Determinants of Nonrecovery following Hip Fracture in Older Adults:

A Chronic Disease Trajectory Analysis

Chapter I

Introduction

According to the American Academy of Orthopedic Surgeons (AAOS), the incidence of hip fracture in the United States is estimated to occur at a rate of over 280,000 per year (AAOS, 1996). Persons who are over 65 years of age sustain the majority of these fractures. As the number of older persons rises into the 21st century, the incidence of hip fractures is expected to rise to a rate of 350,000 per year. Considering that each hip fracture carries a health care bill of approximately $35,000 per event, the total annual financial costs for these acute injuries will approach $ 9.8 billion in this country alone. By 2040, the number of hip fractures will rise to an estimated 512,000 cases annually at a cost of $16 billion if present cost factors continue at current rates (Cummings, Rubin, & Black, 1988).

For the substantial number of older persons who fracture their hip each year, the chances for full functional recovery remains relatively low. Hip fracture in older persons may be the sentinel event of life that leads to functional decline, disability, or death. Common health outcomes for older persons who fracture a hip include mortality or functional decline. In a review of the hip fracture literature, Craik (1994) found that mortality after hip fracture ranged from 2% to 63%, while Marotolli and his colleagues (1994) reported a range of 13% to 44% mortality after 6 months following hip fracture. Although Craik (1994) reported that 30% to 83% of older persons with hip fracture recovered independent ambulation, other researchers (Magaziner, Simonsick, Kashner, Hebel, & Kenzora, 1990) indicated that between 26% and 76% of individuals with a fractured hip do not recover their prefracture ambulation ability.

The continued high rates of mortality and morbidity after hip fracture in older persons suggests that further research that identifies and explains determinants of positive and negative outcomes is essential for reducing death and disability following such an event. Expanded knowledge regarding determinants of recovery is needed to guide the care procedures for persons who suffer a hip fracture such that functional outcomes can be optimized. Additionally, information about hip fracture recovery is necessary for

establishing national policies that promote a high quality of medical care with adequate financial reimbursement that leads to successful hip fracture outcomes for the majority of older persons who fracture a hip. The purpose of this research was to examine the differences between those older persons who fully recover physically from a hip fracture and those who do not. The specific goal of the research findings was to identify factors that differentiate older persons who regain their previous level of function from those who remain dependent within the functional activity domain.

Theoretical Framework

The amount of research on hip fracture outcomes is quite extensive. However, the majority of these studies are not grounded in any particular theoretical framework. Rather, predictors of recovery or nonrecovery have been statistically determined merely by comparing various medically related factors (e.g., fracture site, type of surgical repair, or type of anesthesia) to health outcomes (e.g., ambulation ability, residential location). To advance the previous atheoretical research on hip fracture outcomes, I utilized a chronic illness trajectory model (Corbin & Strauss, 1991a) as a theoretical basis for selecting elements of the hip fracture recovery process for investigation. The chronic illness trajectory model provides a theoretical framework backed by four decades of qualitative research on chronic conditions. Utilization of this theoretical model allowed a more systematic exploration of factors that influence functional outcomes after hip fracture, a comprehensive treatment of the entire hip fracture recovery course, and the opportunity for new and previously unknown factors that affect recovery to emerge. As a result, the findings of this study offer an enhanced understanding of the hip fracture recovery process and contribute to the improvement in the quality of life of substantial numbers of older persons.

Hip fracture is most often described in medical texts and journal articles as an acute illness or condition. The general linear pathway for recovery from an acute illness includes a limited pre-event symptom period, a brief acute crisis, an immediate medical intervention phase, rapid resolution of symptoms, and full recovery (Barbour, 1995). Lubkin (1986) described an acute illness as having a dynamic onset that ends shortly with complete recovery and resumption of prior activities or with death. This unidimensional path model appears to match appropriately to older persons with hip fracture who are

healthy, physically active, live independently in the community, and recover mobility quickly and without complications. However, exclusive congruency with this model is often not the case for the majority of older persons who are more medically frail or marginally independent prior to their hip fractures. These older individuals traverse a recovery course that is longer, more variable, and less satisfactory in outcomes.

Certain elements of the hip fracture recovery course appear more chronic than acute in nature. For example, significant predictors of the degree of recovery from hip fracture include prefracture variables such as age, functional ability, mental status, and psychiatric conditions such as dementia and depression (Craik, 1994). The strength of these prefracture variables in predicting subsequent functional outcomes indicates the pre-event period has much more importance than the acute model would suggest. The recovery course after hip fracture tends to be protracted. Thus, hip fracture recovery does not fully demonstrate the rapid resolution of symptoms of an acute illness course. Katz and his colleagues (1967) showed that most recoveries occurred within one year after fracture, but improvement was possible even into the second year. In addition, the recovery course after hip fracture is not strictly linear; variability in recovery pathways are common. Many older persons with hip fracture move in and out of various health care settings due to unstable medical conditions and changing needs for assistance and therapeutic intervention. Full functional recovery is not the normative outcome following a hip fracture. To effectively study recovery after hip fracture, it was imperative to include elements of chronicity into this study's theoretical framework.

Corbin and Strauss (1991a) developed a chronic disease trajectory framework following over 30 years of interdisciplinary research on a variety of chronic illnesses. Originally conceptualized as a general chronic illness theory, the framework was subsequently converted into a more practical model that could be used to study nursing practice. They designed the model to be sufficiently general so that other disciplines could use the theoretical framework to study a variety of chronic conditions.

Grounded research conducted by Strauss and his colleagues since the 1960s contributed to the development of the chronic disease trajectory framework (Robinson et al., 1993). Some of the many individuals with chronic disorders who were studied included persons dying from terminal cancer, suffering from long-standing pain, or living

at home with conditions such as diabetes mellitus, arthritis, or heart disease. Studying the care of dying cancer patients demonstrated that the course of dying takes time and can be managed and shaped (Corbin & Strauss, 1991a). Research on managing chronic illness in the home setting revealed different phases (crisis, acute, comeback, stable, unstable, downward, and dying) for the course of a chronic disease and differences in care management during these distinct phases (Corbin & Strauss, 1988).Two major concepts from the chronic disease trajectory framework are applicable to this study. The first is the concept of "trajectory." Trajectory is used to describe the illness course and builds upon the idea that chronic conditions have a course that varies and changes over time (Corbin & Strauss, 1991a). The use of the term trajectory also indicates the potential for the course of a chronic condition or illness to be shaped or managed. The second relevant concept is "trajectory phasing" (Corbin & Strauss, 1991b). Trajectory phasing refers to the many different changes in status that make up the course of an illness. Corbin and Strauss (1991b) identified nine phases: pretrajectory, trajectory onset, crisis, acute, comeback, stable, unstable, downward, and dying (Table 1). These phases allow for variable paths through the illness course.

The strength of this trajectory model is the identification of differential phases in the course of a chronic disease, allowance for a variety of pathways in the disease trajectory, and inclusion of a prelude period before the onset of a condition. The chronic disease trajectory framework phases fit well with the distinct periods that predominate in the hip fracture recovery trajectory. The model is able to simultaneously capture the acute medical paradigm and the elements of chronicity that may be relevant to recovery in cases of hip fracture. In order to study hip fracture recovery more effectively, I adapted this framework for the current research project.

Table 1

Definitions of Phases in the Chronic Disease Trajectory Framework

Phase	Definition
1. Pretrajectory	Before the illness course begins, the prevention phase, no signs or symptoms present
2. Trajectory onset	Signs and symptoms are present, includes diagnostic period
3. Crisis	Life-threatening situation requiring emergency/critical care
4. Acute	Active illness or complications that require hospitalization for management
5. Comeback	Signs and symptoms reduced or eliminated, rehabilitation, or recovery
6. Stable	Illness course/symptoms controlled by regime
7. Unstable	Illness course/symptoms not controlled by regime but not requiring hospitalizations
8. Downward	Progressive deterioration in physical/mental status characterized by increasing disability or symptoms
9. Dying	Immediate weeks, days, or hours preceding death

Based upon the chronic illness trajectory framework, I developed a phase model for the hip fracture trajectory to provide a theoretical guide for this study. This hip fracture phase model uses all of the phases in the chronic disease trajectory model matched to distinct periods in the hip fracture course. The pretrajectory and trajectory onset phases of the chronic illness trajectory model were combined to form a single prefracture phase representing the months before the fracture event. The unstable phase and downward phases of the chronic disease trajectory framework were combined into one phase of decline in the hip fracture phase model. Overall, the hip fracture phase model retains the mix of relevant acute and chronic components in the recovery course. The hip fracture trajectory phase model designed for this study is presented in Figure 1 below.

Prefracture => Fracture => Acute <==> Rehabilitation <==> Recovery

   Phase   Phase   Phase   Phase

```
              .         ↖         ◆         ↗
                           ↘
```
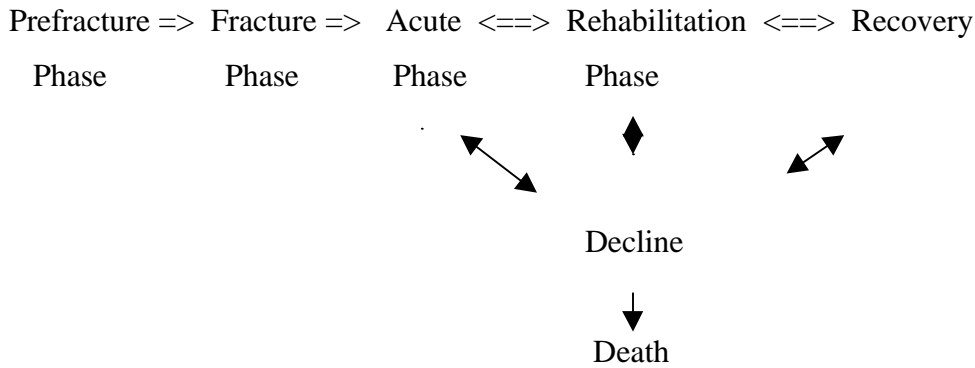
Decline

↓

Death

Figure 1. Hip Fracture Trajectory Phase Model

       The model starts with a prefracture phase that precedes the actual fracture event. After the hip fracture event and entrance into the acute phase, progression through the model may include the rehabilitation phase, the decline phase, and the outcome or recovery phase. Death can occur in any of the phases of this model once the fracture event has occurred and can be defined as a subtype of outcome. This phase model does not necessarily represent a linear path; rather it allows individuals to move forward and backward between the acute, rehabilitation, decline, and outcome phases as indicated by the bi-directional arrows in the model (See Table 2 for definitions of the phases of the hip fracture trajectory model).

Table 2

Definitions of the Hip Fracture Trajectory Model Phases

Phase	Definition
1. Prefracture	Weeks and months leading up to the fracture event
2. Event	Perifall period
3. Acute	Hospitalization with acute care, surgery, and initial rehabilitation
4. Rehabilitation	Active and intensive rehabilitation period
5. Recovery	Long-term outcomes stabilize, no active rehabilitation
6. Decline	Short or long-term period of further medical complications, new diagnoses, readmission to acute care, and more disability
7. Death	Most negative and final functional outcome without opportunity to move into another phase

In this study, I examined specific predictor factors within each of these phases. I identified these variables through a thorough examination of the prior hip fracture research, the literature on chronic disease, and my clinical expertise. For the prefracture phase, factors I examined included personal characteristics, social status, psychological status, and physical status. I explored the circumstances and response activities surrounding the hip fracture event. Examination of the acute phase of the hip fracture trajectory incorporated the hospitalization period and include medical and surgical interventions, responses to care, timing of progress and discharge destination, and functional status. The rehabilitation phase was examined for changes in medical status, location, activities of rehabilitative therapies, timing of progress, and discharge functional status. In the final phase, I examined the outcomes of long-term functional status, level of pain, and residential location. These broad concepts are operationalized by use of specific variables that are clearly identified and defined in the methods section of this document.

Propositions/Hypotheses

A review of the hip fracture recovery literature demonstrates that the research on this topic regularly identifies personal characteristics that influence recovery, but identifies few external factors that consistently improve outcomes. Additionally, much of the prior research has focused on the hospitalization phase or acute care for older hip fracture patients. Thus, little is known about the influence of rehabilitative care following discharge from the hospital. From the chronic disease trajectory literature, the rehabilitation phase is the last portion of the hip fracture trajectory in which there is substantial support from health professionals in directing care and managing the course towards a positive outcome.

Further limitations in the literature have been presented in the findings of a special committee on hip fracture for the Institute of Medicine (Heithoff & Lohr, 1990). The committee's report, *Hip Fracture: Setting Priorities for Effectiveness Research*, focused on five methodological issues for future hip fracture research: (a) consistency in health and functional status assessment, (b) definitions of outcomes and comparability of outcome measures, (c) the need for longitudinal data, (d) risk stratification and classification by comorbidity, and (e) patterns of care. The report also identified three

clinical or patient management topics: prevention of hip fracture, treatment options, and rehabilitation. The committee strongly recommended that future research investigate differences in the timing, types, and intensity of rehabilitation efforts, longitudinal follow-up across settings of care, and differences in sites of care (Heithoff & Lohr, 1990).

The primary focus of this study centers on the rehabilitation phase of the hip fracture recovery trajectory. The main proposition of this study was that older persons who do not recover fully following hip fracture differ from persons who do fully recover on factors related to the rehabilitation process following acute hospitalization for hip fracture. General hypotheses for this study related to four factors to be examined in the rehabilitation phase of the trajectory to recovery: type of therapy, frequency of therapy, the number of organizations rendering rehabilitative services, and the primary setting involved in the provision of rehabilitation services at four weeks post-hospitalization. The specific hypotheses of this study were these:

1. Older persons who do not recover fully from hip fracture differ from persons who do recover in the type of therapies received during the rehabilitation phase. Individuals who do not recover have received only physical therapy services, whereas persons who recovered have received physical and occupational therapy.

2. Older persons who do not recover fully from hip fracture differ from persons who do recover fully on the frequency of therapy provided during the rehabilitation phase. Individuals who do not recover have received less frequent therapy visits than individuals who recover.

3. Older persons who do not recover fully from hip fracture differ from persons who do recover fully in the number of agencies or facilities involved in the provision of therapy services during the rehabilitation phase. Individuals who do not recover have received therapy services from only one agency or facility; individuals who recover will have received therapy from multiple agencies.

4. Older persons who recover fully from hip fracture differ from persons who do recover fully in the setting from which they receive rehabilitation services at four weeks post-hospitalization. Those individuals who do not

8

recover will receive therapy in an institutional setting four weeks after hip fracture; individuals who recover will receive therapy at home at four weeks.

Chapter II

Literature Review

Hip fracture in old age can have disastrous consequences. These consequences are best reflected by the following quotes from narrative interviews with older persons who had fractured a hip (Borkan, Quirk, & Sullivan, 1991, p. 951-952): "I don't think I'll ever walk normally again"; "I think that on account of my age, it will take a long time to recover"; "I might have to go to a nursing home because I'll be good for nothing"; "I'm getting so I'm afraid to walk"; "The hip fracture was severe. It was a shock to my body."

Survival and full recovery from a hip fracture are elusive outcomes for many older persons. Mortality and morbidity data for hip fractures injuries remain high despite improved surgical management and more comprehensive rehabilitation services. Marottoli and associates (1994) suggested that the mortality rates for community dwelling older adults who fracture a hip range from 13% to 44% in the first six months and are considerably higher than a comparison group of older persons without a hip fracture. Craik (1994), in her review of hip fracture studies, stated that mortality reported to be associated with hip fracture ranges from 2% to 63% depending on factors such as time of measurement, study location, and sample characteristics. Mortality rates following hip fracture remain above those of the general population for the six months to one year after the fracture event (Beals, 1972; Magaziner, Simonsick, Kashner, Hebel, & Kenzora, 1989). Although mortality rates have slowly dropped over the past two to three decades, overall death rates are estimated to remain at the relatively high level of 12% to 25 % over the norm (Craik, 1994; Heithoft & Lohr, 1990).

With better medical management, success rates for surgical repair of hip injuries have improved. Attention has shifted from issues of mortality after hip fracture to other outcomes, such as functional recovery (Ahmad, Eckhoff, & Kramer, 1994). Physical impairment is common in large numbers of older persons who break a hip and are unable to return to previous levels of ambulation, self-care, and social function. Craik (1994) reported that the percentage of persons reaching independent ambulation within the first year after fracture repair ranged between 30% and 83%. The wide range in percentages resulted from differences in length of time for follow-up, definitions of the recovery outcome, and sample characteristics. In addition, hip fracture leads to a decreased ability

to perform activities of daily living (ADL) (Cobey et al., 1976; Katz et al., 1967). Individuals may not be able to perform basic tasks such as bathing, dressing, and toileting without assistance. Thus, physical disability and dependence in ADL are common functional outcomes after a hip fracture.

In this chapter, I summarize the existing knowledge regarding prediction of hip fracture outcomes, discuss conceptual and methodological difficulties inherent in past and current research, and describe the literature on chronic disease. First, I will discuss the relationship of demographic variables to outcomes. Second, I will describe physical or biomedical factors that dominate the hip fracture research literature. Third, I consider research on psychological and social variables. Then, I analyze the research dilemmas in hip fracture outcome studies. I conclude by discussing chronic illness and the chronic disease trajectory framework.

Hip Fracture Outcomes

The majority of researchers who study hip fracture outcomes have compared demographic, physical, or biomedical factors to several different outcome measures. These outcome measures usually fall into one of three categories: survival, functional recovery, or living arrangements following a hip fracture. Survival outcomes consider mortality after hip fracture. Functional recovery measures usually reflect the ability to ambulate or perform ADL. Outcomes based on living arrangements refer to residential location following a hip fracture (i.e., home, assisted living, or skilled nursing facility). In order to critically evaluate the major portion of the hip fracture outcome research, I incorporate and review all three types of outcome measures.

