A COMPARISON OF SELF-REPORT AND PERFORMANCE-BASED MEASURES OF PHYSICAL FUNCTION IN OLDER ADULTS

A Thesis

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DEDICATION

I would like to dedicate my thesis to my loving parents, Thomas and Susan Dunbar, who have always been there for me my entire life. They have supported me in every challenge I have faced and have been my biggest source of motivation over the years. I am very thankful to have such wonderful parents to have helped me become the "young lady" I am today through lots of hard work and dedication. I love you, mom and dad, with all of my heart and thank you both for everything.

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ABSTRACT

The purpose of this thesis was to examine the associations between perceived quality of life (QOL) and self-report and performance-based measures of function. An additional purpose of this thesis was to determine whether the afore-mentioned tests could differentiate between independent-living and assisted-living older adults. A total of 36 residents, independent-living (n=22) and assisted-living (n=14), of a continuing care retirement community (age range=65-94) completed the study. Perceived QOL was assessed using the SF-36 and Nottingham Health Profile. The Barthel Index and Functional Status Index (FSI) were used to assess Activities of Daily Living (ADLs). Physical function was measured using the reduced Continuous Scale-Physical Functional Performance test (CS-PFP 10). Test/retest data (n=10) revealed good stability of the CS-PFP items (ICCs= 0.91-0.99). There were significant associations with age and both ADLs and the CS-PFP 10 composite score. There were also significant associations with dwelling status and both the individual tasks and composite score of the CS-PFP 10 and ADLs, but not with perceived QOL (except for NHP-PM). The "scarves" and composite score of the CS-PFP 10 were related to the physical composite score of the SF-36 ($p<.005$). In addition, the FSI pain and difficulty indicators were also closely associated with the SF-36 PCS score ($p<.05$). Multiple regression of these predictors on the SF-36 PCS score revealed that the "scarves" and FSI pain indicator items provide a strong model of the PCS component of the SF-36 ($F= 9.51$, $p<.001$). The results of this investigation suggest that the combination of objective and subjective measures of function are associated with the perceived physical aspects of QOL in older adults.

CHAPTER 1—INTRODUCTION

Adults over the age of 65 represent one of the fastest growing segments of the United States population, as well as of the international population (King et al, 2000). In the year 2000, approximately 35 million Americans were over 65 years of age (Hurley & Hagberg, 1998). By the year 2030, the number of Americans 65 years and older will reach 70 million. Furthermore, individuals 85 years and older will represent the fastest growing segment of the United States population (Mazzeo et al, 1998).

While the majority of adults aged 65 years and older continue to live independently, over 40% of these older adults report difficulty in performing their usual activities of daily living (ADLs). Such functional limitation is generally manifest as restrictions in accomplishing basic physical and/or mental actions such as walking, lifting, and talking that may lead to difficulties in performing ADLs. Several factors can influence functional ability among older adults including disease, injury, lack of motivation, and the constraints imposed by the individual's physical and social environment (Sonn, Frandin, & Grimby, 1995). Regardless of the cause, the high prevalence of disease and functional limitations among older adults account for the greatest proportion of chronic disease burden and disability, resulting in annual health care costs averaging over $3,000 per person (King et al, 2000). Therefore, understanding age-related changes in functional ability is currently of considerable interest (West et al, 1997).

As functional limitations progress and ADL competency declines, there is an increased risk for a loss of independent-living status and need for long-term, costly care (Schroeder, Nau, Osness, & Potteiger, 1998). Of particular concern are the basic ADLs, which include six basic human functions: bathing, dressing, toileting, transfer, continence, and feeding (Katz & Akpom, 1976). However, it is also important to recognize the extent to which older adults experience difficulty in performing instrumental activities of daily living (I-ADLs). I-ADLs include such activities as cleaning, shopping, and transportation, which are important to maintain a dwelling status in the community and are likely to have some implications for quality of life (QOL) (Sonn et al, 1995).

The goals of the health care system for older adults are changing from diagnosis and cure of diseases to maintenance of independent living in late life. The process of aging is complex and involves several variables that interact together and greatly influence the manner in which an individual ages (Mazzeo et al, 1998). It is crucial that we identify tools that adequately identify and measure those aspects of function that best predict independent-living status and QOL so as to identify the specific needs of the older adult population, and appropriately implement preventive and rehabilitative treatment strategies designed to optimize function and QOL.

1.1 Physical Function

While the disablement process may be influenced by a variety of pathologic as well as environmental influences, the majority of limitations in older adults are expressed as either physical and/or cognitive deficits. The focus of the present study is the measure of physical function in older adults, and it is therefore not within the scope of the present work to discuss the breadth of information that deals with cognitive deficits in the older adult population.

