute care were gender (females were almost 3 times as likely to use post-acute care controlling for the other variables) and preoperative hip score (where each statistical step increase in the preoperative hip score increased the likelihood of using post-acute care by 3.9% controlling for the other variables). Even when controlling for other factors (Step 2) living in a rural area had no significant effect.

Summary

In research question 1, the direct relationship between the type of post-acute care received and the clinical and functional outcomes was analyzed using analysis of covariance. There was no significant relationship between the type of post-acute care received and the patient outcome using the delta hip score although there was significance when examining these relationships using the change in hip score and the follow-up hip score. However, using post-hoc comparisons, there were no significant differences between the sites of care. Research question 2, the relationship between patient/family characteristics and the change in the Hip score were tested using bivariate correlation and multiple regression. There was a negative correlation between the change in hip score and hospital LOS, a negative relationship between the follow-up hip score and the Charlson comorbidity score and a positive relationship with the preoperative hip
score ($r = .34, p < .001$). Regression analysis revealed no significant predictive relationship except when examining the follow-up hip score as the dependent variable. In this case, the significant independent variables were hospital LOS, Charlson comorbidity and the preoperative hip score.

Logistic regression was used in Question 3 to determine if environmental factors moderated the relationship between patient/family characteristics and resource consumption. The results indicated there was no significant moderating effect. The only variables that influenced the use of post-acute care were female gender and functional deficits reflected by a lower Mayo Hip score preoperatively.

Returning to the purpose of the study, patients living in rural locations were not significantly different than patients living in non-rural areas when examined bivariately on each independent variable. Even when examined in a multivariate fashion, controlling for the environmental, market and patient/family characteristics, there was no significant effect of living in a rural location on the use of post-acute care.
CHAPTER V

This chapter presents a discussion of the study findings, implications for nursing and other health care professionals, suggestions for future research, and limitations. An adaptation of Andersen’s behavioral model of health service use was utilized in this study. Patient outcomes, environmental factors, and patient/family characteristics between rural and nonrural populations were the concepts of focus. The research questions focused on whether elderly rural patients used different post-acute resources and had different outcomes than their non-rural counterparts.

Discussion

An important issue in Medicare redesign is whether beneficiaries have access to health care services, without which the core Medicare benefits guaranteed by law are meaningless (Coburn & Slifkin, 2000). Largely based on administrative data, there is research evidence that shows differences in resource use between rural and nonrural Medicare beneficiaries with rural beneficiaries most often found to have less access and less use of services (Congdon & Magilvy, 1998a, 1998b; Krout, 1994; Magilvy & Congdon, 2000; Magilvy et al., 1994; Rogers, 1999; Schultz, 1997; Swan & Benjamin, 1993; Yawn et al., 1994). Researchers also have found differences in post-acute outcomes based on patient characteristics such as age and gender, comorbid conditions (Kane et al., 1996; Kramer et al., 1997; MacWilliam et al., 1996; Myers et al., 1996; Williams et al., 1994) and environmental factors such as geographic residence and type of post-acute setting (Hadley et al., 2000; Intrator & Berg, 1998; Kane et al., 1996; Kane et al., 1994, 1998, 2000; Kramer et al., 1997; Mahomed et al., 2000; Myers et al., 1996; Williams et al., 1994). Within this body of research older patients, women and
those with more comorbid conditions generally did not achieve the same level of positive outcomes following the use of healthcare resources as those who were younger, male and healthier. Yet there was a significant gap in the literature in that there was no current research in the post-acute setting which took into account geographic differences while controlling for patient/family characteristics. This study is the first in a program of research aimed at providing empirical results to explain attributes that enabled or hindered the use of formal post-acute services and the resultant patient outcomes among rural patients.

In addition to the main study findings, further described below, there was an additional finding that merits discussion. Women were almost 3 times as likely to use post-acute care, even when controlling for other factors. This is consistent with past research (Kramer et al., 1997; Myers et al., 1996). One possible explanation for this is differential mortality, where women are more likely to be widowed and live alone, and therefore are more likely to use formal post-acute services (Williams et al., 1994). Additionally, it is possible that women preferred to use formal services even if informal support was available related to more traditional gender roles. Specifically, in this age cohort of older adults, women more often have been identified in the caregiver role rather than a care-receiver role and assuming a care-receiver role even with family members (husbands, adult children) may have been uncomfortable. Both of these explanations deserve further exploration in future studies.