Demographic variables

The demographic variables of age and gender are frequently examined in hip fracture studies. Researchers consistently demonstrate a link between increasing age and higher mortality, poorer recovery, and increased risk of institutionalization. Beals' study (1972) of 607 older persons with fractured hips resulted in a 50% mortality rate for the sample at the end of one year post-fracture. He concluded that the most important factor influencing survival was age of the person. Similarly, persons who were older demonstrated higher short- and long-term mortality in a large study of 27,434 Medicare enrollees with hip fracture (Lu-Yao, Baron, Barrett, & Fisher, 1994). Kiel and colleagues

11

studied over two thousand older persons admitted to nursing homes post-hip fracture and found a correlation between being older and reduced probability of returning home at one month (Kiel, Eichorn, Intrator, Silliman, & Mor, 1994). In a 1997 study of 612 elderly victims of hip fracture, a patient age of greater than 85 was predictive of mortality based on a one-year follow-up (Aharonoff, Koval, Skovan, & Zuckerman, 1997).

Although females have a higher incidence of hip fracture than males, men who fracture a hip often show higher mortality rates than women (Beals, 1972; Lu-Yao et al., 1994). Beals (1972) studied older persons with hip fracture for a ten-year period. The ratio of females to males in his sample was 2.5:1. Females in his study showed a much lower hospital mortality rate than males. Being male was associated with higher short- and long-term mortality in a large study of hip fracture patients by Lu-Yao and her associates (1994). Unlike mortality figures, data on functional recovery of males and females have not shown significant differences based on gender.

The incidence of hip fracture among Blacks is lower than Whites (Farmer, White, Brody, & Bailey, 1984). Studies examining racial differences in hip fracture outcomes are rare and limited by small sample sizes (Jacobson et al., 1992). A few studies have demonstrated higher mortality rates for older Black Americans who break a hip when compared to a matched group of older White Americans. Plausible explanations for this difference include greater degree of preinjury illness and disability, lower socioeconomic status, limited access to health care for Blacks, and variability in patterns of medical care (Jacobson et al., 1992; Lu-Yao et al., 1994).

Physical and Biomedical Variables

Consistently, prefracture mobility status is a determining factor in the degree of functional recovery after hip injury and repair. Katz and his associates (1967) conducted a prospective analysis for over 9 years on 147 patients with hip fracture in Cleveland. Their study found that prefracture status for ambulation (measured on a 5-point graded scale) and ADL ability (measured on a 7-point graded scale) were significant predictors of positive functional outcome in hip fracture recovery. In a 1996 study of 162 hospitalized persons over 60 years of age, the ability to ambulate independently (measured as independent or dependent) prior to a hip fracture improved the odds of regaining independence (measured as independent or dependent) in bed mobility,

transfers, and ambulation in the acute phase of recovery after hip fracture repair (Guccione, Fagerson, & Anderson, 1996). Koval and associates (1995) found prefracture ambulation ability (measured on a 7-category graded scale) to be predictive of ambulatory recovery status at one year following the fracture event. In a study of 219 community dwelling older patients with hip fracture, a positive association was found between the level of prefracture ambulation (measured dichotomously as independent or needing assistance) and ambulation ability at one year after fracture (Mossey, Mutran, Knott, & Craig, 1989). Thus, prefracture mobility is a strong predictor of functional outcome after hip fracture.

Multiple studies (Katz et al., 1967; Kiel et al., 1994; Magaziner et al., 1989; Marottoli et al., 1994) have shown a significant correlation between the existence of one or more medical conditions at the time of a hip fracture with poor recovery. In the study by Katz and associates (1967), the presence of complicating diseases such as heart disease, diabetes mellitus, renal failure, obesity, rheumatoid arthritis, Parkinson's Disease, and cancer were adverse prognostic indicators for recovery. Likewise, Kiel and his associates (1994) found significant associations between the presence of neurological disease and increased mortality following hip fracture. A high number of comorbid conditions (≥ 2 conditions) was related to decreased survival in a study of over 2,000 New England older persons with hip fracture (Marottoli et al., 1994). In a study of 814 community dwelling older persons in Baltimore, Magaziner and his colleagues (1989) found that coexisting illness (e.g., presence of one or more other serious medical conditions) at the time of hospital admission was associated with increased mortality. Researchers who did not find significant comorbidity indicated that study samples specifically included "healthy" or "hardy" individuals; thus, findings would not be expected to show significance for pre-existing conditions (Guccione et al., 1996).

Any invasive surgical procedure carries a concomitant risk of complications. Findings from a number of recent studies showed that the number of complications after fracture repair is associated with decreased survival and poorer recovery. Based on a bivariate analysis of a subsample of 120 older persons with hip fracture, a significant prediction of death was due to a high number of complications (≥ 2 complications) such as fever, hematoma, pneumonia, pressure sore, urinary infection, or wound infection

(Marotolli et al., 1994). Aharonaff and colleagues (1997) concluded from their study of 612 elderly patients who sustained a non-pathological hip fracture that reduction of postoperative complications decreased mortality in the first year postfracture. Guccione and his associates (1996) at Massachusetts General Hospital examined hip fracture care for older persons during the acute hospital phase after a hip fracture. Their findings showed that the occurrence of postoperative complications ($\geq$ 1 of eight specific post-surgery complications) reduced the chances of discharge directly home.

Many researchers (Barnes & Dunovan, 1987; Bohannon, Kloter, & Cooper, 1990; Guccione et al., 1996) investigated the effects of hospital rehabilitation on outcomes for hip fractures. Barnes and Dunovan's (1987) study of 65 elderly patients with hip fracture determined that fewer than 40 visits to physical therapy were associated with independent ambulation at one year post-fracture. Individuals who required more physical therapy were less likely to become independent ambulators (Barnes & Dunovan, 1987). In a study of 182 community dwelling older persons with hip fracture, persons who received physical therapy on average more than once per day in the hospital were more likely to be discharged home from the acute care setting than those who did not (Guccione et al., 1996). In a retrospective patient chart analysis of 94 patients from a Connecticut hospital ($\underline{M}$ age = 75.5, $\underline{SD}$ = 13.1), scores on the Functional Independence Measure (FIM) at the time of evaluation and discharge from physical therapy were correlated with the number of physical therapy visits and the discharge location (Bohannon et al., 1990). The FIM measures physical performance of 4 activities (bed mobility, transfers, level surface ambulation, and steps) using a 7-point scale with 1 indicating total assistance required to 7 indicating complete independence. The number of physical therapy visits was positively correlated with an increase in scores for bed mobility, transfers, and locomotion. Higher admission and discharge FIM scores were predictive of discharge home rather than to a nursing home. Thus, provision of therapy during the acute phase of recovery after hip surgery positively influences functional recovery and return to the home setting.

An investigation at Massachusetts General Hospital of 75 patients ($\underline{M}$ age = 78) with hip fracture tested whether an intensive rehabilitation program would improve survival and functional outcomes in older individuals with hip fracture (Jette, Harris,

14

Cleary, & Campion, 1987). No significant differences were found in mortality, discharge status from acute care, or functional status at one year between sample participants assigned to the standard care group and the intensive rehabilitation group. However, in a larger study of 431 older patients, Zuckerman and his colleagues (1990) illustrated improved recovery indices for persons with hip fracture involved in a comprehensive interdisciplinary treatment and care program compared to patients receiving the standard care protocol at the hospital. As suggested by Craik (1994), the contradictory results of these two studies can be explained by differences in sample size (40 versus 431), control group size (35 versus 60), interdisciplinary team membership (inclusion of several nontraditional team members such as a psychiatrist in the second study), and frequency of therapy visits (therapy frequency was not described in the first study).

Because the incidence of the two major types of hip fractures changes with advancing age, many researchers have examined differences in outcomes for differing types of hip fractures. The two categories frequently studied are intertrochanteric (between the greater and lesser trochanters) and femoral (cervical) neck fractures. In a 1977 study of 103 patients over 50 years of age who were hospitalized with a hip fracture (Ceder, Thorngren, & Wallden, 1980), patients with a cervical fracture initially returned home earlier than patients with a trochanteric fracture. However, by the end of twelve months, the proportion returning home had equalized.   Beringer, McSherry, and Taggart (1984) compared 87 patients with cervical hip fractures to 63 patients with intertrochanteric fractures and demonstrated that patients with trochanteric fractures required longer hospital stays and returned to their previous environment less frequently. Beals (1972) found that patients with a femoral neck fracture had a lower initial mortality rate than patients with intertrochanteric hip fracture, but at the end of one year, equal percentages were still alive. A secondary analysis from a prospective study of 923 elderly patients with hip fracture revealed that patients with femoral neck fracture were more functional than intertrochanteric fracture patients at 2 months postfracture. However, at 1 year post fracture, both groups had recovered equally well in all daily activities (Fox, Magaziner, Hebel, Kenzora, & Kashner, 1999). Overall, these findings suggest that there are differential patterns of recovery and short-term outcomes based on the type of hip fracture sustained.

In 1983, Congress, in an attempt to reduce the rising costs of medical care, passed legislation changing the way Medicare reimbursed hospitals for acute care services (Schulz, 1995). Since the introduction of the prospective payment system (PPS), researchers have compared differences in hip fracture care before and after the implementation of the program. Fitzgerald and his colleagues (1987; 1988) reported that after PPS implementation, the mean length of hospitalization and the amount of inpatient physical therapy for older hip fracture patients decreased. In addition, the number of patients with hip fracture discharged to nursing homes increased and the number of patients still residing in a nursing home at one year after hospitalization for a hip fracture increased. In a subsequent and larger comparison study, Ray and colleagues (1990) reported no significant changes in mortality (23.2% prior to PPS and 23.7% after PPS) or the number of individuals who lived at home before the fracture and were still institutionalized at one year post-fracture.

Psychological and Social Variables

Psychological and social variables are studied less often in the hip fracture outcome literature than physical and biomedical factors. The primary psychological conditions previously considered are dementia (Kiel et al., 1994; Magaziner et al., 1990; Marotolli et al., 1994) and depression (Mossey, Knott, & Craik, 1990). Other psychological aspects of hip fracture recovery explored include coping strategies (Roberto, 1992a), self-expectations regarding outcomes (Borkan & Quirk, 1992), perceptions about the fall experience (Borkan, Quirk, & Sullivan, 1991), personality factors (Mossey et al., 1989), and motivation (Barnes, 1984).

The research findings relating cognitive status to hip fracture survival and return of functional status clearly indicate that the presence of cognitive deficits, either dementia or delirium, was associated with death and delayed return of mobility. Beals (1972) showed that pre-existing organic brain syndrome was associated with a lowered 5-year survival in elderly patients with hip fracture compared to individuals who did not have pre-existing organic brain syndrome. In a retrospective analysis by Miller (1978), the preoperative presence of cerebral dysfunction (i.e., chronic brain syndrome, cerebral vascular disease, or psychosis) correlated with an increased probability of death and non-ambulation. In the study by Marottoli and his associates (1994), poor baseline mental

status was one significant predictor of mortality in a multiple regression analysis and a primary predictor of institutionalization in a bivariate analysis. Similarly, Kiel and his colleagues (1994) found disorientation in older persons who had fractured a hip to be significantly associated with mortality whereas returning home was associated with the absence of disorientation. In addition, Magaziner and associates (1989) demonstrated that marked delirium at the time of hospitalization, without the presence of dementia, was an important factor in predicting mortality in the first year following a hip fracture. The findings of these studies suggest that cognitive status at the time of fracture influences the ability to participate and benefit from rehabilitation and may affect functional outcomes and recovery.

The presence of depression in older persons who fracture a hip also is a determining factor in recovery. In a 1989 study of 219 females who had broken a hip, high depression scores following surgery were associated with poorer functional and psychological recovery (Mossey et al., 1989). In a subsequent analysis of this same study data, individuals with persistently elevated depressive symptomatology were at a much higher risk for not returning to prefracture levels of physical functioning, controlling for other significant predictors of recovery (i.e., age, prefracture function, and cognitive status) (Mossey et al., 1990). In a study sample of 536 older persons with hip fracture, the degree of depressive symptoms was negatively associated with recovery of physical ADL when controlling for all other predictors studied (i.e., age, gender, functional status, fracture type, length of stay, cognitive status, and others). Bivariate analysis showed depressive symptomatology to be associated with poorer recovery in walking, physical ADL, and instrumental ADL (Magaziner et al., 1990).

Exploration of the psychic pathways after hip fracture offers other psychological variables that may relate to full recovery. In an investigation of the coping strategies of 101 older women who had suffered a hip fracture, Roberto (1992a) found that women who used more self-controlling, accepting responsibility, escape avoidance, and positive reappraisal coping strategies were more likely to rate their functional recovery at lower levels than women who used other types of coping strategies (e.g., confrontation, distancing, seeking social support, or planful problem solving). She speculated that use of these emotional-focused coping strategies reduced the distress

associated by the situation, but did not alter the reality of having a fractured hip, the actual source of the stress. Barnes (1984) did not find a significant relationship between motivation for rehabilitation (i.e., cooperation, following instructions, goal setting, and active participation) and patients' ability to reach prefracture ambulation status. Mossey and her colleagues (1989) explored personality dimensions of neuroticism and extroversion in their study of older women with hip fracture. They failed to demonstrate consistent associations between personality style and achieved recovery (measured by summing the weighted scores for survival status, physical functioning, self-rated health, presence of pain, extent of depressive symptomatology, and degree of return to prefracture functional levels). These studies provide a narrow insight into the psychic experience of older persons after hip fracture; findings have not been replicated in sufficient studies to substantiate the conclusions.

In a qualitative study, Borkan, Quirk, and Sullivan (1991) analyzed injury narratives of 80 elderly participants with hip fracture and reported that those individuals who perceived the hip fracture event in a mechanistic way and attributed cause to the environment showed greater improvement in gait ability at three and six month follow-ups than those individuals who did not demonstrate that perception or perceived the event as an organic illness or disease. Also, persons whose perception of disability with respect to their environment indicated autonomy, independence, and a sense of connectedness had greater improvement in gait at three and six months following the hip injury. In a related prospective analysis of the same participants (Borkan & Quirk, 1992), the variables of initial expectations and previous experience with illness were correlated with changes in ambulation from prefracture to three-month post repair. Older individuals who had positive expectations for recovery and previous experiences with illness were more likely to have less reduction in ambulation ability than those individuals who had negative expectations for recovery and no experience with a prior illness.

Social aspects of hip fracture outcomes were the specific focus of a few studies; in other research, investigators discovered the importance of social variables less directly. Kiel and associates (1994) examined preinjury living situation (i.e., living alone vs. with someone) with outcome status of location at one month (i.e., returned home, remained in a nursing home, returned to a hospital, or died). Their findings demonstrated a

18

significant association between living with someone and the likelihood of returning home. In a prospective study of 103 patients over age 50 with hip fracture in Sweden, Ceder, Thorngren, and Wallden (1980) reported that if individuals were living with someone prior to a hip fracture, their chances for an earlier return home increased. Also, individuals who had at least monthly social contacts with friends or relatives before a hip fracture were more frequently discharged directly home after their hospitalizations. Higher percentages of individuals who were able to do their own shopping prior to a hip fracture were at home at four months after surgery compared to individuals who were not able to shop. These higher percentages remained static through the one-year follow-up. In another analysis of the data, ability to visit someone before fracture, as well as age, were two significant predictors for returning and remaining at home following hip fracture at one year (Ceder, Svensson, & Thorngren, 1980). However, these two variables were not significant predictors at the time of discharge. Although social interaction prior to a hip fracture appears to affect short- and long-term recovery outcomes, the reason for its influence remains unclear. Measures of social interaction used in prior research are global or focus on structural components of the social network. Questions remain, for example, as to how social support functions to influence recovery.

In a prospective study of 92 older persons, Cummings and his colleagues (1988) examined the role of social support in functional recovery after hip fracture. Social support was measured by the number of persons in an individual's "core" network of support. The study findings revealed a significant positive relationship between social support and recovery, even while controlling for significant predictors of arm strength, mental status, and serum albumin. Analysis of data from a 1990 study of 151 older participants with hip fracture showed lack of family involvement as a significant predictor of continued skilled nursing home placement six months after a hip fracture (Bonar, Tinetti, Spheechley, & Cooney, 1990). Mossey and her associates (1989) did not find a significant effect for the social connectedness measure in their study on hip fracture outcomes, but suggested that the measure was not sufficiently sensitive to detect social isolation. Magaziner and colleagues (1990) collected information on three measures of social support: presence of a spouse, total size of the social network, and typical amount of contact frequency. In comparing these measures to outcomes after hip

fracture, they showed that a larger social network and the amount of contact with the network were associated with better functional recovery. Results of a study of social support and older women's recovery after hip fracture suggested social support variables such as assistance of family and friends may have a more indirect than direct association on recovery (Roberto, 1992b). The positive influence of social support may be mediated through individual variables such as perceived control, self-esteem, or perceived competence to affect hip fracture outcomes.

Although much of the psycho-social research has focused exclusively on community dwelling older persons, a few researchers have focused on the social factor of place of residence and investigated the relationship between being institutionalized at the time of a hip fracture and recovery levels. For example, Lu-Yao and her colleagues (1994) found a significant relationship between residing in an institution prior to a fracture and increased short- and long-term mortality. Kiel and associates (1994) found a positive correlation between residence in an institution and the likelihood of not returning home.

Limitations of the Research

The research on outcomes following hip fracture provides researchers and clinicians with much information regarding factors that influence surviving the event and regaining functional abilities. However, comparisons of these studies and interpretation of the results are sometimes difficult due to differences in sample size, participant characteristics, definitions of terms, timing of follow-up measurement, research designs, and the changing nature of hip fracture care and management.