It is important to distinguish physical function from other similar concepts such as physical performance and physiological capacity. Physical function can be defined as the integration of physical performance, physiological capacity, and psychosocial factors. Physical performance is the ability to combine the physiological systems into efficient, coordinated movements so that optimum physical function is achieved. Physiological capacity is the basic cellular and anatomic functions such as muscle strength per cross-sectional area, nerve conduction velocity, or ejection fraction. Also, psychosocial factors such as perceived ability, confidence, and motivation influence physical function (Cress et al, 1996).

The methods used to characterize functional ability are still evolving. The traditional approach to assessing functional ability has been through self-report measures that are imprecise and suffer from threats to validity. Limitations on self-report measures may include discrepancies between the individual's perception and his/her ability to perform and the lack of sensitivity to change (Cress et al, 1995).

After a long period of time during which only self-report measures of function were used, performance-based measures of function were introduced to deal with problems inherent in self-report measures, such as errors in judgment or memory for those with impaired cognitive function, and the ability and willingness to answer questions correctly (Rockwood, Awalt, Carver, & MacKnight, 2000). Measuring an individual's physical performance by direct observation has face validity, sensitivity to change over time, and usefulness in assessing an individual with cognitive limitations. Furthermore, an individual may learn that his/her ability to perform certain activities is greater than he/she perceived it to be (Cress et al, 1995). Performance-based tests appear to provide important information about the functional status of an individual and predict future disability and mortality, indicating that these tests provide some degree of structure and predictive validity. Also, when collected in a standardized clinic setting, performance-based tests of ADLs are thought to be a meaningful reflection of the conduct of similar tasks usually performed at home (West et al, 1997).

Other researchers have also reported a number of advantages that performance-based measures are thought to have compared to self-report measures. “First, performance-based measures offer the ability to assess change over time on a continuous scale, rather than broad, categorical changes. Second, the reliability may be better for individuals with mild to moderate cognitive impairment that are able to follow the task instructions, and performance can be assessed even if recall is impaired. Finally, performance-based measures of function may be better for between-subject comparisons because the basis of comparison is the same” (West et al, 1997).

Measures of disability in physical function have become important indicators of the health status of older adults. Disability refers to “the consequences that specific health problems have on the person’s ability to act in typical and personally desired ways in society” (Jette, 1994). Disability occurs when there is a gap between the capability of older adults and environmental demand to function on a daily basis without assistance. Impairments in an individual’s ability to perform ADLs are very likely to affect an individual’s ability to live independently and affect his/her QOL. There is considerable interest in studying the association between functional limitations and dependence in ADLs. Although the relationship may not be linear, there may be a certain threshold level in a functional limitation that results in disability in a specific activity in a certain situation (Sonn et al, 1995).

1.2 Activities of Daily Living

The term ADL refers to the performance of basic personal tasks that are necessary for self care of an individual. The use of ADLs as a valid and reliable measure of physical function in older adults has been well established (Laditka & Jenkins, 2001). According to recent reports, there is a strong association between poor performance on physical function tests and the development of ADL dependence. A single assessment of physical function is a strong predictor of dependence in ADLs. A change in an individual's physical functioning is associated with coexisting ADL dependence and may be useful in predicting an individual's future disability if measured over shorter intervals (Gill, Williams, Mendes de Leon, & Tinetti, 1997). The decline in ADL performance and physical function by individuals may be accounted for by the loss of strength, flexibility, and balance, all being associated with the loss of independence. Self-efficacy or confidence in avoiding falls while performing everyday activities is also associated with basic ADL function (Judge, Schechtman, Cress, & FICSIT, 1996).

The Continuous-Scale Physical Functional Performance test (CS-PFP) was developed to address a broad range of activities that are important to independence in older adults. The CS-PFP is related not only to performance-based measures of physical function but also to self-report measures of physical function. The CS-PFP is appealing because of the possibility for insight into the location and severity of functional impairment, sensitivity to change, and face validity (Cress et al, 1999).

Based on normal ADLs, the CS-PFP is performed with the individual functioning at maximum effort and relies on the individual's judgment to stay within appropriate safety and comfort boundaries. The CS-PFP provides both a total score and individual physical domain scores of upper and lower body strength, flexibility, endurance, and coordination (Cress et al, 1999). In addition, the CS-PFP utilizes a continuous scale in order to quantify physical functional performance of the entire body as well as across many physical domains (Cress et al, 1996).

The CS-PFP is a unique instrument designed to provide an in-depth, comprehensive measure of physical function reflecting many abilities in several separate physical domains. Cress et al found that the CS-PFP is a valid and reliable measure of physical function, appropriate to a broad range of functional levels having minimal floor and ceiling effect. Both the total score and physical domain scores can be used to discriminate, evaluate, and predict physical functional performance for both clinical and research purposes (Cress et al, 1996).