**Rural/Nonrural Patient Factor Differences**

Previous research on rural elders revealed a population who experienced more medical conditions (Congdon & Magilvy, 1998a), more functional limitations (Congdon
& Magilvy, 1998b), disabilities (Coward & Dwyer, 1992) and a lower health status (Clark & Dellasega, 1998) than their non-rural counterparts. In comparing the previous research with the current study, the current study found that there were no significant differences between the rural and non-rural patients on any of the patient factors: age, hospital length of stay, gender, amount of support, living alone or comorbid conditions. There are several possible explanations for why the current study differed from past research. Characteristics of the patient population serviced by the Mayo Clinic could be one explanation for the lack of significant differences. This institution is an academic referral center and, in fact, patients are known to come long distances (hundreds of miles) to come to the Mayo Clinic. This suggests that these patients could be “sicker” with either more severe hip disease or more comorbidities who were seeking academic medical center care because of the severity of their disease. At the same time, patients may have chosen the Mayo Clinic because of its reputation when they could have had the surgery done at a local community hospital. In this case, they may actually have been more functionally able because they were able to travel the long distances. Descriptive data suggests the latter explanation in that there were few comorbid conditions and patients had relatively high functional ability preoperatively. Because they were scheduled for elective surgery, these patients may be generally healthier than those described in past studies.

Another plausible explanation is that the differences found in past studies have been eliminated as part of the movement to a prospective payment system (PPS) methodology for Medicare in all post-acute care settings. The first PPS to be implemented was in SNFs, starting in 1999 while inpatient rehabilitation PPS was not in
effect until 2002. The PPSs were intended to shift care from a fee-for-service system to one based on payment dependent on the condition of the patient at the time of admission. Because the PPS methodologies all have some type of risk adjustment strategy to adjust for patients who are sicker or more functionally impaired, the past differences between rural and non-rural patients (in which rural patients had higher levels of functional impairment) might have eliminated differences for rural patients. Thus, although past research found differences between rural and urban patients on a number of factors, the same findings were not evident in the present study and further research in this area would be useful in determining whether the change to post-acute PPS has eliminated differences.

**Rural/Nonrural Post Discharge Site of Care**

Geographic patient location is an environmental factor, which may influence access to care, utilization of health care services, and patient outcomes. Previous research comparing rural to nonrural populations in relation to their access and health care services have had mixed findings on access and the use of health care services (Dansky et al., 1998; Rosenbach et al., 1995; Stearns et al., 2000). Rural location was not found to be associated with any consistent utilization of formal health care services (Rosenbach et al., 1995) or self-reported access to care (Stearns et al., 2000).

Research aimed at specifically analyzing rural/nonrural differences in post-acute care has also produced inconsistent findings. Dansky and colleagues (1998) did find a greater use of home health in rural counties while Clark and Dellasaga (1998) found no significant difference in use of home health services. When comparing the previous findings and the current study, the current study found no significant differences in the
type of post-acute care received based on geographic location of the patient during the postoperative period. The Dansky study relied on a national sample of Medicare beneficiaries. This allowed for a larger and more geographic representation thus perhaps overcoming any regional post-acute practices or practices specific to the Mayo Clinic.

There is some evidence that patients with more family support are less likely to use home care services (Coughlin et al., 1992; Kemper, 1992). Kemper (1992) found that living with a spouse resulted in less hours of formal care. Coughlin et al. (1992) similarly found that living with a spouse or a relative resulted in less care by formal providers. A research study by Magilvy, Congdon, and Martinez (1994) found that rural cultural norms encouraged and supported family management of caregiving activities when possible (Magilvy et al., 1994). This qualitative research also found that informal caregivers included members of the community as well as the traditional family members. The present study found that living alone was associated with more use of post-acute care of all types, not just home healthcare. One explanation for this is that there were too few users of inpatient rehabilitation and home healthcare to allow for adequate comparison. A second explanation may be that those who live alone chose post-acute services because they lived alone, whether or not they had informal resources to draw upon.