Outcome measures vary throughout the hip fracture literature and may reflect mortality only, various definitions of functional status such as ambulation or ADL, or discharge location. Very few studies have extended the functional status outcome to a more global measure of disability individuals may experience in their environment following hip fracture. Some researchers use a final measure of functional status as the outcome criterion for the study, whereas others compare the final recovery status to the individual's prefracture level of function. Even prefracture level of function can be deceiving. Independence may be reported as the prefracture status, but the hip fracture was the result of balance instability for which the individual would have benefited from

20

an assistive device or help with ambulation. Thus, the individual was truly dependent prior to the fracture, but was inaccurately categorized as independent.

Studies often are retrospective rather than prospective in nature and have measurement issues inherent to this type of study design. For example, the participants are often asked to assess their prefracture ambulation, ADL, or health status after the hip fracture event and surgery. Resultant data may be inaccurate or inflated related to perceptual distortions or memory impairment.

Another concern regarding the hip fracture outcome research relates to timing issues. The outcome measures have been collected at a variety of time intervals: discharge from the hospital, one month, three months, four months, six months, and one year and so forth. Timing of follow-up data collection may not only bias results of the study, but may also obscure less obvious findings. For example, researchers have repeatedly reported a negative relationship between age and recovery. Two research studies shed additional light on the influence of age on recovery. Jette and his colleagues (1987) found significant differences between short- and long-term predictor variables for degree of physical disability. Increased age predicted increased short-term physical disability, but at one year follow-up, the risk of increased disability was no longer significantly determined by age of the person. A retrospective study by Kauffman, Albright, and Wagoner (1987) of rehabilitation outcomes after hip fracture in persons 90 years old and over demonstrated positive recovery results, with 63% regaining independent ambulation at the time of the final physical therapy treatment. Possibly, persons who are part of the old-old segment of the aged may have the potential to recover if given sufficient time for that recovery to occur. Thus, findings in the literature may be contradictory due to the interactive effects of age and time of follow up assessment.

The samples used in most hip fracture studies have included a select group of active, independent, community-dwelling elderly persons that serves to optimize research findings, but neglects the experiences of more dependent and cognitively impaired older persons. The wide range of percentages reported for many outcomes of hip fracture recovery reflects the large degree of variability that exists in characteristics of the research samples. Research findings may conflict depending on the use of healthy participants rather than a mixed-case sample. The presence of cognitive dysfunction

21

consistently predicts poor recovery after hip fracture. However, in a prospective study of 58 older persons with hip fracture at a rehabilitation hospital, cognitively impaired persons made comparable gains towards functional independence and discharge location with those who were cognitively intact in the first three weeks after hip repair (Goldstein, Strasser, Woodard, & Roberts, 1997). Another prospective study by Resnick and Daly (1997) on the effect of cognitive status for rehabilitation of 181 participants after an orthopedic event suggested that rehabilitation of older adults, with and without cognitive impairment, can result in functional improvement that is sustained over a one-year period. The results of these studies are in contrast to much of the existing literature and may reflect initial differences in sample characteristics.

Although sample sizes of prior hip fracture studies vary from under a hundred to thousands of participants, there are relatively few hip fracture outcome studies with large sample sizes. Large sample sizes are needed to allow for more sophisticated statistical analyses. Larger sample sizes allow for the examination of more variables and better statistical control of mixed-case samples. Small sample size is frequently identified as a limitation in a number of available research studies.

Over the past thirty years, medical care and treatment following hip fracture have changed dramatically. In the 1960s and 1970s, patients often completed their convalescence and rehabilitation in the acute care setting with lengths of stay approaching four to five months not uncommon. Beginning in 1983, the length of stay in the acute care facility was substantially reduced due to the implementation of Medicare's prospective payment system (Schulz, 1995). Today, the majority of the recovery and rehabilitation of older persons with hip fracture has shifted to specialized institutions (e.g., subacute facilities, rehabilitation hospitals, or long-term care institutions) or to the home setting with support from community-based services such as home health care. Earlier mobilization and more intensive and comprehensive rehabilitation efforts have altered the typical recovery care pattern following hip fracture from several decades ago. Thus, previous studies that equate data on discharges to institutions as being indicative of permanent physical decline and lack of potential for recovery in study participants may not be as relevant in the health care continuum that exists today. Also, because surgical repair of the hip has advanced over the years, fewer individuals are restricted in initial

weight bearing following hip fracture. Previous differences in recovery rates for certain types of fracture may, therefore, be minimized or reduced.

<center>Chronic Disease Research</center>

A fractured hip is often described in the literature as an acute crisis or event. However, the importance of a person's prefracture status to recovery, the long period that may be necessary for recovery, and the variability in the functional outcomes suggest there are elements of chronicity present in the trajectory course. To understand the chronic nature of hip fracture recovery more fully, I present a general description of chronic disease and a more detailed discussion regarding the pioneering research of Strauss and his associates in formalizing a chronic disease trajectory framework.

Defining Chronic Disease

Chronicity and chronic illness are difficult concepts to define in terms that are clear, yet all encompassing. In the early 1950s, the Commission on Chronic Illness defined chronic illness as "all impairments or deviations from normal which have one or more of the following characteristics: are permanent, leave residual disability, are caused by nonreversible pathological alteration, require training of the patient for rehabilitation, and may be expected to require a long period of supervision, observation, or care" (Mayo, 1956, p. 9). Cluff (1981) described chronic illness as a condition requiring periodic monitoring and supportive care to reduce the degree of illness and maximize the person's functioning and responsibility for self-care. A less medically-oriented definition was offered by Lupkin (1986): "chronic illness is the irreversible presence, accumulation, or latency of disease states or impairments that involve the total human environment for supportive care and self-care, maintenance of function, and the prevention of further disability" (p. 6). In addition, Lupkin (1986) described chronicity as a "state of unwellness produced by disease or disability requiring medicosocial intervention over an extended interval and affecting many aspects of an individual's life" (p.18). Finally, in 1996 The Robert Wood Johnson Foundation put forth a more simplistic definition of chronic disease, defining it as a condition lasting more than three months. Common themes in these definitions are disability, dependence, prolonged need for care or assistance of family and medical professionals, and long rather than short time frames.

<center>23</center>

These themes also occur frequently in the hip fracture literature and validate the idea that components of chronicity are present in the hip fracture trajectory.

Chronic conditions take many forms. Some of the more prevalent forms of chronic illness such as hay fever or sinusitis are not generally disabling (The Robert Wood Johnson Foundation, 1996). However, other chronic conditions such as heart disease and cancer can cause significant restrictions in a person's ability to be mobile and perform daily activities. The prevalence of chronic conditions increases and varies with age. The top six most common chronic conditions for individuals over 65 years of age are arthritis, hypertension, hearing impairments, heart disease, orthopedic impairments, and cataracts (National Center for Health Statistics, 1995). For many of these conditions, the prevalence rates increase substantially with increasing age. A major consequence of chronic disease in old age is disability; prevalence of disability in ADL is estimated at 38% for adults aged 70 or older (Jette, 1996).

Chronic Illness Trajectory

Anselm Strauss and his colleagues began studying chronic illness in patients who were dying over 40 years ago. These initial studies brought about the application of the term "trajectory" and focused on the conceptulation of the phenomenon of managing the evolving course of chronic conditions (Corbin & Strauss, 1991a). From extensive qualitative research and graduate teaching on chronic and different specific chronic conditions in the 1960s and 1970s, Strauss and Glaser published *Chronic Illness and the Qualtiy of Life* in 1975. In this book, they synthesized a large body of knowledge and research findings into a general theoretical framework of chronic illness. Continued research by Strauss and his associates led to a revised edition of *Chronic Illness and the Quality of Life* in 1984 that further developed the framework. In 1988, Corbin and Strauss published *Unending Work and Care: Managing Chronic Illness at Home* that provided an indepth discussion of how individuals and their families manage chronic conditions in the home setting. Corbin and Strauss (1991a) introduced a more formalized and systematic nursing model for chronic illness management based upon the trajectory framework.

The major concept of the chronic illness theoretical framework is the trajectory, which denotes an illness course (Corbin & Strauss, 1991a). The course of an illness or its

24

trajectory can be managed or shaped by the combined efforts of the individual, family, and others such as health providers (i.e., trajectory management). This is the unifying concept around which other concepts in the framework revolve or upon which they rely. Trajectory phasing is a way of representing the different changes in status that a chronic condition can exhibit in its course. The definitions of the nine specific phases in the chronic disease trajectory model were delineated in Chapter 1 (See p. 6). The projection of the trajectory refers to the vision of the illness course including personal meaning, symptoms, biographical information, and timing (Corbin & Stauss, 1991a). Trajectory scheme is the plan to shape the trajectory course, manage symptoms, and psychologically integrate the limitations of the disability. Conditions that may influence the effectiveness of the trajectory scheme in shaping the trajectory course (called reciprocal impact) involve technology resources, labor, money, time, past experience, motivation, care setting, lifestyle, beliefs, relationships, and time of illness (Corbin & Strauss, 1991a). The nursing model further describes the steps in developing and implementing a nursing plan for patients with chronic illness.

Over the past four decades of qualitative research by Strauss and his colleagues, a number of chronic conditions have been studied. The earliest studies demonstrated that dying takes time and that strategies of dying patients, families, and health professionals can moderate, manage, or shape the course of illness (Corbin & Strauss, 1991a). A later study on the management of pain in chronic illness showed how individuals' past experience with illness and pain can influence their current response to care and staff (Fagerhaugh & Strauss, 1977). Strauss and his associates examined the effects of technology in patient care and found an increased need for meeting emotional needs of patients being cared for in a high technology setting such as a hospital (Stauss et al., 1982). Much of Corbin and Strauss's work has explored care of individuals with chronic conditions in the home setting. These qualitative studies have demonstrated the enormous amount of work and energy expended by patients and families in managing chronic illnesses.

The chronic disease trajectory model has been adapted by other researchers for general studies of chronic illness, a variety of disease-specific studies, and for books on chronic diseases. Lubkin (1986) used the chronic disease trajectory framework as a

central theme of her book, *Chronic Illness: Impact and Interventions*. Robinson and her colleagues (1993) operationalized the chronic disease trajectory model and examined the usefulness of the model in guiding care for chronically ill elderly persons. The model challenged this research team by placing the patient in a position of equal authority in goal setting with the nurse. Also, the recommendation for changing emphasis of assessment components within varying phases of the trajectory challenged the nursing tradition of standardized, comprehensive assessment for all patients. Overall, the research team suggested the model was useful for developing practical tools for nursing research and care delivery (Robinson et al., 1993).

Six nurse researchers independently critiqued the chronic illness trajectory framework by application of the nursing model to a variety of chronic conditions (i.e., cardiac illness, HIV/AIDS, mental illness, cancer, multiple sclerosis, and diabetes mellitus). Overall, they provided strong positive assessments of the framework for studying chronic diseases in later life and identified the potential of the model for improving knowledge of disease processes, patient care, education of health providers, and policy (Woog, 1992). However, the model is not perfect. One criticism of the model is that the theoretical base needs to be more clearly defined and integrated into the nursing practice model. Another problem with the model is the lack of terminology describing care that is reimbursable in today's health care financing arena. The model also assumes the presence of a family support system when in practice, none may exist (Woog, 1992).

The chronic disease trajectory framework was chosen for this study because it is the only model of chronic disease grounded in studies of actual chronic conditions. Additionally, the chronic disease trajectory model has been successfully adopted and tested on a wide spectrum of chronic conditions and diagnoses. The model is practical and useful for guiding research (Woog, 1992). The abundance of information available about this model and its operationalization facilitated further application of the model in this study of hip fracture outcomes. The chronic disease trajectory framework is a flexible model that allows for the dynamic nature of hip fracture recovery. Finally, although the framework proposed by Corbin and Strauss describes the significant personal work of individuals in managing their own chronic illness, the important role of

health professionals in assisting individuals in the management schemes for their conditions is also a primary emphasis of this nursing model.

Summary

This study was specifically designed to explore the hip fracture recovery trajectory in a new and innovative way. A chronic disease trajectory model was used to map out the course of the trajectory. The theoretical basis for the partitioning of the course into phases originated from the chronic disease trajectory framework and resulted in a structured but dynamic trajectory model for hip fracture recovery. In considering that the main emphasis of past research centered heavily on prefracture characteristics, event factors, and hospitalization variables, I identified the post-hospital rehabilitation period as the primary phase of the recovery trajectory to be investigated by this research. To minimize some of the limitations of prior research, a longitudinal design was used for conducting the study with the inclusion of several follow-up points over a one-year period following the hip fracture. All data were collected from medical records prospectively rather than retrospectively. In addition, the sample included participants who varied in functional status, cognitive ability, and residential location as well as other demographic characteristics.

Many prior research studies on hip fracture outcomes conclude with recommendations for future research that explores the influence of rehabilitation efforts after discharge from the hospital on recovery outcomes (Bonar et al., 1990; Kiel et al., 1994, Magaziner et al., 1990). Findings from a special committee on hip fracture for the Institute of Medicine (Heithoff & Lohr, 1990) strongly recommended that future research examine differences in the timing, type, and intensity of rehabilitation care across varied care settings for older individuals following hip fracture. This study was constructed to incorporate those suggestions with the inclusion of therapy process variables from the rehabilitation phase of the recovery trajectory. Thus, this research explored the effect of factors such as type of therapy, frequency of therapy, number of agencies or organizations providing therapy, and the location of therapy at four weeks post-hospitalization on functional outcomes of the participants in the sample.

Chapter III

Methods

In this chapter, I describe the methods used to conduct this research. Specific topics include a detailed description of the sample, procedures, variables, and data analysis.

<u>Sample</u>

The sample for this study consisted of 102 older individuals who fractured a proximal femur from January1993 through September 1998. All of the participants had undergone surgical repair of their fractures or received rehabilitation services at a small, acute-care, 66-bed, community medical center in North Carolina. Participants were 60 years of age or older at the time of their fracture or became 60 during the hip fracture recovery period. The Health Information Management Department at the medical center identified the sampling frame from a search of their patient database using the International Classification of Diseases, 9th version, Clinical Modification (ICD-9-CM) codes for fractured femur as the primary diagnosis (DHHS, 1980). The year 1993 was selected as the first year from which to collect data because that was the year that a large orthopedic practice began performing all of the orthopedic surgeries at this medical center. Data were not collected on cases after October 1, 1998 because Medicare initiated a new prospective payment system in long-term care and home health to reduce the rising health care costs from these areas. The implementation of this new payment system altered the previous insurance coverage, length of stay, and patterns of care of patients served by these facilities and agencies. Initially, cases used for this study were to include only individuals who were followed through their entire recoveries by staff from service agencies and divisions operated by the medical center. To increase the number of cases in the sample, individuals who were provided some services through other agencies and institutions were included as well.

The sampling frame started with 131 individuals identified through a search of the medical records of the medical center and affiliated long-term care facility. Of those individuals identified as potential candidates for this study, a final sample of 102 participants was obtained. Reasons for non-inclusion in the final sample were not having had surgical repair (<u>n</u> =2), surgery performed by another orthopedic group (<u>n</u> = 5), not

meeting the age criterion ($\underline{n}$ = 1), not beginning or ending the one year recovery process within the specified years of the study ($\underline{n}$ = 6), location of the fracture other than proximal femur ($\underline{n}$ = 1), medical records from various sites could not be located ($\underline{n}$ = 12), or the final functional outcomes could not be determined ($\underline{n}$ = 2).

The study sample was composed of 75 females (73%) and 27 males (27%). The mean age of the participants was 80.4 years ($\underline{SD}$ = 7.5), with the ages ranging from 60 to 97 years. The majority of the sample members were White ($\underline{n}$ = 90, 88%) with the remainder being Black ($\underline{n}$ = 12, 12%). The participants ($\underline{n}$ = 77) had a mean education level of 9.9 years ($\underline{SD}$ = 4.5). A large portion of the sample lived in the community prior to their hip fracture (61% lived in their own house, 5% in an apartment, and 5% lived with family) while a smaller portion lived in institutions (16% lived in domiciliary homes and 13% were in nursing homes). Almost two-thirds of the sample were not married (54% widowed, 8% never married, 2% divorced); 34% of the participants were married and 2% were separated from their spouses. Nearly one-fourth (23%) of the sample relied on Medicaid funds for health care reimbursement.

The majority of the sample participants (67%) were oriented cognitively in three spheres (name, place, and time). The diagnosis of depression was present in the medical records of 23 participants (23%). The mean number of existing medical conditions at the time of the fracture was 4.07 ($\underline{SD}$ = 2.36) with a range from 0 to 11 conditions. Approximately one-third of the participants (36%) had been hospitalized in the year prior to their fracture. Based on current acceptable ranges for body mass index (BMI; NSI, 1992), only 16% of the sample were considered well nourished with the remaining portion being considered either poorly nourished (66 %) or overweight (17 %).

Prior to the fracture, independent ambulation was the primary mobility status for 61 of the 102 participants (60%). The remaining participants (40%) were dependent in ambulation requiring human assistance or an assistive device (38%), or were nonambulatory (2%). The majority of the sample (64%) was independent in the performance of ADL (e.g., bathing, dressing, and transferring from one location to another) prior to the hip fracture.

The location where the hip fracture event primarily occurred was indoors (47% at home and 28% at a facility), but a portion of the hip fractures took place outdoors (25%).

All of the fractures were unilateral and the side of the fracture was almost equally divided between left (53%) and right (47%). The type of fracture was split into the two main subtypes of proximal hip fractures: cervical or femoral neck (48%) and pertrochanteric (52%). Surgical repair of the fracture consisted of internal fixation by pinning (63% of the participants) or hemiarthroplasty (37% of the participants). The average length of stay in the hospital was 9 days ($\underline{SD} = 4.7$) with a range from 3 to 28 days. Most individuals (79%) were discharged from the hospital to a long-term care facility for rehabilitation; others went to a domiciliary home (9%), an acute rehabilitation facility (5%), or directly home (7%).