The present study did not find that patients living in rural areas were significantly different from those residing in non-rural areas when examined bivariately on each independent variable. Similarly, multivariate analyses, when controlling for environmental, patient/family or market variables, revealed no significant effect of living in a rural area on the use of post-acute care or the outcomes achieved. As presented
previously, the most plausible explanation is the type of patient referred to the Mayo Clinic for hip arthroplasty. These are patients who are able to travel from rural areas in the State of Minnesota. Although not measured in this study, they are perhaps of a higher socioeconomic and educational level, despite being primarily insured via Medicare.

Another explanation for the lack of significance is that almost half of the sample was discharged from the hospital with no formal care. While there is no national data on the percentage of patients discharged to formal post-acute care after primary hip arthroplasty, the fact that half of the patients did not need formal care may not be typical.

There is recent evidence that patients treated at hospitals and by surgeons with higher annual caseloads of primary hip arthroplasties had lower rates of mortality and complications, hence better outcomes (Katz, 2001). The Mayo Clinic Rochester does approximately 1000 hip arthroplasties annually with each orthopedic surgeon performing greater than 50 procedures. This volume-outcome relationship could also account for positive outcomes--regardless of where the patient resides postoperatively, if their surgery is performed by a surgeon with a high volume, they are more likely to have a positive outcome.

Results from the present study suggest that even when controlling for the preoperative hip score, patients attain positive outcomes with or without post-acute care. One explanation for this is that the Medicare reimbursement system has provided financial incentives to refer patients to post-acute care. Changes in the Medicare payment system may encourage those patients who are healthier to go into inpatient rehabilitation because they must meet thresholds for tolerating therapy to be admitted to those
programs. Similarly, the payor type may contribute to the difference in the utilization of post-acute services in Minnesota, although the rate of managed care penetration and the types of managed care products vary (Holtzman et al., 1998). As well, because of the complex organizational relationships between acute care settings and post-acute care settings within any health system, there may be financial incentives to the healthcare system for referring patients to post-acute care, especially if those services are owned by the same entity. These issues are beyond the scope of the present study but may provide explanation for the findings.

Implications for Nursing Knowledge

The most significant contribution of this study to nursing knowledge is that the results show that the use of post-acute services and resultant patient outcomes do not differ for rural patients. The study also provides some evidence to support that for a large part of the patient population undergoing hip replacement, no formal post-acute care is necessary to achieve positive outcomes. Therefore, careful evaluation of the patient’s needs should be done when the discharge planning process is undertaken. Despite longstanding accreditation requirements that discharge planning begin on admission, the processes involved in selecting the eventual destination for patients may not be systematic. Thus the lack of differences in the outcomes related to the post-acute site of care may be related to the unsystematic approach to discharge planning where patients with similar conditions at discharge may have received no care or care at any of the sites. Although those discharged without formal care had significantly more family assistance than those discharged to other sites of care, the other factors associated with post-acute care have yet to be determined. It is possible that patient or family preferences play a
large role in discharge planning and this could account for the lack of relationships between the physiologic factors and discharge placement.

Finally, the Andersen model as adapted by Fortinsky and Madigan, was useful in guiding the research, despite the lack of significance for the rural location variable. Further use of this adaptation is recommended for nursing research studies using a health services research methodology because it takes into account the environmental (geographic market) as well as patient/family characteristics. This model provides a theoretical framework that bridges the use of administrative data with the qualitative nature of many of the studies conducted examining the needs of the rural elderly.

Limitations of the Study

The disadvantages of a nonprobability sample include threats to the internal validity (Henry, 1990). For the current study these disadvantages were dealt with, where possible, by taking steps to increase the representative level of the sample. Deriving the sample from a computer-generated database, which contained all eligible subjects, minimized selection bias. All subjects who were eligible were included in the sample until an adequate sample size was obtained.

Retrospective data collection had an advantage over a prospective informed consent study since it was not concerned with the possible interaction between the sample and participation. There did exist, however, a small threat of sample bias secondary to the sample including only those subjects who have given prior authorization for the release of medical records for research purposes. These subjects may be systematically different from those who do not give authorization for research participation.
The major threat to external validity in this study lies in its ability to generalize the study findings beyond the sample used in the study. This study was limited to data collection at one hospital, which is a tertiary research center. This was a recognized limitation in that there may be systematic differences in the patients seen in a tertiary medical center versus those seen in a community medical center. There is also acknowledgment that the circumstances during which the study was conducted are historically unique to that time period. In spite of the sample limitations, this study was the first to seek to describe the relationship between the geographic location and access to post-acute services in a defined sample of elderly subjects who had undergone major hip arthroplasty. While this approach may have been limited in generalizability, it was an efficient use of limited resources to determine whether a larger study should be undertaken in the future.