No deaths occurred through the hospitalization period, but three individuals died during the 30-day period following the initial fracture event. At six months postfracture, 49% of the sample were at home, 26% were in a long-term care setting, 11% were in a domiciliary home, and 14% were deceased. At one year following the fracture, 57% of the remaining sample participants were at home, 25% were in long-term care, 9% were in a domiciliary home, and 9% ($n = 8$) had died. The total number of deaths over the one-year recovery period was 22 (22%).

At the time of completion of rehabilitation or the discontinuation of any physical or occupational therapy ($\underline{M}$ number of weeks = 11.4, $\underline{SD} = 8.6$, $\underline{n} = 82$), the number of individuals who were alive and fully recovered was 24, and the number who were alive but not fully recovered was 75. At six months following hip fracture, only 22 participants were categorized as fully recovered, 66 were categorized as not fully recovered, and a total of 14 had died. One year after hip fracture, the total number of individuals who were fully functionally recovered was 22; the number of individuals who were not fully recovered was 58 and the number who had died was 22.

A comparison of this study's sample members to individuals who participated in previous hip fracture research demonstrates similarities on a number of key descriptive characteristics. Many hip fracture studies (Lu-Yao et al., 1994; Magaziner et al., 1990; Ray et al., 1990; Roberto, 1992a) included sample members with mean ages ranging from 79 to 82 years of age. The percentage of females compared to males in mixed gender samples ranged from 67% to 85% (Cummings et al., 1988; Fitzgerald, 1988; Magaziner et al., 1990; Ray et al., 1990). As in this study, previous samples, also, have high

percentages (ranging from 88% to 95%) of White participants (Cummings et al., 1988; Fitzgerald, 1988; Ray et al., 1990;). Short-term mortality rates (1 month) fall between 3% and 12 % (Jette et al., 1987; Kiel et al., 1994), whereas mortality rates at one-year follow-up generally have shown a range from 12% to 29% (Heithoff & Lohr, 1990; Jette et al., 1987; Lu-Yao et al., 1994; Miller, 1978). The short- and long-term mortality rates for the participants in this study were 3% and 22%, respectively. Regarding residential location at six months follow-up, previous studies have indicated a range from 29% to 35 % of sample participants remained in the nursing home setting (Bonar et al., 1990; Marottoli et al., 1994). In this study, 26% of the sample members were in a nursing home at 6 months. Average acute days or hospital length of stay in previous research ranged from 9 to 17 depending on the year of the study (Bonar et al., 1990; Guccioni et al., 1996; Ray et al., 1990). Studies conducted in recent years generally showed reduced length of stays as patients are discharged sooner to other less acute venues for care. The average length of stay in the hospital for this study was nine days.

Procedure

Prior to beginning data collection, I submitted the study to the Institutional Review Board for Research Involving Human Subjects (IRB) at Virginia Tech for review. Once official approval from the IRB was obtained, I initiated the research procedures outlined in the following narrative. As requested, I provided copies of the IRB approval to the medical center and orthopedic group from which the data were to be collected. Prior to IRB approval, I obtained the written approvals for use of medical records for this study from the medical center and the orthopedic group affiliated with this medical center. Facsimiles of these agreements are in Appendix A and Appendix B, respectively.

The Director of the Health Information Management Department of the medical center prepared a list of patients who met the diagnosis criteria described in the sample section of this paper. This list was compiled from a search of the medical center's database of patients. I screened all patients on the list for other criteria for inclusion in this study: age, surgical repair, and extent of rehabilitation using this medical center's services. I retained names of patients who did not stay within this medical center's

system of services for the entirety of their recovery to check if sufficient information was available from medical center records to complete the data collection process for the case.

I secured the medical records for the sample members in a variety of ways. The Health Information Management staff assisted in pulling the hospital charts for the sample participants (acute care and outpatient divisions). The medical record clerk at the long-term care facility of this medical center assisted in locating the patient charts for those individuals who were transferred to the facility during their recovery course. I was responsible for securing patient charts at the home health agency affiliated with this division of the medical center. The home health division of this medical center ceased operations during the data collection phase of this study, but the home health patient records were made available for this study. Lastly, the office staff of the orthopedic group that followed these patients located the patient records for the six-month and one-year data collection points.

I extracted the data for this research from medical chart reviews. Although extraction of data from medical records may pose potential problems such as consistency and completeness of the information, researchers (Fisher, Whaley, & Krushat, 1992; Haley et al., 1980) have demonstrated the accuracy of hospital coding data for hip fracture research and retrospective medical chart review in prior reliability studies. The chart reviews covered four phases of the hip fracture recovery trajectory: prefracture, acute care, rehabilitation, and long-term recovery. Information on prefracture variables was found in the acute care and long-term care facility records. I also found information for the variables related to the hospitalization in the acute care records. I located data related to the rehabilitation variables from the long-term care facility, home health, and outpatient records. The orthopedic group's medical records and the medical center records provided data for the sixth month point in the recover and the one-year outcomes.

I developed a coding form to record data for each member of the sample (See Appendix C). The coding form was designed to record the available chart information efficiently, allow space for later calculations necessary for some variables of interest, and assign numerical codes to the data. Coding forms were numbered consecutively by study case and included the patient's medical chart identification numbers only. The medical center staff provided space for reviewing medical charts at each of the site locations of

medical records. Chart reviews involving the medical center's records took place only during service hours for the Health Information Management Department over a period of three months.

Variables

A large number of variables was examined for this study, including personal characteristics, prefracture physical, social, and psychological status variables, event and hospitalization factors, rehabilitation process variables, and outcomes. The variables were either indicated in the research literature as strong predictors of functional recovery or as important demographic characteristics, or are related to the measures of interest in this study. Variables were selected and defined in order to minimize the potential for missing data. I reduced the number of variables to a level appropriate for the sample size and statistical power of the data analysis through a process of elimination based on the study focus, possible use of a prefracture health index in the analysis, and missing data. See Appendix D for a table describing the characteristics of the trajectory variables neither used to describe the sample nor used specifically in the study analysis.

Prefracture variables. The personal characteristics recorded included gender, age, education level, and ethnicity. Age was determined for the individual based on the age at the time of the fracture. In addition, two individuals were included who were 59 at the time of the fracture, but turned 60 during the early part of their hip fracture recovery process. Education level was the number of years of completed schooling. Race was defined as White, Black, or other.

Prefracture social status was measured by three variables: marital status, living arrangements, and socioeconomic status. Marital status was defined as being married, single, separated, divorced, or widowed. Later, I dichotomized this variable to married or not married in preparation for use in the health status index. Living arrangements were categorized as living in one's own house, living in an apartment, living in a home for the aged, or living in a skilled nursing facility. I collapsed this variable into two categories for possible use in the analysis: living at home in the community or institutionalized. Socioeconomic status was measured by reviewing the payment sources for medical treatment: Medicare only, Medicaid only, Medicare and Medicaid, Medicare plus private

hospitalization insurance, and other reimbursement sources. I created a binary variable that indicated Medicaid enrollment or not.

Assessing prefracture psychological status focused on three variables: the number of psychoactive drugs used, the number of psychiatric diagnoses, and mental status. I identified the number of psychoactive drugs from the medical history and included drugs in the following categories: antidepressants, antipsychotics, hypnotics and sedatives, antihypertensives, diuretics, antianginals, antihistamines, hypoglycemics, and antianxiety agents. These categories reflect pharmacological agents that may precipitate falls in older persons (Tideiksaar, 1989). All of the medications taken prior to the fracture were recorded and the number of medications that met the criteria for inclusion was identified. I calculated the number of psychiatric diagnoses by summing the number of diagnoses in the medical history related to depression, anxiety, dementia (i.e., Alzheimer's disease, organic brain syndrome, or senile dementia), and psychosis. Additionally, a variable was created to indicate the presence or absence of depression. The mental status of the individual prior to the fracture was extracted from the medical history and dichotomized as oriented or disoriented to time, place, and person.

The measurement of prefracture physical status focused on functional ability, medical status, and nutritional status. I divided the prefracture functional ability into two categories: ambulation ability and ADL ability. Prefracture ambulation ability was categorized as independent ambulation, ambulation with an assistive device or assistance of one person, ambulation with minimal to moderate assistance of one person and use of an assistive device, maximal assistance of two persons, or unable to walk. I transformed the prefracture ambulation status variable into a binary measure indicating independence in ambulation or not. Prefracture ADL status focused on four areas of function: bathing, dressing, transferring, and stepclimbing. Each of these was measured on the following categorical scale: independent, requires assistance of one person or an assistive device, requires assistance of two persons, and unable to perform. I found this information in the Physical Therapy and Occupational Therapy evaluation portions of the patient chart. I created a new variable indicating independence or dependence in all ADL for possible use in the health status index.

Measurement of prefracture medical factors consisted of four variables: (a) number of existing conditions at admission, (b) hemoglobin level, (c) prescription of vitamin B-12 injections, and (d) the use of hormone replacement therapy. I identified any preexisting conditions from the medical history section of the chart and recorded the total number. The main categories of conditions to be identified were as follows: arthritis, osteoporosis, cancer, stroke, Parkinson's disease and heart, vascular, liver, pulmonary, or renal disease. I found the prescription of vitamin B-12 injections (indicative of the presence of pernicious anemia) prior to fracture in the medical history section of the chart and recorded accordingly. I located the hemoglobin value in the admission records and used the hemoglobin level to determine the presence or absence of anemia. Anemia is defined as < 12.6 mg/dl for older men and < 11.9 mg/dl for older women (Schlenker, 1998). However, due to differences in the laboratories doing the testing, the presence or absence of anemia was determined by using the normal reference range of the lab that performed the test (Burtis & Ashwood, 1999). Lastly, for females, I noted the use or lack of use of hormone replacement therapy prior to the hip fracture.

I determined nutritional status using the measures of body mass index (BMI) and serum albumin lab values. BMI was calculated by the ratio of body weight (pounds) times 703 to height (inches) squared. A BMI of < 24 was considered malnourished or poor nutritional status, 24-27 well nourished, and > 27 overweight (NSI, 1992). The serum albumin level was extracted from the admission laboratory tests and used to determine the presence of protein-energy malnutrition. I determined if the serum albumin level was low by observing if the value fell below the normal reference range for the lab doing the testing (Burtis & Ashwood, 1999).

The individual's vision and hearing status prior to fracture, also, was assessed. The coding scheme used to categorize these sensory systems included: no deficit indicated and no related disease diagnosis; corrected with glasses or hearing aid or surgery; or deficit indicated. These sensory variables were later dichotomized into deficit indicated or deficit not indicated.

Event or hospitalization variables. I examined the circumstances of the hip fracture event. The location or place, time of day, and date of the fracture were recorded. The amount of time from the point of the fracture until the patient arrived in the

35

emergency room was recorded in terms of hours. The method of transport to the hospital was documented (e.g., ambulance, car, or wheelchair).

I examined a number variables related to the patient's hospitalization. The type of fracture, based on the fracture location, was coded as surgical neck, trochanteric, or subtrochanteric (Heithoff & Lohr, 1990). I collapsed the types into two categories, surgical neck or pertrochanteric, for use in the analysis. I identified and recorded the type of surgical repair as internal fixation with pins, plates, and rods, hemiarthroplasty or total hip replacement. I calculated the time from arrival to the emergency room to the time of surgery in hours. Then, a total time from fracture event to surgery was obtained by summing the amount of time from the hip fracture to the emergency room and the amount of time from entrance into the emergency room until surgery. Mental status on the first day after surgery was coded as oriented to person, place, and time or disoriented if not oriented in any one sphere. I determined each participant's initial weight bearing status: full weight bearing (FWB), weight bearing as tolerated (WBAT), partial weight bearing (PWB), or non-weight bearing (NWB).

Any surgical or medical complication during the hospitalization was identified through the ICD-9-CM codes defined by the Health Care Financing Administration (HCFA) Expert Panel on hip fracture (Keeler, Kahn, & Bentow, 1992). These included the presence or absence of a problem in the following areas: wound infection or hematoma; urinary tract infections, urinary retention, or incontinence; pneumonia; pulmonary emboli; mechanical problems of the hip; thrombophlebitis; anemia; cardiovascular episodes; or decubitus ulcer. I calculated a total complications score for the one-year period after the hip fracture based on subsequent complications identified in the trajectory process. Additionally, I identified the number of new diagnoses, major changes in medicine regimes as measured by the number of new drugs prescribed for new conditions, and missed therapy visits for the hospitalization stage.

I recorded the timing of achievement of indices of progress or recovery during the hospitalization. These included the post-operative day in which the individual first: (a) got out of bed, (b) went to the bathroom, (c) ate solid food, (d) received pain medicines by mouth, (e) had the urinary catheter removed, and (f) had the intravenous fluid line

36

removed. The occurrence and frequency of visitation by family, friends, and clergy were coded as follows: daily and regular, infrequent and sporadic, or none.

I recorded the total days spent in acute care. I coded the ambulation and ADL status at discharge from the hospital as previously described. The discharge location was identified as own home, long-term care facility, acute rehabilitation facility, or to the home of a relative or friend.

Rehabilitation process variables. Variables collected during the rehabilitation phase from the time of discharge from the hospital to the end of the physical and occupational therapy (PT and OT) phase of recovery included: (a) location of rehabilitation for the first one to four weeks, (b) location after four weeks, (c) initial and fourth week frequency of PT and OT, (d) changes in medical status, (e) time of achievement for progress markers, and (f) ambulation and ADL functional status at discontinuation of PT and OT. Location of rehabilitation for the two time frames was categorized as home with home health care, home with outpatient services, long-term care facility, acute rehabilitation facility, or subacute rehabilitation facility. Initial- and fourth-week frequency of PT and OT were coded based on frequency of visits per week.

Changes in medical status during the rehabilitation phase of recovery included the number of readmissions to the hospital, new diagnoses, new major changes in drug regime, new complications, and days of missed therapy. I identified reasons for readmission to the hospital and missed therapy visits, new diagnoses, and the numbers of new complications. I calculated a total score of changes in medical status over the trajectory by summing the number of complications, new diagnoses, major changes in medications, readmissions to higher levels of care, and missed therapy visits over the hospital and rehabilitation stages.

Recovery progress was measured by calculating the postoperative week in the recovery trajectory in which the following occurred for the first time: (a) independent donning and doffing of street clothes, (b) independent transfer in and out of bed, (c) independent use of the toilet, (d) independent negotiation of steps, and (e) independent entering and exiting the car. Additionally, I recorded the week in which PT and OT was officially discontinued.

Outcome variables. I recorded the functional status regarding ambulation and ADL at the time of discontinuation of PT and OT. I determined the ambulation and ADL status, pain level, and residential location at six months and one year post-fracture by locating the information in the orthopedic physicians' records of each patient. The ambulation and ADL status were measured using the previously described categories. Pain level was determined as being present and an issue or not present and not an issue. Residential location included home, long-term care facility, adult care facility, or a family member's or friend's home. Any readmission to the hospital or further complications were identified. The total number of complications was calculated by summing the complications for the hospital stay, the rehabilitation phase, and the rest of the year's recovery period.

I determined the functional recovery outcome variables for each patient by comparing the prefracture ambulation to the ambulation at the time of discontinuation of therapy, at six months, and at one year. If the individual had attained his or her prefracture ambulation status, the individual was categorized as fully recovered. If an individual had not attained his or her prefracture ambulation status, the individual was coded as not fully recovered. If any person died during the year following the time of the fracture, the date and cause of death were identified and that individual was coded deceased.

Data Analysis

I obtained descriptive statistics including means, standard deviations, and frequency distributions on all study variables for which these statistics were appropriate and viewed the shape of the distributions of the study variables by histograms. Chi-square statistics and *t*-tests were use to evaluate the relationships between the independent and dependent variables. Data were examined for accuracy in coding and data entry. All analyses were conducted using SPSS (version 7.5) for Windows. To assist in the evaluation of the goodness of fit (GOF) of the model (i.e., how well the model describes the observed data) (Hosmer, Taber, & Lemeshow, 1991), I identified and analyzed outlying and influential data, and assessed the violation of the assumptions for chi-square and logistic regression analyses.

38

Because logistic regression models are very sensitive to the effects of extreme cases, data were carefully analyzed for outlying values and influential observations using the diagnostics of leverage, studentized residuals, and Cook's Distance (Pregibon, 1981). Leverage is a measure of extreme values in the independent variables (Pedhazur, 1997). Leverage analysis indicated 15 cases with values over $2(k + 1)/N$, a formula used to identify high leverage values (Hoaglin & Welsch, 1978). Inspection of these 15 cases revealed that these cases were either extreme on the age of the individual or extreme on the combination of scores on the seven independent variables. Nevertheless, no discernible change or gap in the list of leverage values was observed, suggesting the absence of high leverage cases (Pedhazur, 1997).

Studentized residuals are used to detect cases with unusually large residuals between predicted and observed values. Using a cutoff of ± 3 standard deviations (default in SPSS) on studentized residual values, no cases were identified as possible outliers. Cook's Distance is a measure of influential observations on the independent or dependent variables, or a combination of both (Pedhazur, 1997). Analysis of the Cook's Distance values showed no values over 1 (indicative of influence) and only one case with a discernible rise in its value. None of the cases identified as possible outliers through the leverage analysis were confirmed as influential through the use of the Cook's Distance. Based on these findings, I decided to retain all of the cases in the analysis.

The data met the assumptions of mutually exclusive, independent observations and minimum expected frequency of at least five in any one cell required for the chi-square statistic. The assumptions for logistic regression assessed included error-free measurement, correct model specification, homoscedasticity, and absence of collinearity (Menard, 1995; Pedhazer, 1997). In order to assure reliable and valid measurement, the study variables used in the analysis were operationalized using well-defined, concrete or standard indicators (e.g., age in years, number of agencies providing therapy, frequency of therapy visits). The precision used in defining variables suggests that there was minimal measurement error in the scores. Correct model specification was assessed through examination of a scatterplot of residuals against predicted values (Pedhazer, 1997). A scatterplot that does not show any discernible pattern indicates that the model was well specified and all relevant independent variables have been included. The

scatterplot of the residuals against predicted values for this study demonstrated two parallel curvilinear patterns. This suggests that possibly one or more important predictor variables were missing from the analysis.

The scatterplot of residuals also indicated violation of the homoscedasticity assumption. In other words, the prediction error was least for those individuals who were clearly recovered or non-recovered and greater for those individuals who were not clearly recovered or non-recovered. In contrast, the histogram of the studentized residuals offered a slightly leptokurtic distribution without evidence of skewness. Thus, the histogram did not provide further evidence of heteroscedasticity.

Multicollinearity may pose a problem in regression analyses when independent variables are correlated with one another (Menard, 1995; Pedhazur, 1997). Menard (1995) suggests that high levels of collinearity may be present if any of the standardized logistic regression coefficients are large or greater than 1. Since two of the standardized logistic regression coefficients met this criterion (prefracture ambulation status, 3.77, and prefracture mental status, 1.86), the collinearity of the variables was analyzed using tolerance levels from a linear regression using the same model variables (Menard, 1995). Since all tolerance levels were greater than .01, high collinearity was not detected among the variables (Menard, 1995; Pedhazur, 1997).

I determined the maximum number of variables to be used in the data analysis through an estimation of power. Power analysis estimates effect size based on multiple correlations of the study variables, the alpha level, and the final sample size (Green, 1991). Cohen (1988) recommends a sample size of 99 for six predictor variables based on a medium effect size, alpha .05, and a power of .80. He also suggested the number of sample participants in a regression analysis be adjusted downward if any of the independent variables has a strong relationship to the dependent variable. Because two strong predictor variables (prefracture ambulation status and cognitive status) were used in the analysis, I decided that seven variables was an acceptable number of independent variables for the logistic regression model. All alpha levels for significance testing were set at .05. A post hoc determination of power for the logistic regression was calculated following the statistical analysis.

I analyzed the data using hierarchial logistic regression. Logistic regression analysis is used to regress a categorical dependent variable on continuous or categorical independent variables (Pedhazur & Schmelkin, 1991). The SPSS program automatically performs dummy coding of categorical data when running the logistic regression analysis. Binary logistic regression requires a dichotomized dependent variable. For this analysis, I categorized the cases into "completely recovered functionally" or "not completely recovered functionally." Adjustments to the operational definition of recovered and not recovered (allowance of a cane for the recovered category) were attempted to improve the proportional size of the outcome categories (e.g., 24 fully recovered, 75 not fully recovered). Although the categories became more equal in size, I determined the revised definitions to be impractical and unrealistic. Thus, the original definitions for recovery were retained.

In order to control statistically for differences among the sample participants on variables known to be strong predictors of functional outcomes after hip fracture, the following variables were entered in the first hierarchical step as a block: age, prefracture ambulation, and prefracture cognitive status. Because of the limited number of variables recommended for the logistic regression, a 12-item health status index was considered initially for inclusion in the first step of the analysis. However, the reliability of the health status index was low (alpha = .64) and factor analysis revealed four separate factors. Modification of the variables downward to seven variables in the index only increased the alpha coefficient to .74 and the index could not be reduced to fewer than two factors. Therefore, I decided not to use the health status index in the analysis. Instead, I used the control variables of age, prefracture ambulation status, and prefracture cognitive status. The remaining variables of interest to this study were added in the next step of the analysis: frequency of therapy, type of therapy program, primary location of therapy at the fourth week, and number of organizations providing therapy.

From the data analysis, I compared the log likelihood ratios using a chi-square statistic to test the GOF of the model at each step (Menard, 1995). Significance levels for each model, both sets of variables, and all of the independent variables were determined at the appropriate step in the analysis. I identified the odds ratios for independent variables with corresponding confidence intervals. In addition, the 95% confidence

41

intervals for the odds ratios were calculated from the regression coefficients and the standard error terms.

Chapter IV

Results

In this chapter, I identify the study hypotheses and describe the characteristics of the variables used in the analysis. Next, I report the results from the statistical analysis conducted for this study. Then, I provide the results of the power analysis estimation for this study. In the last section of this chapter, I describe the findings of post hoc analyses performed on the data.

Study Hypotheses

Four hypotheses were tested in this study. Specifically, I hypothesized that: (a) older persons who do not recover fully from hip fracture differ from older persons who do recover in the type of therapies received during the rehabilitation phase, (b) older persons who do not recover fully from hip fracture differ from elderly persons who do recover on the frequency of therapy provided during the rehabilitation phase, (c) older persons who do not recover fully from hip fracture differ from age-peers who do recover in the number of agencies or facilities involved in the provision of therapy services during the rehabilitation phase, and (d) older persons who do not recover fully from hip fracture differ from aged individuals who do recover in the setting from which they receive rehabilitation services at four weeks post-hospitalization.

Variable Analysis

Hosmer and Lemeshow (1989) recommended careful univariate analysis of each study variables to be used in a logistic regression analysis. The characteristics of the study variables are presented in Table 3. In testing the relationships between the seven independent variables to the dependent variable, a Bonferroni adjusted alpha of .007 was used to maintain the family-wise alpha at .05 (Pedhazer, 1997). The relationship between age and the dependent outcome variable was tested using an independent sample t-test. The relationship was not significant ($\underline{p} > .007$). Evaluation of the relationships between the dichotomous independent and dependent variables, using the chi-square statistic, offered one significant finding. Prefracture ambulation status and functional recovery status at discontinuation of therapy showed a significant relationship, $\chi^2 (1, \underline{n} = 99) = 29.18, \underline{p} < .007$. Specifically, independent ambulation prior to hip fracture was associated with full recovery at the time therapy was discontinued.

Table 3

Characteristics of the Study Variables

Variable	Characteristic	n
Age	$\underline{M}$ = 80.4 years, $\underline{SD}$ = 7.5	102
Prefracture Ambulation	61 independent; 41 not independent	102
Cognitive Status	68 oriented; 34 not oriented	102
Frequency of Therapy	38 5x/wk or less; 64 >5x/wk	102
Type of Therapy	43 PT only; 59 PT and OT	102
Number of Therapy Organizations	411 org.; 58 2 or more org.	99
Location of Therapy @ 4 Wks	31 home; 68 institution	99
Recovery Status @ 3 Months	24 recovered; 75 not recovered	99

The relationships between the independent variables were tested using chi-square statisitics and t-tests. Age was not significantly related to any of the other independent variables using a Bonferroni adjusted alpha of .008 for the family of 6 t-tests. Prefracture ambulation was not significantly related to any of the other independent variables using a Bonferroni adjusted alpha of .010 for the family of 5 chi-square statistics. Prefracture mental status was significantly related to frequency of therapy, number of agencies, and type of therapy using a Bonferroni adjusted alpha of .013 for the family of four chi-square statistics. Significant relationships (using a Bonferroni adjusted alpha of .008 for the family of chi-square tests) among the rehabilitation variables included frequency of therapy to type of therapy, type of therapy to number of agencies involved in rehabilitation, and frequency of therapy to number of agencies involved in rehabilitation. Specifically, a frequency of greater than five visits per week was associated with receiving physical and occupational therapy rather than physical therapy alone. Receiving multiple types of therapy was related to receiving therapy from more than one agency. Receiving therapy more than five times per week was associated with receiving therapy from more than one agency.

Test of the Hypotheses

The χ^2 test on the differences of the log likelihood values was significant for the logistic regression model after the first block of variables (age, prefracture ambulation status, and prefracture cognitive status) was entered, χ^2 (3, $\underline{N}$ = 99) = 40.55, $\underline{p}$ < .05. Two independent variables were significant in this first step model: prefracture ambulation status, $\underline{p}$ < .05, and cognitive status, $\underline{p}$ < .05. At the second step in the hierarchical logistic regression, the set of rehabilitation process variables (type of therapy, frequency of therapy, number of organizations providing therapy, and location of therapy at four weeks post-hospitalization) was entered in the equation. The second block of variables was not significant, $\boldsymbol{c}^2$ (4, $\underline{N}$ = 99) = 3.01, $\underline{p}$ = .56. Two of the independent variables were found to be significant using the Wald test (Hosmer & Lemehow, 1989) on the regression coefficients in the final logistic model: prefracture ambulation status, $\underline{p}$ < .05, and cognitive status, $\underline{p}$ < .05. The overall accuracy of the model in correctly predicting the outcomes was 85.86%. Using a formula suggested by Huberty (1984) for calculating the maximum chance criterion, the standardized normal statistic value was 1.93, $\underline{p}$ < .03. Thus, the model yields a classification accuracy better than would be expected by chance. Table 4 identifies the odds ratios and 95% confidence intervals for the seven independent variables.

Table 4

Odds Ratios and Confidence Intervals for the Independent Variables

Independent Variable	Odds Ratio	95% Confidence Interval
Age	1.06	0.97, 1.16
Prefracture Ambulation	43.56	8.74, 217.16*
Cognitive Status	6.44	1.17, 35.41*
Type of Therapy	1.47	0.24, 9.13
Frequency of Therapy	1.19	0.19, 7.42
Number of Therapy Organizations	0.42	0.10, 1.81
Therapy Location @ 4 Weeks	0.41	0.09, 1.85

* $\underline{p}$ < .05

The odds ratio for a dichotomous variable is interpretable as a probability and is a measure of association that approximates how much more likely it is for an outcome to be present among those with $x = 1$ than among those with $x = 0$ (Hosmer & Lemeshow, 1989). An odds ratio of 1 means that there is an equal probability for an outcome to be present regardless of the group one occupies. For example, an individual who is oriented is 6.44 times more likely to recover fully after hip fracture than someone who is not oriented. The significance of each of the independent variables is determined by the exclusion of 1 in the 95% confidence interval range.

Power Analysis

Using Cohen's (1988) method for calculating power of a statistical analysis, the power of this logistic regression based on a χ^2 statistic was .66. Other factors in the power analysis included a significance of .05, 4 degrees of freedom, and a medium effect size of .30. The power estimation times 100 is interpretable as "the percent of tests carried out under the specified conditions which will result in the rejection of the null hypothesis" (Cohen, 1988, p. 249). For this analysis, a power of .66 is interpreted as a two in three chance of finding significance if differences, indeed, exist. Thus, power for this study was somewhat low compared with a standard of .80.

Post Hoc Analyses

Because I was unable to explore the functional outcomes of participants over a longer period of time by logistic regression analysis, I examined each case in the study to assess if the functional recovery status achieved in ambulation by the end of the rehabilitation period (at an average of three months) remained the same, declined, or improved through the six-month and one-year points of the recovery process. Of the 102 cases in this study, 61 maintained their ambulatory status from the end of therapy until 6 months post-fracture while 13 others improved, 14 declined, 11 died, and 3 died during the rehabilitation phase. For the 88 remaining participants in the study, 60 of the participants maintained their ambulatory status, 12 improved, 8 declined, and 8 died from the six-month point to the one-year follow-up.

However, individuals did not remain in the same categories through the three points of measurement. For example, of the 61 individuals who remained at the

same functional status from the time therapy was discontinued until the six-month follow-up, 41 continued to stay the same, 8 improved, 6 declined, and 6 died in the period from 6 months to 1 year. Similarly, of the 13 who improved from the time therapy was discontinued to the six month follow-up, 1 declined, 1 improved further, 9 stayed the same, and 2 died in the period from 6 months to 1 year. For the total period from the time therapy ended until the one-year follow-up, 41.4 % of the participants ($\underline{n}$ = 41) remained at the same level of ambulation, 17.2 % showed sustained decline ($\underline{n}$ = 17), 22.2% showed sustained improvement ($\underline{n}$ = 22), and 19.2 % died ($\underline{n}$ = 19). In summary, almost two-thirds (59%) of the participants did not show stability in their functional status from the time therapy ended through the one-year post-fracture assessment.

In order to explore the lack of significance of age in the regression analysis, I analyzed the data to examine the influence of gender, prefracture residential location, and type of fracture on the relationship between functional outcomes and age. For males, there was a significant relationship between age and recovery, $\underline{F}$ $(1, \underline{n} = 26) = 6.98$, $\underline{p} < .05$. Thus, for males, being younger had a significant influence on the ability to recover full ambulation after hip fracture. No relationship between age and recovery was found for women, $\underline{F}$ $(1, \underline{n} = 73) = .886$, $\underline{p} > .05$. When controlling for gender in an analysis of variance, age and functional status approached significance, $\underline{F}$ $(1, \underline{N} = 99) = 3.67$, $\underline{p} = .059$. In separate analyses, no significant differences were observed in the relationship between age and functional outcomes when controlling for prefracture residential location or type of fracture.

Chapter V

Discussion

In this chapter, I discuss the findings of this study by explaining the results in relationship to measurement issues and the study design, linking the results back to the theoretical model, and describing the policy implications of the study results. Next, I consider the limitations of this research study. Then, I identify the benefits of this exploratory examination into hip fracture outcomes using a chronic disease trajectory model. At the end of the chapter, I present the conclusions and recommendations of the study that emerged during the process of conducting and completing this research project.

The hypotheses for this study propose that older persons with hip fracture who fully recover differ from those who do not fully recover on factors related to the rehabilitation process during the immediate post-hospitalization period. The findings of the study did not support these hypotheses. Type of therapy, frequency of therapy, the number of organizations involved in rehabilitation after acute care, and the location of rehabilitation at four weeks post-hospital discharge did not influence the functional outcome of ambulation upon completion of therapy. Specifically, the expectation that only receiving physical therapy, receiving therapy less frequently, involvement of only one agency for rehabilitation, and receiving institutional-based therapy at four weeks post-fracture would relate to poorer outcomes was not substantiated by the results of the analyses. The discussion that follows identifies and describes some of the possible reasons for these findings.

From the power analysis performed following the logistic regression analysis, power was somewhat low even to discover factors with a medium effect size. The lack of significance in the results of the rehabilitation variables may be directly related to the power of the statistical analysis rather than the lack of any actual influence from the rehabilitation. Thus, the effect of the rehabilitation variables may have been present, but the power of the analysis was such that the effect was not detected. If the parameters of the power analysis could have been modified or altered, significant findings for the rehabilitation variables may have been demonstrated. Thus, a larger sample size or an increased alpha could have resulted in different findings for the variables of interest.

Cohen (1988) suggested the results of an analysis with low power should be regarded as ambiguous since the a priori probability of rejecting the null hypothesis was low.

The small initial sample size for this study limited the number of variables that could be examined in the statistical model. Additionally, the sample sizes available for analysis at 6 months and one year were further reduced through deaths of 14 and 8 sample participants, respectively. Thus, to maximize the number of variables that could be examined in the analysis, I decided to utilize the functional outcome data from the follow-up point of discontinuation of therapy (approximately 3 months). In other hip fracture outcome studies, time of testing affected results (Jette et al., 1987; Heithoff & Lohr, 1990; Mossey & Magaziner, 1999). Variables that do not directly influence short-term outcomes (moderators) may appear as significant predictors later on in the recovery process or vice versa. For example, instrumental social support may be helpful to short-term recovery, but this type of caregiving behavior may be detrimental to recovery in the long term (Roberto, 1992b). Thus, although the rehabilitation variables did not show significance in the short-term, opposite findings might be found in the long-term. The question remains of when interventions are most important in the trajectory of recovery (Mossey & Magaziner, 1999).

Another consideration relevant to the findings of this study is the characteristics of the sample. Many of the research studies on hip fracture outcomes have used healthy, community-dwelling older persons exclusively and excluded more frail, cognitively impaired, and institutionalized older persons. Variance in the results of many hip fracture studies is attributed to differences in the sample populations (Jette et al., 1987, Marotolli et al., 1994; Mossey et al., 1989). This study involved a mixed-case sample of participants who fractured a hip (e.g., mental status, gender, pre-fracture residential location varied). The possibility exists that there were differential effects of the rehabilitation variables on these different populations and the presence of a mix of these types of participants may have contributed to the lack of significance in the findings.

With the exception of age, the final study variables used in this analysis were measured dichotomously. Participants were categorized as being in one group or another. For example, on the variable of frequency of therapy, the original information was divided into three groups: (a) 5 times per week or fewer, (b) 6 to 10 times per week, or

(c) more than 10 times per week. The data were then collapsed into two categories to minimize the need for additional variables representing interactive effects between the three different categories. For frequency of therapy, the two categories were 5 or fewer and more than 5. In the process of collapsing the data across all of the independent and dependent variables, variance in scores was lost. This loss of variance could have influenced the results.

Additionally, operational definitions for variables affected how I grouped the participants. For example, I defined dependent ambulation as needing human assistance or an assistive device. If I had chosen to define dependent ambulation as needing human assistance only, fewer individuals would have been classified as dependent in ambulation prior to hip fracture. Although multicollinearity was not determined to be a problem in this study, the significant relationships between some of the rehabilitation variables in this study may indicate redundancy within the set of rehabilitation process variables entered into the analysis. This would explain the minimal explanatory power of the set of rehabilitation variables. Also, the lack of significance for the set of rehabilitation may reflect a less than ideal specification of the model by the inclusion of irrelevant variables. Additionally, the scatterplot of residuals demonstrated heteroscedasticity that suggests the possible omission of relevant variables such as gender. Thus, the results of this study may have been influenced by the way in which the data were constructed.