Another limitation lies within the definition of the environment. No single definition exists for the term rural. Previous research has defined rural differently (Dansky et al., 1998; Rogers, 1999; Rosenbach et al., 1995; Stearns et al., 2000). The lack of consistency stems from the federal government’s lack of a consistent definition.

There are several definitions used by the government to define rural. According to the U.S. Bureau of Census (1995), rural areas are comprised of place, both incorporated and unincorporated, with fewer than 2,500 residents and open territory. The Office of Management and Budget (OMB) uses a “metropolitan/nonmetropolitan” system of classifying populations; with metropolitan and nonmetropolitan defined on the basis of counties. Finally, the US Department of Agriculture, (USDA) further developed classifications of rurality (Beale & Johnson, 1995; Butler & Beale, 1994) which classifies
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counties into categories. Since any one of these government definitions can be used in research, comparisons across studies are difficult. As well, the scientific literature has not provided guidance into which definition is preferred. Therefore, a better and more consistent definition of rural is needed for comparison in future studies.

Two limitations exist within the instruments used in this study. The use of the Charlson comorbidity score and the tool defining the amount of support may have affected the results. Related to the Charlson comorbidity score, this study used the highest level of comorbidity rather than a summary score of all comorbid factors. If a summary score was used, a higher degree of comorbidity may have existed, therefore potentially changing the outcomes. The amount of support was a subjective scale scored by clinicians involved with direct patient care. A more refined, objective instrument may have yielded different outcomes.

Suggestions for Future Research

Findings from this study suggest that rural patients have no different post-acute needs or outcomes than their nonrural counterparts. Suggestions for future research are classified into five areas—sample, population, discharge planning studies, educational initiatives, and need characteristics.

Sample

Future studies might include a multisite sample of community-based and tertiary medical center patients in several geographic areas. This would allow for a more heterogeneous population upon which to draw more generalizable conclusions. Because of the relatively small number of patients who lived in very rural areas, further study with a larger number of patients from the very rural areas would be helpful in further
examination of the relationships between rurality, post-acute care and outcomes. Inclusion of a measure for physician volume for the surgery would be useful in further exploration of the volume-outcome relationship that has been found in other medical procedures (e.g. cardiac surgery). The multi-level modeling approaches needed for this could include institutional, provider, and patient factors to further explore the factors associated with outcomes and whether rural residence has an impact.

Population

Future research should include testing this model using different variations of this patient population. The truncated hospital length of stay may be contributed to the lack of significance in patient differences. Examining the post-acute outcomes of hip arthroplasty patients who experienced a longer hospital LOS and complications in the acute care setting may yield very different results. Similarly, the hip arthroplasty revision population may experience a very different post-acute experience and therefore experience different outcomes.

Discharge Planning

The existing empirical literature in the area of the discharge planning process is very limited. In light of the lack of significant differences between those who received no formal care and those who did, further exploration into how the sites of care are determined at hospital discharge and what factors are associated with the referral would be useful in beginning to develop a more systematic approach to discharge planning. The long-term goal of this line of research would be to determine whether some patients and families attain incrementally more benefit from post-acute care than others and which patients require post-acute care. As well, examination of the inter-relationships between
the acute care institution and the post-acute site of care might help explain some of what appears to be unsystematic referral. As well, the role of patient preference for the site of care is under-studied in this area and is likely to have significant impact on the post-acute site of care and use of post-acute services.

**Educational Initiatives**

Another approach would be to include an analysis of the patient education programs implemented in the immediate postoperative period to compare whether different programs yield different patient outcomes, especially for those who return home with no formal postoperative care. A focus on family caregivers and their inclusion in postoperative instruction and resultant impact on patient outcomes is another area for future research.

**Need Characteristics**

Finally, the lack of significance in this study may indicate that when controlling for environmental and patient/family characteristics, it is not the geographic differences that are significant. It may lie in the socioeconomic differences among patients who undergo hip arthroplasty that would yield significant findings since there may be more variation in the patient/family characteristics that contribute to the resultant post-acute outcomes.