For this study sample, few individuals fully recovered (24%) and most individuals did not fully recover (76%). The fact that few persons in this study recovered limited the amount of data available for the category of recovered individuals in the analysis. Although requirements were met for all cells in the chi-square test on the regression model, the disparity in the cell frequencies in the analysis may have contributed to the lack of significant findings. In a recent workshop on hip fracture recovery outcomes, Mossey (Mossey & Magaziner, 1999) warned that how investigators define recovery in hip fracture research affects what is found. Thus, the definition used for recovered in this study resulted in few individuals being categorized as fully recovered and may have contributed to the lack of significance for the rehabilitation variables.

The research on hip fractures has consistently demonstrated the strong influence of prefracture personal characteristics such as ambulation level, ADL function, and

cognitive status on recovery outcomes (Cobey et al., 1976; Katz et al., 1967; Koval et al., 1995; Magaziner et al., 1989; Miller, 1978; Mossey et al., 1989). Prior research has been less successful in clearly showing the importance or influence of more external factors such as care locations, techniques, and patterns. The findings in this study that prefracture ambulation and cognitive status are significant predictors of functional recovery are supportive of the strong influence of intrinsic factors in recovery after hip fracture. Rehabilitation process variables appear to sway recovery outcomes only marginally in comparison to personal or internal characteristics.

As described in the literature review, hospital rehabilitation process variables such as intensity or frequency have a positive effect on short-term functional outcome and discharge location, and long-term functional outcomes (Barnes, 1984; Bohannon et al., 1990; Guccione et al., 1996; Zuckerman et al., 1990). Contrary to the findings of those studies, this study did not demonstrate the same results. Specifically, intensity of therapy and type of therapy were not significant. The effects of a mixed-case sample may have bearing on the findings for these two variables. The frequency of therapy after discharge from the hospital is determined by multiple parameters. Doctors and therapists may prescribe a certain frequency of therapy based on a particular pattern of care or place of care. Rehabilitation potential often determines frequency of therapy (Hielema, 1979). Less functionally independent individuals may be in a long-term care facility for rehabilitation that provides either daily or twice-a-day services to meet Medicare reimbursement requirement for skilled daily care (higher frequency of visits). More functionally independent patients may be discharged directly to home and typically receive therapy two to three times per week through home health care services(lower frequency of visits). Cognitively impaired individuals who do not have the memory skills necessary for OT treatment for ADL training are often not referred for OT and the frequency of their overall therapy is limited to PT only (lower frequency of visits). In this sample, 79 % of the sample participants were discharged to a long term-care facility with the remainder going to other settings. The sample was also divided on cognitive status with 67 % oriented and 33 % disoriented prior to the fracture. The presence of multiple types of patients in the sample may serve to confound the measurement of these two variables and contribute to the nonsignificant findings.

51

Because the other rehabilitation process variables, number of organizations involved in the rehabilitation phase and location of rehabilitation at 4 weeks, have not been observed in the prior research on hip fracture outcomes, comparison to other findings is not possible. The expectation that the number of organizations involved in rehabilitation would make a difference in recovery was based on a course that I commonly observed as a physical therapist. Older persons who fracture a hip often are discharged from the hospital, receive therapy in a long-term care institution for several weeks, return home with home health services prescribed, and then receive outpatient therapy once they are no longer home-bound. The premise for including the variable was that individuals who follow this typical course receive therapy from more than one organization while other individuals who go to a skilled nursing facility and remain there only receive therapy from a single organization.

Similarly, the variable of location of therapy at four weeks was operationalized to represent the same commonly observed trajectory. Patients who are more functionally independent earlier in their recovery will most likely be back at home by four weeks following discharge from the hospital. Frequently, patients leave a nursing facility after the 20th day because there is a hefty Medicare co-payment on skilled nursing bed charges on the 21st day of coverage. Longer lengths of stay are required for individuals who are functionally dependent, making slow progress, or who live alone. The lack of significance in these variables may relate part to the variety of trajectories towards functional recovery that exist rather than adherence to any one particular pattern or course.

Age was included as an independent variable in this study based on consistent research findings demonstrating a strong relationship to recovery outcomes (Beals, 1972; Kiel et al., 1994; Lu-Yao et al., 1994). However, it was not a significant contributor to the logistic regression model. The findings of the second post hoc analysis suggest that when controlling for gender, age and recovery outcome become more closely related to each other. Therefore, a possible explanation for the lack of significance in this study is the inability of the analysis to support more variables to control for personal differences like gender in the sample. Ferrucci and colleagues (1997) suggested that the oldest patients (>85 years) received less intensive care following a disabling condition like hip

fracture or stroke than their younger counterparts (65 to 85 years). Thus, prior research may reflect differential care of the elderly patients with advancing age while this study did not.

At issue in this research study was a larger general question of whether hip fracture should be considered an acute or a chronic condition. The lack of stability of functional outcomes after the discontinuation of therapy at approximately three months shown in the first post hoc analysis indicated the long-term nature of the recovery process after a hip fracture. This instability in functional outcomes also suggests the possible need for continued management or shaping of the trajectory of the condition by the patient, family members, and health professionals for far longer periods of time than was typically provided to individuals in this study sample. In addition, descriptions of recovery trajectories for this sample through one year clearly indicate variance in form and functional outcome. I believe these indicators demonstrate elements of chronicity. However, taking into consideration the acute features that do exist at the time of the actual hip fracture event, a clearer, overall picture of hip fracture may be seen through the following definition. Hip fracture is a disabling condition with a recovery course that includes both acute features and chronic sequelae.

A chronic disease trajectory model guided this study. In discussing the findings, clear linkages back to the theoretical model are useful. The findings of this study supported other hip fracture research demonstrating the strong influence of intrinsic or personal characteristics on recovery and the more limited effect of extrinsic or environmental factors such as post-hospital rehabilitation (Craik, 1994; Heithoff & Lohr, 1990; Mossey & Magaziner, 1999). The chronic disease trajectory model treats individual phases as equally important (Corbin & Strauss, 1991a). The findings of prior research have demonstrated the positive effects of hospital rehabilitation (Barnes, 1984; Bohannon et al., 1990; Guccione et al., 1996; Zuckerman et al., 1990). Perhaps the role of health professionals is more effective at other phases of the trajectory. If optimization of personal factors can result in more positive outcomes, then the prefracture phase of the trajectory would be an obvious target for intervention. Health promotion programs that foster functional independence, adequate nutrition, strong social support, and cognitive integrity are potential strategies for enhancing overall functional status. The objectives of

the health promotion interventions would be two-fold: prevention of hip fracture from ever occurring and maximization of functional status in case hip fracture should occur.

In view of changes in the health care arena, Corbin (1998) recently presented an updated version of the original chronic illness trajectory model. The model now incorporates the same concepts of health promotion and illness prevention. Corbin stated that the main goal of care is "to keep populations free of chronic conditions, and when chronic conditions do strike, to assist those affected to control symptoms, prevent complications and disability, and maintain stability so that there might be quality and quantity to life" (p.37). This goal of care is well suited to the condition of hip fracture in older adults.

Another strategy suggested by the chronic illness trajectory model is to develop new methods or better ways for health professionals, earlier on in the trajectory, to assist patients and their families in preparing for the management of the illness course after their exit from the therapeutic relationship. Considering the lack of stability shown in functional outcome measures from short-term to long-term time periods, the presence of health professionals for therapy or other supportive care should be extended longer into the trajectory course. Corbin (1998) stated that "shaping an illness course is so complex that it requires the cooperative efforts of many people" (p.37). Given sufficient time for intervention by therapists and other health professionals, the significance of rehabilitation efforts may be realized. Lastly, with evidence of a variety of differing recovery trajectories after hip fracture, emphasis remains on flexible and individualized care than can assist in the management of coexisting multiple chronic conditions commonly seen with older individuals, including those with hip fracture.

Although hip fracture in older adults may seem distance from or unrelated to governmental concerns, the findings of this study have direct implications for policy makers. Of first concern is the length of time Medicare will reimburse therapy services after hip fracture. Together doctors and therapists must discontinue therapy services when no further progress is observed, maximum benefits have been reached, or goals have been achieved. But, the findings from this study, as well as others, demonstrate a lack of stability of functional outcomes in the vast majority of hip fracture patients after the discontinuation of therapy. One reason for a lack of predictive power for the

rehabilitation factors included in this study could have been the short period of time therapy was provided. Since 1998, the final year of this study, a new system of prospective payment for nursing home and home health agencies has further altered the care patterns after hip fracture with shorter lengths of stay in nursing homes and fewer allowable home health visits. As Lyons (1997) suggested "caution must be taken to prevent short-term cost-saving measures from compromising long-term outcomes for elderly hip fracture patients" (p. 51s).

At present, only a single hospital reimbursement category exists for the diagnosis of hip fracture. Thus, all older persons, regardless of their age, health, gender, type of fracture, and residential location, are grouped together for the purposes of paying for care. With the variations reported in hip fracture recovery trajectories and outcomes that are based on differences observed on these variables, treating all older persons with hip fracture as a homogeneous group may artificially limit the probability for full recovery for some groups of elders. A more effective method of reimbursement for care following a hip fracture would need to incorporate allowances for individual differences into the payment system. Fox and her colleagues (1999) recently suggested at least two reimbursement groupings based on their findings of differences between older individuals with femoral neck hip fractures and those with intertrochanteric fractures.

Similarly, treatment patterns for older persons who fracture a hip may, also, require further differentiation. Some older persons with hip fracture may benefit from longer hospital stays while others may not. Other elderly hip fracture patients may recover better with more frequent and intense short-term rehabilitation after discharge from the hospital while some may just need an extended total time of therapeutic intervention. Individualization of care based on differential health and demographic characteristics has the potential to improve the functional outcomes of a large number of older persons who fracture a hip. The larger question surrounding this issue may be whether care patterns should be determined by reimbursement guidelines or by individual patient need.

The present system of post-hospitalization care for older persons with hip fracture is fragmented with multiple types of organizations providing services. Presently, after-care such as therapy and nursing services are provided by acute rehabilitation facilities,

long-term care facilities, home health agencies, and outpatient rehabilitation agencies. The relative merits or limitations, in terms of outcomes, for these differing organizations or the use of certain combinations of these organizations have yet to be determined. The determination of which of these organizations will be used is often based on information such as doctor preference, patient request, or payment criteria. Health care professionals need guidelines that provide objective information on the optimization of recovery outcomes based on patient characteristics so that an appropriate match could be assured between the characteristics of the older person who has fracture a hip and the best method of after-care.

Research Limitations

Although this research was designed to minimize specific problems found in previous hip fracture outcome studies, the results and findings of this project were bound as all research by the methodology employed. The number of missing records and incomplete information on some variables in the medical charts reviewed were limiting factors of this research. The sample size limited the number of variables that could be examined in the regression analysis. Logistic regression analysis was limited to the functional outcome at the three-month follow-up period because of the smaller number of living participants at the six-month and one-year follow-up times. Additionally, the sample did not include older individuals who sustained a hip fracture but were treated by nonsurgical approaches for their injury. Thus, the findings of this study are only generalizable to older individuals who fracture a hip and are treated surgically for their hip injury.

Contributions of the Study

This study served to replicate and support previous research efforts by using similar predictive and functional outcome variables. It extended the previous research by investigating new variables related to the use of a chronic illness trajectory framework to organize the recovery course. The project's conclusions suggest new determinants of nonrecovery that need future exploration (e.g., pain, low vision, nutritional status). Application of the chronic disease trajectory framework and the hip fracture trajectory phase model may be useful in guiding others to further research aimed at identifying ways to moderate or shape the course of recovery. Improvement in hip fracture recovery

rates has the potential of affecting the quality of life for the over a quarter million older persons. Continued and concentrated work in this research area can make significant contributions in guiding public policy regarding medical care and cost effective health coverage after a disabling injury. Overall, the findings augment the existing body of knowledge on hip fracture recovery and further define areas of future research so that the prognosis for full recovery is the expected outcome for most older persons who fracture a hip.

Conclusions and Recommendations

Much more research is needed to continue the investigation into recovery outcomes for older persons who fracture a hip. Future studies should be designed such that samples are sufficiently large to study more factors, provide more statistical control on characteristics of the sample, and find smaller-sized effects. More studies need to be designed longitudinally such that short- and long-term outcomes can be examined. Further improvement in the knowledge base on this topic could be realized if more prospective research designs rather than retrospective designs were implemented. More research is needed on mixed-case samples or special populations within the older adult category. For example, examining the differences between treatment regimes, care patterns, and outcomes for the young-old versus the old-old might lead to the discovery of particular methods to optimize care for these two very different groups of older persons. Other differential categories to explore include race, gender, cognitive status, and prefracture residential location. The study of hip fracture recovery would benefit substantially from an expanded use of theory as the foundation for future research efforts. For example, use of a socio-feminist theoretical perspective might be helpful in describing the differential experiences of men and women after hip fracture.

Although there are many factors that could be examined in relation to their influence on hip fracture outcomes, there are a few specific factors that warrant special attention in future research endeavors. The effect of pain throughout the recovery course has received very limited attention in the prior research. Research into the influence of pain on functional outcomes and the usefulness of pain management techniques in moderating the effects of pain on recovery are overdue. The prefracture nutritional status of the majority of the participants in this study appeared to be below acceptable levels.

Many of the study participants were recognized as being at nutritional risk and were provided nutritional supplements during their convalescence. Questions remain as to the consequences of poor nutritional status on long-term recovery outcomes for elderly hip fracture patients and the effects of nutritional supplementation in shaping the course of the recovery trajectory. The relationship between low vision and hip fracture recovery is not well documented in prior research studies. Given the capacity of visual deficits to limit the performance of both gross and fine motor activities, research into the influence of visual integrity on functional outcomes is essential. From a practitioner's view, the significant relationship between mental status and patterns of care (frequency of therapy and type of therapy) is troublesome. Research is needed that isolates the best interventions and care patterns for all older adults and reduces any bias in care based on cognitive status.

Finally, a new definition of recovery is needed. Examining hip fractures from the narrow perspective of physical recovery provides a limited view of outcomes after hip fracture. Future research needs to incorporate more global measures of recovery (Mossey & Magaziner, 1999). Factors such as resumption of roles, relationships, and living arrangements need to be reflected in the recovery index. Important in any future definition of recovery is the concept of adaptation. Full recovery may not necessarily mean complete recovery to prefracture status in every aspect of functioning. Instead, full recovery may involve a reorganization of skills and abilities to incorporate or accommodate for changes in physical status such that an active and vital life is possible. Inconsistency in the definition of recovery outcomes makes comparison of research studies difficult or impossible. Verbrugge and Jette's (1994) theoretical model of the disablement process model may prove to be a useful framework for unifying the definition of recovery to include factors other than physical performance measures and provide consistency in the definition of recovery. Continued use of the chronic disease trajectory model (Corbin & Strauss, 1991a) in other hip fracture studies may be beneficial in the reconstruction of a more comprehensive definition of recovery after hip fracture.

The number of older persons who will fracture a hip is expected to rise rapidly in the 21st century as the number of older individuals increases. Thus, attention to the issue of hip fracture recovery is pressing. Unlike cancer, heart disease, and Alzheimer's

disease, there are no special associations or organizations advocating for research on this condition and no network of support groups for elderly hip fracture patients or their families. Continued research to identify factors that promote full recovery is essential for assuring that the opportunity for complete recovery is the reality for older adults who fracture a hip.

References

Aharonoff, G.B., Koval, K.J., Skovan, M.L., & Zuckerman, J.D. (1997). Hip fractures in the elderly: Predictors of one year mortality. Journal of Orthopedic Trauma, 11,162-165.

Ahmad, L.A., Eckhoff, D.G., & Kramer, A.M. (1994). Outcome studies of hip fractures: A functional viewpoint. Orthopedic Review, 23, 19-24.

American Academy of Orthopaedic Surgeons (1996). Online service: Live it safe.available: http://www.aaos.org/wordhtlm/home2.htm.

Barbour, A.B. (1995). Caring for patients: A critique of the medical model. Stanford, CA: Stanford University Press.

Barnes, B. (1984). Ambulation outcomes after hip fracture. Physical Therapy, 64(3), 317-323.

Barnes, B., & Dunovan, K. (1987). Functional outcomes after hip fracture. Physical Therapy, 67, 1675-1679.

Beals, R.K. (1972). Survival following hip fracture: Long follow-up of 607 patients. Journal of Chronic Diseases, 25, 235-244.

Beringer, T.R., McSherry, D.M., & Taggart, H.M. (1984) A microcomputer based audit of fracture of the proximal femur in the elderly. Age and Ageing, 13, 344-348.

Bohannon, R.W., Kloter, K.S., & Cooper, J.A. (1990). Outcome of patients with hip fracture treated by physical therapy in an acute care hospital. Topics in Geriatric Rehabilitation, 6, 51-58.

Bonar, S.K., Tinetti, M.E., Speechley, M. & Cooney, L.M. (1990). Factors associated with short versus long-term skilled nursing facility placement among community-living hip fracture patients. Journal of the American Geriatrics Society, 38, 1139-1144.

Borkan, J.M., & Quirk, M. (1992). Expectations and outcomes after hip fracture among the elderly. International Journal of Aging and Human Development, 34, 339-350.

Borkan, J.M., Quirk, M., & Sullivan, M. (1991). Finding meaning after the fall: Injury narratives from elderly hip fracture patients. Social Sciences and Medicine, 33, 947-957.

Burtis, C.A. & Ashwood, E.R. (1999). Clinical chemistry (3rd ed.). Philadelphia: W.B. Saunders Company.

Ceder, L., Thorngren, K.G., & Wallden, B. (1980). Prognostic indicators and early home rehabilitation in elderly patients with hip fracture. Clinical Orthopedics, 152, 173-184.