**Summary**

Post-acute care is expected to become increasingly important with the aging of the American population and the associated morbidity. Some older Americans have been found to face particular challenges related to access and use of services, particularly those in rural areas. Yet findings from the present study suggest that the rural and non-rural
subjects were very similar in characteristics, attained similar outcomes, and did not experience differences in post-acute sites of care. Future research efforts focusing on other populations of patients and with a larger and more heterogeneous sample are important in further investigation of these relationships. Research in this area is important to understand patient care needs in acute care and beyond to the post-acute care setting.
## Appendix A

### Population-based surveys measuring access to care

#### Federally Sponsored Surveys

<table>
<thead>
<tr>
<th>Survey</th>
<th>Target population</th>
<th>Sampling design/Periodicity</th>
<th>Sample size</th>
<th>Design factors</th>
<th>Areas of access evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medicare Current Beneficiary Survey (MCBS)</td>
<td>Entire Medicare population</td>
<td>Longitudinal, in-person panel survey of a random sample of beneficiaries. / Annual; interviews conducted every 4 months for 3 years</td>
<td>13,000 Medicare beneficiaries.</td>
<td>Oversamples disabled persons under 65 and those 85 and older</td>
<td>Services utilized, sources of payment, changes in health status, spending down to Medicaid eligibility.</td>
</tr>
<tr>
<td>Medical Expenditure Panel Survey (MEPS) 1996-1997</td>
<td>U.S. non-institutionalized population</td>
<td>Cross-sectional, longitudinal household study. In-person survey with each year’s sample followed for two yrs./Annual with sampling and interviewing conducted throughout a given year.</td>
<td>Using an NHIS sub-sample there were approx. 13,000 households with 35,000 individuals</td>
<td>Over sampling of functionally impaired adults, children with activity limitations, expected low-income families and expected high-cost individuals.</td>
<td>Specific aim was to measure the differences in utilization, access, total expenses and out-of-pocket costs.</td>
</tr>
<tr>
<td>Medicare Managed Care Access Survey (MMCAS) 1996</td>
<td>Medicare beneficiaries enrolled (or disenrolled) in a Medicare managed care plan</td>
<td>Stratified random sample of Medicare managed care enrollees and disenrollees. /One-time only telephone survey during a 12 week period</td>
<td>3,080 Medicare beneficiaries who were enrolled in a Medicare risk plan for at least two months during a year</td>
<td>Over sampling of African Americans, disabled persons under 65 years and those 85 and older</td>
<td>Focus was to evaluate access to care in the Medicare managed care plans</td>
</tr>
<tr>
<td>National Health Interview Survey (Revised) (NHIS) 1997</td>
<td>U.S. non-institutionalized population</td>
<td>Multistage area probability sample. /Annual with sampling and interviewing continuously conducted throughout a given year.</td>
<td>43,000 households with 106,000 persons surveyed</td>
<td>Latinos and African Americans over sampled</td>
<td>Consumer perspective of perceived barriers to care and satisfaction with access.</td>
</tr>
</tbody>
</table>

#### Private Foundation Sponsored Surveys

<table>
<thead>
<tr>
<th>Survey</th>
<th>Target population</th>
<th>Sampling design/Periodicity</th>
<th>Sample size</th>
<th>Design factors</th>
<th>Areas of access evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>National Access to Care Survey (1994)</td>
<td>U.S. non-institutionalized population</td>
<td>Convenience sample using the NHIS sample to draw respondents</td>
<td>3,993 adults (18 yrs and older)</td>
<td>Non over sampling</td>
<td>Measured access by self-reported perceptions of access. Included specific questions about services: eyeglasses, dental care, prescription drugs and mental health service.</td>
</tr>
<tr>
<td>Getting Behind the Numbers (GBN) 1995</td>
<td>U.S. non-institutionalized population</td>
<td>Random- digit-dial phone survey/one time sample</td>
<td>60,000 person in 33,00 families in 60 randomly selected communities. Included a random subset of 12 sites for more intensive study</td>
<td>Those labeled as “high need” in initial interview may be over sampled in the longitudinal sample</td>
<td>Tracked health system effects on insurance coverage, access in relation to service use and costs. Measured quality of care. Included a follow-back survey of the health plans</td>
</tr>
<tr>
<td>Community Tracking Study (CTS/Household Survey) 1996</td>
<td>U.S. non-institutionalized population</td>
<td>Repeated, cross-sectional and longitudinal telephone surveys. Households without telephones had face-to-face interview/Biennial</td>
<td>60,000 person in 33,00 families in 60 randomly selected communities. Included a random subset of 12 sites for more intensive study</td>
<td>Those labeled as “high need” in initial interview may be over sampled in the longitudinal sample</td>
<td>Tracked health system effects on insurance coverage, access in relation to service use and costs. Measured quality of care. Included a follow-back survey of the health plans</td>
</tr>
</tbody>
</table>
## Appendix B