Ceder, L., Svensson, K., & Thorngren, K.G. (1980). Statistical prediction of rehabilitation in elderly patients with hip fractures. Clinical Orthopedics, 152, 185-190.

Cluff, L.E. (1981). Chronic disease, function and the quality of care. Journal of Chronic Disease, 34, 299-304.

Cobey, J.C., Cobey, J.H., Conant, L., Weil, U.H., Greenwald, W.F., & Southwich, W.O. (1976). Indicators of recovery from fractures of the hip. Clinical Orthopedics, 117, 258-262.

Cohen, J. (1988). Statistical power analysis for the behavioral sciences (2nd ed.). New York: Academic.

Corbin, J.M. (1998). The Corbin and Strauss chronic illness trajectory model: An update. Scholarly Inquiry for Nursing Practice, 12, 33-41.

Corbin, J., & Strauss, A. (1988). Unending work and care. San Francisco: Jossey-Bass.

Corbin, J., & Strauss, A. (1991a). A nursing model for chronic illness management based upon the trajectory framework. Scholarly Inquiry for Nursing Practice, 5, 155-174.

Corbin, J., & Strauss, A. (1991b). Comeback: The process of overcoming disability. In G. Albrecht & J. Levy (Eds.). Advances in medical sociology (Vol. 1, pp.137-159). Greenwich Connecticut: JAI press.

Craik, R.L. (1994). Disability following hip fracture. Physical Therapy, 74, 387-398.

Cummings, S.R., Phillips, S.L., Wheat, M.E., Black, D., Goosby, E., Wlodarczyk, D., Trafton, P., Jergesen, H., Winograd, C.H., & Hulley, S.B. (1988). Recovery of

function after hip fracture: The role of social support. Journal of the American Geriatrics Society, 36, 801-806.

Cummings, S.R., Rubin, S.M., & Black, D. (1988). The future of hip fractures in the United States: Numbers, costs, and potential effects of postmenopausal estrogen. Clinical Orthopedics, 252, 163-166.

Fagerhaugh, S., & Strauss, A. (1977). The politics of pain management. Menlo Park, CA: Addison-Wesley.

Farmer, M.E., White, L.R., Brody, J.A., & Bailey, K.R. (1984). Race and sex differences in hip fracture incidence. American Journal of Public Health, 74, 1374-1379.

Ferrucci, L., Guralnik, J., Pahor, M., Corti, M.C., & Havlik, R. (1997). Hospital diagnoses, Medicare charges, and nursing home admissions in the year when older persons become severely disabled. Journal of the American Medical Association, 277, 728-734.

Fisher, E.S., Whaley, F.S., Krushat, W.M., Malenka, D.J., Fleming, C., Baron, J.A., & Hsia, D.C. (1992). The accuracy of Medicare's hospital claims data: Progrss has been made, but problems remain. American Journal of Public Health, 82, 243-248.

Fitzgerald, J.F., Fagan, L.F., Tierney, W.M., & Dittus, R.S. (1987). Changing patterns of hip fracture care before and after implementation of the prospective payment system. Journal of the American Medical Association, 258, 218-221.

Fitzgerald, J.F., Moore, P.S., & Dittus, R.S. (1988). The care of elderly patients with hip fracture: Changes since implementation of the prospective payment system. The New England Journal of Medicine, 319, 1392-1397.

Fox, K.M., Magaziner, J., Hebel, J.R., Kenzora, J.E., & Kashner, T.M. (1999). Intertrochanteric versus femoral neck hip fractures: differential characteristics, treatment, and sequelae. Journal of Gerontology: Medical Sciences, 54A, M635-M640.

Goldstein, F.C., Strasser, D.C., Woodard, J.L., & Roberts, V.J. (1997). Functional outcomes of cognitively impaired hip fracture patients on a geriatric rehabilitation unit. Journal of the American Geriatrics Society, 45, 35-42.

Green, S.B. (1991). How many subjects does it take to do a regression analysis? Multivariate Behavioral Research, 26, 499-510.

Guccione, A.A., Fagerson, T.L., & Anderson, J.J. (1996). Regaining functional

independence in the acute care setting following hip fracture. Physical Therapy, 76, 818-826.

Haley, R.W., Schaberg, D.R., McClish, D.K., Quade, D., Crossley, K.B., Culver, D.H., Morgan, W.M., McGowan, J.E., & Shachtman, R.H. (1980). The accuracy of retrospective review in measuring nosocomial infections rates. American Journal of Epidemiology, 111, 516-533.

Heithoff, K.A., & Lohr, K.N. (Eds.). (1990). Hip fracture: Setting priorities for effective research. Washington, DC: National Academy Press.

Hielema, F.J. (1979). Epidemiology of hip fracture: A review with implications for the physical therapist. Physical Therapy, 59, 1221-1225.

Hoaglin, D.C., & Welsch, R.E. (1978). The hat matrix in regression and ANOVA. The American Statistician, 32, 17-22.

Hosmer, D. W., & Lemeshow, S. (1989). Applied logistic regression. New York: John Wiley and Sons.

Hosmer, D.W., Taber, S., Lemeshow, S. (1991). The importance of assessing the fit of logistic regression models: A case study. American Journal of Public Health, 81, 1630-1635.

Huberty, C.J. (1984). Issues in the use and interpretation of discriminant analysis. Psychological Bulletin, 95, 156-171.

Jacobson, S.J., Goldberg, J., Miles, T.P., Brody, J.A., Steers, W. & Rimm, A.A. (1992). Race and sex differences in mortality following fracture of the hip. American Journal of Public Health, 82, 1147-1150.

Jette, A.M. (1996). Disability trends and transitions. In R. H. Binstock & L.K. George (Eds.), Handbook of Aging and the Social Sciences (4th ed.)(pp.94-116). San Diego, CA: Academic Press.

Jette, A.M,, Harris, B.A., Cleary, P.D., & Campion, W. (1987). Functional recovery after hip fracture. Archives of Physical Medicine and Rehabilitation, 68, 735-740.

Katz, S., Heiple, K.G., Downs, T.D., Ford, A.B., & Scott, C.P. (1967). Long term course of 147 patients with fracture of the hip. Surgery, Gynecology and Obstetrics, 124,1219-1230.

Kauffman, T.L., Albright, L. & Wagner, C. (1987). Rehabilitation outcomes after hip fracture in persons 90 years old and older. Archives of Physical Medicine and Rehabilitation, 68, 369-371.

Keeler, E.B., Kahn, K.L., & Bentow, S.S. (1992). Assessing quality of care for hospitalized Medicare patients with hip fracture using coded diagnoses from the Medicare provider analysis and review files (No. N-3450-HCFA). Santa Monica, CA: RAND.

Kiel, D.P., Eichorn, A., Intrator, O., Silliman, R.A., & Mor, V. (1994). The outcomes of patients newly admitted to nursing homes after hip fracture. American Journal of Public Health, 84, 128l-1286.

Koval, K.J., Skovan, M.L., Aharon, G.B., Meadows, S.E., & Zuckerman, J.D. (1995). Ambulatory ability after hip fracture: A prospective study in geriatric patients. Clinical Orthopedics, 310, 150-159.

Lubkin, I.M. (1986). Chronic illness: Impact and interventions. Boston: Jones and Bartlett Publishers.

Lu-Yao, G.L., Baron, J.A., Barrett, J.A. & Fisher, E.S. (1994). Treatment and survival among elderly Americans with hip fractures: A population-based study. American Journal of Public Health, 84, 1287-1291.

Lyons, A.R. (1997). Clinical outcomes and treatment of hip fractures. American Journal of Medicine, 103, 51S-63S.

Magaziner, J., Simonsick, E.M., Kashner, T.M., Hebel, J.R., & Kenzora, J.E. (1989). Survival experience of aged hip fracture patients. American Journal of Public Health, 79, 274-278.

Magaziner, J., Simonsick, E.M., Kashner, T.M., Hebel, J.R., & Kenzora, J.E. (1990). Predictors of functional recovery one year following hospital discharge for hip fracture: A prospective study. Journal of Gerontology: Medical Sciences, 45, M101-107

Marottoli, R.A., Berkman, L.F., Leo-Summers, L. & Cooney, L.M., Jr. (1994).

Predictors of mortality and institutionalization after hip fracture: The New Haven EPESE cohort. American Journal of Public Health, 84, 1807-1812.

Mayo, L. (1956). Problem and challenge: Guides to action on chronic illness. New York: National Health Council.

Menard, S. (1995). Applied logistic regression analysis. Thousand Oakes, CA: Sage Publications.

Miller, C.W. (1978). Survival and ambulation following hip fracture. The Journal of Bone and Joint Surgery, 60-A, 930-934.

Mossey, J.M., Knott, K. & Craik, R. (1990). The effects of persistent depressive symptoms of hip fracture recovery. Journal of Gerontology: Medical Sciences, 45, M163-168.

Mossey, J.M., & Magaziner, J. (1999, November). Issues in the study and the understanding of recovery. Workshop session presented at the annual meeting of the Gerontological Society of America, San Francisco, CA.

Mossey, J.M., Mutran, E, Knott, K. & Craik, R. (1989). Determinants of recovery 12 months after hip fracture: The importance of psychosocial factors. American Journal of Public Health, 79, 279-286.

National Center for Health Statistics (1995). Current estimates from the National Health Interview Survey. Vital & Health Statistics, Series 10 (No. 193). Hyattsville, MD: Public Health Services.

Nutritional Screening Initiative (1992). Nutrition interventions manual for professionsals caring for older Americans. Washington, D.C.: Author.

Pedhazur, E.J. (1997). Multiple regression in behavioral research: explanation and prediction (3rd ed.). New York: Harcourt Brace.

Pedhazur, E.J., & Schmelkin, L.P. (1991). Measurement, design, and analysis: An integrated approach. Hillsdale, NJ: Lawrence Erlbaum Associates.

Pregibon, D. (1981). Logistic regression diagnostics. The Annals of Statistics, 9, 705-724.

Ray, W.A., Griffin, M.R., & Baugh, D.K. (1990). Mortality following hip fracture before and after implementation of the prospective payment system. Archives of Internal Medicine, 150, 2109-2114.

Resnick, B., & Daly, M.P. (1997). The effect of cognitive status on outcomes following rehabilitation. Family Medicine, 29, 400-405.

Roberto, K.A. (1992a). Coping strategies of older women with hip fractures: Resources and outcomes. Journal of Gerontology: Psychological Sciences, 47, P21-26.

Roberto, K.A. (1992b). The role of social supports in older women's recovery from hip fracture. The Journal of Applied Gerontology, 11, 314-325.

Robinson, L.A., Bevil, C., Arcangelo, V., Reifsnyder, J., Rothman, N., & Smeltzer, S. (1993). Operationalizing the Corbin & Strauss trajectory model for elderly clients with chronic disease. Scholarly Inquiry for Nursing Practice: An International Journal, 7, 253-264.

Schlenker, E.D. (1998). Nutrition and aging (3rd ed.). Boston: McGaw Hill.

Schulz, J.H. (1995). The economics of aging (6th ed.). Westport, CT: Auburn House.

The Robert Wood Johnson Foundation (1996). Chronic care in America: A 21st century challenge. Princeton, NJ: same.

Tideiksaar, R. (1998). Falls in older persons: Prevention and management (2nd ed.). Baltimore, MD: Health Professionals Press, Inc.

U.S. Department of Health and Human Services. (1980). The international classification of diseases, 9th version, clinical modification. (DHHS publication no. PHS 80-1260. Washington, DC: U.S. Government Printing Office.

Verbrugge, L., & Jette, A. (1994). The disablement process. Social Science and Medicine, 38, 1-14.

Woog, P. (Ed.). (1992). The chronic illness trajectory framework. New York: Springer.

Zuckerman, J., Sakales, S., & Fabian, D. (1990). The challenge of geriatric hip fractures. Bulletin of the New York Academy of Medicine, 66, 255-265.

APPENDIX A

Medical Center Letter of Agreement

A Facsimile of the Medical Center Letter of Agreement

Medical Center Logo
January 11, 1999

Donna K. Dawson, MSG-LPT
103 Fox Road
Clarksville, VA 23927

Dear Ms. Dawson:

It was a pleasure meeting with you on December 21, 1998 at which time we discussed your upcoming dissertation research project which you wish to conduct at the medical center. I understand that the research will consist of the examination of the differences between older individuals who fully recover following hip fracture with those who do not. This will require obtaining information from patient records and will be permitted based on the following understanding:

- All medical record information will be held confidential.
- No individual patient or physician identifying information will be reported.
- All data will be reported in aggregate.
- Documentation of approval for this research by the Institutional Review Board for Research Involving Human Subjects (IRB) at Virginia Tech will be provided to the medical center before the research is initiated.
- Findings from this research will be shared with the medical center following the defense of the final dissertation paper.

If your are in agreement with the terms as stated above, please sign and return this correspondence. We look forward to working with you and sharing the results of your research.

Sincerely,

_____
Donna K. Dawson, MSG-LPT

Chief Executive Officer

APPENDIX B

Orthopedic Group Letter of Agreement

Facsimile of Orthopedic Group Letter of Agreement

April 11, 1999

The Center for Gerontology
Virginia Tech
237 Wallace Hall
Blacksburg, VA 24060

To Whom It May Concern:

Donna K. Dawson has asked permission to review records of our patients for her study concerning hip fractures. We wholeheartedly support her research efforts. The stipulations are that all medical record information will be held confidential, and that no individual patient or physician will be identified. We understand that IRB approval has been obtained at Virginia Tech. We certainly will appreciate information regarding the results of the study as well.

Please feel free to contact me if there are any other questions regarding this matter.

Sincerely,

Orthopedic Group

APPENDIX C

Code Form

Hip Fracture Outcome Research
Coding Form

Case number_____   Date_____   Hospital #_____
                                                  Long Term Care #_____
                                                  Home Health #_____
                                                  Orthopedic #_____

Prefracture Variables

Personal characteristic information:

#1 Age at time of fracture_____ years   #2 Education level_____years

#3 Gender_____male(0)_____female(1)

#4 Ethnicity_____White (0)_____Black(1)_____other(2)

Social status:

#5 Marital status: _____married (0)
                          _____single, never married(1)
                          _____separated (2)
                          _____divorced (3)
                          _____widowed (4)

#6 Living arrangements: _____living in own home (0)
                               _____living in an apartment (1)
                               _____living in a home for the aged (2)
                               _____living in a SNF/ICF facility (3)

#7 Socioeconomic status/payment source: _____Medicare only (0)
                                                _____Medicaid only (1)
                                                _____Medicare & Medicaid (2)
                                                _____Medicare & private insurance (3)
                                                _____Other (4)_____

Psychological status:

Drugs on admission: ——————————————————————————————————
                        ——————————————————————————————————
                        ——————————————————————————————————
                        ——————————————————————————————————

8 Total number of psychoactive drugs:_____

Psychiatric diagnoses: _____

#9 Total number of psychiatric diagnoses:_____

#10 Mental status: _____oriented to time/place/person (0) _____disoriented (1)

Physical status:

Functional status:

#11 Ambulation ability:
             _____independent ambulation (0)
             _____ambulation with an assistive device or assist of one(1)
             _____ambulation with minimal to moderate assistance of one
                  & use of an assistive device (2)
             _____maximal assistance of two people & an assistive device (3)
             _____unable/nonambulatory (4)

ADL ability:
#12 Bathing: _____independent (0)   #13 Dressing: ____independent (0)
             _____assistance of one (1)   ____assistance of one (1)
             _____assistance of two (2)   ____assistance of two (2)
             _____unable to perform (3)   ____unable to perform (3)

#14 Transferring: _____independent (0)   #15 Steps: ____independent (0)
             _____assistance of one (1)   ____assistance of one (1)
             _____assistance of two (2)   ____assistance of two (2)
             _____unable to perform (3)   ____unable to perform (3)

Medical status:

Existing medical conditions: ——————————————————————————
                         _____
                         _____
#16 Total number of existing medical conditions_____

Hemoglobin level:_____
#17 Anemia: _____present (0)
               _____absent (1)

#18 Vitamin B12 injections: _____received (0)
                            _____did not receive (1)

#19 Use of ERT: _____ prescribed (0)
                _____ not prescribed (1)

Nutritional status:

Body weight in lb:_____ Body height in inches:_____ Calculated BMI _____
    #20 nutritional status: _____malnourished/poor nutritional status (0)
                            _____well nourished (1)
                            _____overweight (2)

Serum albumin level_____
#21 Protein status: _____adequate (0)
                    _____deficient (1)

Sensory status:
#22 Vision:_____no deficit indicated/no related disease diagnoses (0)
            _____corrected with glasses or surgery (1)
            _____deficit indicated (2)

#23 Hearing: _____no deficit indicated/no related disease diagnoses (0)
              _____corrected with glasses or surgery (1)
              _____deficit indicated (2)

Event/Hospitalization Variables:

#24 Location of the hip fracture event: _____   _____indoors at home (0)
                                                        _____outdoors (2)
                                                        _____indoors at a facility (3)

#25 Time of day:_____   _____morning (0)   Date:_____
                            _____afternoon (1)
                            _____evening (2)
                            _____night (3)

#26 Time from fracture to arrival in the emergency room:_____hours

#27 Method of transport: _____ambulance (0)
                            _____car (1)
                            _____other (2)_____

#28 Type of fracture: _____surgical neck (0)
                       _____trochanteric (1)
                       _____subtrochanteric (2)

#29 Type of surgical repair: _____internal fixation with pins, plates, & rods (0)
                              _____hemiarthoplasty (1)
                              _____total hip replacement (2)

#30 Time from arrival in the emergency room until surgery: _____hours

#31 Total time from fracture to surgery:_____hours

#32 Mental status 1st day postop: _____oriented (0) _____disoriented (1)