The Charlson Comorbidity Score

<table>
<thead>
<tr>
<th>Assigned Weight</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Myocardial infarctions</td>
</tr>
<tr>
<td></td>
<td>Congestive heart failure</td>
</tr>
<tr>
<td></td>
<td>Peripheral vascular disease</td>
</tr>
<tr>
<td></td>
<td>Cerebrovascular disease</td>
</tr>
<tr>
<td></td>
<td>Dementia</td>
</tr>
<tr>
<td></td>
<td>Chronic pulmonary disease</td>
</tr>
<tr>
<td></td>
<td>Connective tissue disease</td>
</tr>
<tr>
<td></td>
<td>Ulcer disease</td>
</tr>
<tr>
<td></td>
<td>Mild liver disease</td>
</tr>
<tr>
<td></td>
<td>Diabetes</td>
</tr>
<tr>
<td>2</td>
<td>Hemiplegia</td>
</tr>
<tr>
<td></td>
<td>Moderate or severe renal disease</td>
</tr>
<tr>
<td></td>
<td>Leukemia</td>
</tr>
<tr>
<td></td>
<td>Diabetes with end organ damage</td>
</tr>
<tr>
<td></td>
<td>Any tumor</td>
</tr>
<tr>
<td></td>
<td>Lymphoma</td>
</tr>
<tr>
<td>3</td>
<td>Moderate or severe liver disease</td>
</tr>
<tr>
<td>6</td>
<td>Metastatic solid tumor</td>
</tr>
<tr>
<td></td>
<td>AIDS</td>
</tr>
</tbody>
</table>

Appendix C

Mayo Hip Score: Clinical Assessment (80 points)

<table>
<thead>
<tr>
<th></th>
<th>Number of points</th>
<th>Mobility &amp; muscle power (20 points)</th>
<th>Number of points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain (40 points)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>40</td>
<td>Car (5 points)</td>
<td></td>
</tr>
<tr>
<td>Slight or occasional</td>
<td>35</td>
<td>With ease</td>
<td>5</td>
</tr>
<tr>
<td>Moderate</td>
<td>20</td>
<td>With difficulty</td>
<td>3</td>
</tr>
<tr>
<td>Severe</td>
<td>0</td>
<td>Unable</td>
<td>0</td>
</tr>
<tr>
<td>Function (20 points)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Foot care (5 points)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distance walked (15 points)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 blocks or more</td>
<td>15</td>
<td>With difficulty</td>
<td>3</td>
</tr>
<tr>
<td>&gt; 6 blocks</td>
<td>12</td>
<td>Unable</td>
<td>0</td>
</tr>
<tr>
<td>1-3 blocks</td>
<td>7</td>
<td>Limp (5 points)</td>
<td></td>
</tr>
<tr>
<td>Indoors</td>
<td>2</td>
<td>None</td>
<td>5</td>
</tr>
<tr>
<td>Unable to walk</td>
<td>0</td>
<td>Slight</td>
<td>3</td>
</tr>
<tr>
<td>Support Aids (5 points)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>5</td>
<td>Stairs (5 points)</td>
<td></td>
</tr>
<tr>
<td>Occasional use of cane</td>
<td>4</td>
<td>Normal</td>
<td>5</td>
</tr>
<tr>
<td>Full time use of cane or</td>
<td>3</td>
<td>With rail</td>
<td>4</td>
</tr>
<tr>
<td>crutch</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Two canes or crutches</td>
<td>2</td>
<td>One step at a time</td>
<td>2</td>
</tr>
<tr>
<td>Walker</td>
<td>1</td>
<td>Unable</td>
<td>0</td>
</tr>
<tr>
<td>Unable</td>
<td>0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

References


Williams, B. (1994). Comparison of services among different types of home health agencies. *Medical Care, 32*(11), 1134-1152.