#33 Initial weight bearing status: _____FWB (0) _____PWB (1) _____WBAT (2)
_____NWB (3)

Complications during hospitalization: _____
_____
_____
_____

#34 Total number of hospital complications:_____

New diagnoses: _____
_____

#35 Total number of new hospital diagnoses:_____

#36 Number of major changes in hospital medicine regimes: _____

#37 Number of missed hospital therapy treatments: _____

Timing of achievement of indices of progress/recovery:
    #38 Postop day first out of bed:_____
    #39 Postop day for first trip to bathroom:_____
    #40 Postop day for first eating solid food:_____
    #41 Postop day for first taking p.o. pain meds:_____
    #42 Postop day for removal of catheter:_____
    #43 Postop day for removal of IV fluids:_____

#44 Frequency of visitation by family, friends, & clergy:_____daily & regular (0)
_____ infrequent & sporadic (1)
_____ none (3)

#45 Total number of days in acute care:_____ days

#46 Ambulation ability at hospital discharge:
    _____independent ambulation (0)
    _____ambulation with an assistive device or assist of one(1)
    _____ambulation with minimal to moderate assistance of one
      & use of an assistive device (2)
    _____maximal assistance of two people & an assistive device (3)
    _____unable/nonambulatory (4)

ADL ability at hospital discharge:

\# 47 Bathing: _____independent (0)   \#48 Dressing: ____independent (0)
    _____assistance of one (1)   ____assistance of one (1)
    _____assistance of two (2)   ____assistance of two (2)
    _____unable to perform (3)   ____unable to perform (3)

\#49 Transferring: _____independent (0)   \#50 Steps: ____independent (0)
    _____assistance of one (1)   ____assistance of one (1)
    _____assistance of two (2)   ____assistance of two (2)
    _____unable to perform (3)   ____unable to perform (3)

\#51 Discharge location: _____own home (0)
    _____long-term care facility (1)
    _____acute rehabilitation facility (2)
    _____relative/friend's home (3)
    _____funeral home (4) Cause of death & date_____

Rehabilitation Variables:

\#52 Location of rehabilitation for the first 1-4 weeks:
    _____home with home health (0)
    _____home with outpatient services (1)
    _____long-term care facility (3)
    _____acute rehabilitation facility (4)
    _____sub acute rehabilitation facility (5)

\#53 Location of rehabilitation after 4 weeks:
    _____home with home health (0)
    _____home with outpatient services (1)
    _____long-term care facility (3)
    _____acute rehabilitation facility (4)
    _____sub acute rehabilitation facility (5)

\#54 Frequency of PT & OT/week for the first week out of the hospital:
    _____0-5 times/wk
    _____6-10 times/wk
    _____11- 15 times/wk
    _____16-20 times/wk

\#55 Frequency of PT & OT/week for the fourth week out of the hospital:
    _____0-5 times/wk
    _____6-10 times/wk
    _____11- 15 times/wk
    _____16-20 times/wk

#56 Number of readmissions to the hospital:_____ Reason(s)_____
_____

#57 Number of new diagnoses during rehabilitation:_____
New diagnoses:_____

#58 Number of major changes in drug regime during rehabilitation:_____
Description of major changes in drug regime:_____
_____

#59 Number of missed therapy visits during rehabilitation:_____
Reason(s) for missed therapy: _____

Complications during the rehabilitation phase: _____
                                               _____
                                               _____

#60 Total number of new complications during rehabilitation: _____

#61 Total number of changes in medical status through rehabilitation:_____
            If expired, cause and date of death:_____

Recovery indices for the rehabilitation phase:
#62 Independent donning/doffing clothes:___ achieved (0)___not achieved (1)____week
#63 Independent with bed transfers: :___ achieved (0)___not achieved (1)____week
#64 Independent with toileting to the BR:___ achieved (0)___not achieved (1)____week
#65 Independent with steps: :___ achieved (0)___not achieved (1)____week
#66 independent with car transfers: :___ achieved (0)___not achieved (1)____week
#67 Postop week when PT was discontinued:_____
#68 Postop week when OT was discontinued:_____

#69 Ambulation ability at discharge from PT:
            _____independent ambulation (0)
            _____ambulation with an assistive device or assist of one(1)
            _____ambulation with minimal to moderate assistance of one
                & use of an assistive device (2)
            _____maximal assistance of two people & an assistive device (3)
            _____unable/nonambulatory (4)

ADL ability at discharge from PT & OT:
#70 Bathing: _____independent (0)   #71 Dressing: ____independent (0)
                _____assistance of one (1)   ____assistance of one (1)
                _____assistance of two (2)   ____assistance of two (2)
                _____unable to perform (3)   ____unable to perform (3)

#72 Transferring: _____independent (0)   #73 Steps: ____independent (0)
                _____assistance of one (1)   ____assistance of one (1)
                _____assistance of two (2)   ____assistance of two (2)
                _____unable to perform (3)   ____unable to perform (3)

Outcome Variables:

Six month outcome status:

#74 Ambulation ability:
                _____independent ambulation (0)
                _____ambulation with an assistive device or assist of one(1)
                _____ambulation with minimal to moderate assistance of one
                  & use of an assistive device (2)
                _____maximal assistance of two people & an assistive device (3)
                _____unable/nonambulatory (4)

ADL ability:
#75 Bathing: _____independent (0)   #76 Dressing: ____independent (0)
                _____assistance of one (1)   ____assistance of one (1)
                _____assistance of two (2)   ____assistance of two (2)
                _____unable to perform (3)   ____unable to perform (3)

#77 Transferring: _____independent (0)   #78 Steps: ____independent (0)
                _____assistance of one (1)   ____assistance of one (1)
                _____assistance of two (2)   ____assistance of two (2)
                _____unable to perform (3)   ____unable to perform (3)

#79 Pain level ranging from 1-10:_____

#80 Residential location: _____ home (0)
                                _____ long-term care facility (1)
                                _____ home for the aged (2)
                                _____ family/friend's home (3)
                                _____ expired/cause & date of death_____

One year outcome status:

#81 Ambulation ability:
                _____independent ambulation (0)
                _____ambulation with an assistive device or assist of one(1)
                _____ambulation with minimal to moderate assistance of one
                  & use of an assistive device (2)
                _____maximal assistance of two people & an assistive device (3)

_____unable/nonambulatory (4)

ADL ability:

#82 Bathing: _____independent (0)   #83 Dressing: ____independent (0)
                _____assistance of one (1)   ____assistance of one (1)
                _____assistance of two (2)   ____assistance of two (2)
                _____unable to perform (3)   ____unable to perform (3)

#84 Transferring: _____independent (0)   #85 Steps: ____independent (0)
                  _____assistance of one (1)   ____assistance of one (1)
                  _____assistance of two (2)   ____assistance of two (2)
                  _____unable to perform (3)   ____unable to perform (3)

#86 Pain level ranging from 1-10:_____

#87 Residential location: _____ home (0)
                                 _____ long-term care facility (1)
                                 _____ home for the aged (2)
                                 _____ family/friend's home (3)
                                 _____ expired/cause & date of death (4) _____

#88 Number of readmissions to a higher level of care, changes in drug regime, or further complications:_____

#89 Total number of changes in medical condition over the one year trajectory:_____

#90 Final Functional Recovery Outcome:
                                _____Fully functionally recovered (0)
                                _____Not fully functionally recovered (1)
                                _____Deceased (2)

APPENDIX D

Summary of the Hip Fracture Trajectory Variables

Table 5

Summary of the Hip Fracture Trajectory Variables

Variable	Sample Characteristics	n
Prefracture Variables		
Psychoactive drugs	$\underline{M}$ = 3.20, $\underline{SD}$ = 2.20	102
Psychiatric diagnoses	$\underline{M}$ = .68, $\underline{SD}$ = .79	102
Anemia (hemoglobin)	46%- present, 54%- not present	100
Vitamin B-12 injections	1%- receiving, 99%- not receiving	102
Estrogen therapy	3%- receiving, 97%- not receiving	102
Protein status (albumin)	31%- adequate, 68%- deficient	76
Vision	8%- deficit indicated, 92%- no deficit indicated	102
Hearing	37%- deficit indicated, 63%- no deficit indicated	102
Event Variables		
Fracture-time of day	69%- daytime, 31%- nighttime	88
Method of transport	81%- ambulance, 2%- other vehicle, 7%- none	99
Time-fracture to ER	$\underline{M}$ = 7.65 hours, $\underline{SD}$ = 24.92	68
Time-ER to surgery	$\underline{M}$ = 17.25 hours, $\underline{SD}$ = 13.51	78
Time-fracture to surgery	$\underline{M}$ = 15.75 hours, $\underline{SD}$ = 27.78	65
Hospitalization Variables		
Mental status after surgery	53%- oriented, 47%- not oriented	102
Initial weight-bearing status	83%-WBAT, 7%-NWB, 6%-PWB, 4%-TDWB*	102
Complications	$\underline{M}$ = 2.05, $\underline{SD}$ = 1.20	101
New diagnoses	$\underline{M}$ = .14, $\underline{SD}$ = .47	101

Changes in drugs	M = .30, SD = .99	101
Missed therapy	M = .38 visits, SD = .90	95
Post-op day out of bed	M = 1.01, SD = .43	88
Post-op day to bathroom	M = 2.42, SD = 1.24	12
Post-op day with solid food	M = 1.04, SD = .41	67
Post-op day-oral pain meds	M = 1.79, SD = 1.38	66
Post-op day without catheter	M = 3.25, SD = 2.41	65
Post-op day without IV	M = 2.67, SD = 1.5	70
Frequency of visitation	79%- daily & regular, 18%- infrequent, 3%- none	102
Bathing at discharge	1%- independent, 93%-1 assist, 6%- >1 assist	102
Transfers at discharge	4%- independent, 40%-1 assist, 56%- >1 assist	102
Dressing at discharge	1%- independent, 92%-1 assist, 7% - >1 assist	102
Stepclimbing at discharge	8%- 1 assist, 92%- unable	102

Rehabilitation Variables

Location of rehab.- week 1	14%- home, 86%- institution	102
Frequency therapy - week 4	61% $\leq$ 5x/week, 39% > 5x/week	97
Readmissions to hospital	M = .16, SD = .39	102
New diagnoses	M = .18, SD = .41	97
Changes in medications	M = .44, SD = .78	95
Missed therapy	M = .74, SD = 2.03	91
Complications	M = 1.22, SD = 1.40	97
Week PT discontinued	M = 11.37, SD = 8.46	82
Week OT discontinued	M = 5.14, SD = 4.30	65

Bathing at end of therapy	36%- independent, 62%- 1-2 assist, 2%- unable	99
Dressing at end of therapy	36%- independent, 62%- 1-2 assist, 2%- unable	99
Transfers at end of therapy	44%- independent, 44%- 1 assist, 12%- 2 assist	99
Stepclimbing-end of therapy	22%- independent, 39%- 1-2 assist, 39% unable	90

Outcome Variables at 6 Months

Bathing	40%- independent, 57%- $\geq$ 1 assist, 3%- unable	88
Dressing	40%- independent, 57%- $\geq$ 1 assist, 3%- unable	88
Transfers	50%- independent, 48% $\geq$ 1-2 assist, 2%- unable	88
Stepclimbing	37%- independent, 37%- 1-2 assist, 27%- unable	85
Presence of pain	67%- none indicated, 33%- pain presence indicated	88

Outcome Variables at 0ne Year

Bathing	43%- independent, 54%- 1-2 assist, 4%- unable	80
Dressing	44%- independent, 53%- 1-2 assist, 4%- unable	80
Transfers	49%- independent, 46%- 1-2 assist, 5%- unable	80
Stepclimbing	39%- independent, 32%- 1-2 assist, 29%- unable	77
Presence of pain	67%- none indicated, 33%- pain presence indicated	80
Medical changes after rehab.	$\underline{M}$ = 1.13, $\underline{SD}$ = 1.51	80
Medical changes (1 year)	$\underline{M}$ = 4.34, $\underline{SD}$ = 2.40	80

*WBAT- weight bearing as tolerated, NWB – non-weight bearing, PWB – partial weight bearing, TDWB – touch-down weight bearing

Curriculum Vitae

Donna Kay Dawson

103 Fox Road
Clarksville, VA 23927
(804) 252-3861

Education

Virginia Polytechnic Institute and State University
Blacksburg, Virginia
Ph.D., Human Development
Certificate in Gerontology
Dissertation Title: *Determinants of Nonrecovery Following Hip Fracture in
                Older Adults: A Chronic Disease Trajectory Analysis*
Graduation: May 2000

Virginia Commonwealth University
Richmond, Virginia
MS, Gerontology, Public Administration Track
Graduation: December 1983, Honors

University of North Carolina
Chapel Hill, North Carolina
BS, Physical Therapy
Graduation: May 1971, NC License # 66l, VA License #0105-006261

Vance-Granville Community College
Henderson, NC 27536
Emergency Medical Technician Training
Cardiopulmonary Resuscitation Training
NC State Certified EMT- 1976, 1979, & 1981
NC Heart Association Certified CPR Instructor – 1977-1983, 1986-1988
NC State EMT Examiner – 1978 –1982

Employment

1999 to Present – Unit Director, Geropsychiatry and Medical Services Units, John
Umstead Hospital, Butner, NC 27509

1998 to 1999- Adjunct Faculty, Graduate Course Instructor (Social Gerontology),
Department of Gerontology, Virginia Commonwealth University, Richmond, VA 23284

1998 to1999- Graduate Assistant, Adult Day Services, Department of Human Development, Virginia Polytechnic Institute and State University, Blacksburg, VA 24061

1997- Graduate Teaching Assistant, Department of Human Development, Virginia Polytechnic Institute and State University, Blacksburg, VA 24061

1995 to 1997- Senior Manager-Rehabilitation Services, Granville Medical Center, Oxford, NC 27565

1991 to 1995- Director of Rehabilitation, Brantwood Nursing and Retirement Center, Granville Medical Center, Oxford, NC 27565

1989 to 1991- Staff Physical Therapist, Hillhaven Convalescent and Rehabilitation Center, Durham, NC 27702

1976 to1988- Instructor (part-time), Vance-Granville Community College, Henderson, NC 27536 Courses taught: Emergency Medical Technician, Activity Coordinator, CPR, Domiciliary Home Annual Staff Training and Introduction to Gerontology.

1984 to 1988- Consultant Writer (part-time), NC Department of Community Colleges, Raleigh, NC 27603

1984 to 1987- Program Director, Geriatric Care Assisting Program, Piedmont Community College, Roxboro, NC 27573

1980 to 1981- Physical Therapist, Vance-Granville Home Health Agency, Vance-Granville Health District, Oxford, NC 27565

1979 to 1980- Director of Physical Therapy, Pine Crest Manor, Henderson, NC 27536

1978 to 1979- Assistant Director, Emergency Medical Services Regional Planning Project, Kerr-Tar Regional Council of Government, Henderson, NC 27536

1974 to 1978- Director of Physical Therapy, Granville Medical Center, Oxford, NC 27565

1971 to 1974- Director of Physical Therapy, John Umstead State Psychiatric Hospital, Butner, NC 27509

Publications/Technical Writing

"*Slips, Trips, and Stumbles: Preventing Falls in Late Life*", Spring-1999, Aged Wisdom Series, Virginia Cooperative Extension, Virginia Tech, Blacksburg, VA, 24061

Curriculum Manuals, NC Department of Community Colleges, Raleigh, NC 27603,

Certificate in Gerontology (1992), Nursing Assistant (1990), Activity Coordinator (1988), and Geriatric Care Assistant (1985)

Presentations

2000 – Workshop for student attendees, Southern Gerontological Society Annual Meeting, "Careers in Gerontology: Preparing for the Transition from Graduate School to Professional Employment, Raleigh, NC

1999 – Poster Session, Gerontology Society of American Annual Meeting, "An Age-based Analysis of Barriers to Participation in Higher Education, San Francisco, CA

1998 – "Inquiring Voices", graduate student research conference- poster session on "Effects of Low Vision Interventions on Nutritional Intake of Community Dwelling Older Persons", Virginia Polytechnic Institute and State University, Blacksburg, VA 24061

1997 & 1996 – "Geriatric Rehabilitation" – conference for PTA students from Nash Community College, Rocky Mount, NC Granville Medical Center, Oxford, NC 27565

1995 – "Rehabilitation after Total Hip Replacement", presentation for hospital staff, Granville Medical Center, Oxford, NC 27565

Awards

1999 – Gerontology Research and Professional Development Award, Center for Gerontology, Virginia Tech, Blacksburg, VA 24061

1996 – Clinical Supervision Award, Carolina Clinical Education Consortium, nominated by the PTA Program at Nash Community College, Rocky Mount, NC

1984- Gerontology Student of the Year, Virginia Commonwealth University, Richmond, VA

Grants

1997- Adult Day Care Program Development Grant from the Duke Foundation ($63,000), Chair – Adult Day Care Program Planning Committee, Granville Medical Center, Oxford, NC 27565

1979 – Regional Emergency Medical Services Grant from DHHS ($318,613 –Federal funding and $318,613 local match), Assistant Project Director, Kerr-Tar Regional Council of Governments, Henderson, NC 27536

Professional Associations

American Association of Retired Persons - 1985 to present

American Physical Therapy Association (Geriatric Section Member) - 1995 to present

American Society on Aging – 1999 to present

Gerontology Society of America – 1982-1988, 1998 to present, Reviewer- Journal of Gerontology: Psychological Sciences, 1999.

Sigma Phi Omega: National Honor and Professional Society in Gerontology – 1983 to present, President- Beta Sigma Chapter, Virginia Tech, Blacksburg, VA, 1999.

Southern Gerontology Association – 1983 to 1991, 1997 to present, Student Representative to the Board of Directors, 1999-2000

Virginia Association on Aging –1997 to present