1.3 Justification for the Research

Current literature points to the fact that a substantial proportion of disability that accompanies aging is preventable. For example, one of the most important factors contributing to impaired functioning and disability with age is inactivity (King et al, 2000). It has been shown that as individuals grow older, there is an age-related decline in ADLs, balance, muscular strength, and flexibility. However, individuals who maintain a high level of physical activity generally are stronger, more flexible, and have better balance than their sedentary counterparts (Schroeder et al, 1998). Moreover, "A significant relationship has been reported between increases in regular exercise and improvements in physical fitness as measured by aerobic capacity and strength in older adults (King et al, 2000)." Even older adults that maintain healthy aging will see changes in muscle and the cardiovascular system that can affect everyday functional ability (Malbut-Shennan & Young, 1999). While the relationship between functional status and regular physical activity remains to be fully explained (King et al, 2000), it is clear that older adults can benefit significantly from regular physical activity. It is therefore important to: a.) accurately identify those individuals who may be at risk for disablement, and b.) objectively measure the efficacy of treatment strategies designed to enhance function in older adults.

1.4 Purpose of the Study

Therefore, one purpose of this thesis was to examine the relationships among performance-based measures of physical function (as defined by the CS-PFP), self-report measures of physical function (ADLs), and QOL. An additional purpose of this thesis was to examine the extent to which the reduced CS-PFP (CS-PFP 10), ADL, and QOL scores differed between independent-living and assisted-living status in a Continuing Care Retirement Community. Lastly, it will be important to verify the reliability of the CS-PFP 10 in this group of older adults.

1.5 Hypotheses

The primary hypotheses of this thesis were: 1.) both CS-PFP 10 and ADL scores will be associated with QOL; and 2.) independent-living residents will have better ADL and CS-PFP 10 scores in comparison to assisted-living residents. As to whether the CS-PFP 10 is a stronger predictor of QOL as compared to the ADL questionnaires, this question is empirical rather than hypothesis driven.

1.6 Limitations of the Study

For the population tested in this study, certain limitations do exist. First, the participants all came from a Continuing Care Retirement Community where there are many services offered that the average independent-living individual in the community may not have access to on a daily basis. In addition, all the participants in this study are Caucasian, affluent older adults that are well-educated. The majority of the participants that were tested were female. Also, the participants did not have cardiac symptoms and were not at risk for any adverse responses during exercise. Finally, this study included a small number of subjects limiting the significance of the various associations.

CHAPTER 2—REVIEW OF LITERATURE

Assessment of functional ability in older adults has been a focus of research for more than 25 years. The importance of this research is demonstrated by the one-fifth of adults aged 65 years and older in the United States who are not able to perform at least one ADL (Elam et al, 1991). Aging is commonly associated with physical deterioration, loss of mental capacity, and a downhill slide toward death. Though there are some aspects of truth in this association, the degree to which function declines on an individual basis is clearly influenced by behavioral and environmental factors as well. These factors include diet, activity patterns, social supports, and accommodations that individuals make in attempting to maintain function throughout the life span. The perception each individual holds about aging makes him/her live the later stages of life in very diverse manners (Armayor, 2000).

Several studies have shown a decline in physical function with advancing age (Young, Masaki, & Curb, 1995; Guralnik et al, 1993; Jagger et al, 2001; Wu, Leu, & Li, 1999). For example, Young et al (1995) examined function three to five years later in adults older than 70 years of age. A lower level of function (up to 23.2%) was associated with older ages for selected performance-based measures: 10-foot walk, chair stand, handgrip strength, shoulder rotations, walk on toes/heels, and several balance tasks. In addition, this study found that the self-report measures were associated with an age-related lower physical functioning status most apparent in home management skills scores (up to 33.6%) and physical endurance-type tasks scores (up to 30.9%).

Another study by Wu et al (1999) estimated the incidence of chronic ADL disability in older people in Taiwan. The results showed that as age increased, so did the number of chronic ADL disabilities. Therefore, while there are other factors that influence chronic ADL disability, age is the most consistent predictor of functional decline in older adults.

There are a growing number of studies that implicate the age-related decline in function as having harmful influences on disability-free living, survival, and QOL. While the appearance of such age-related changes has been well-documented, our understanding of the decline in function is clouded by the many factors thought to influence functional ability beyond age itself. Other important factors include disease, physical activity, health behaviors, heredity, gender, and race. This chapter will review the evidence regarding the influence of these factors on function, the relationship between function and QOL, and the role of physical activity in optimizing physical function throughout the lifespan.

2.1 Physical Function and Survival

Many studies focus on morbidity and mortality in relation to physical activity and functional ability (Manton, 1988; Schroll, Avlund, & Davidson, 1996; Sihvonen, Rantanen, & Heikkinen, 1998; Bernard et al, 1997; Laukkanen, Heikkinen, & Kauppinen, 1995). The results of a study by Laukkanen et al (1995) indicated that difficulties moving about indoors and outdoors, reduced walking speed, and reduced muscle strength during the follow-up period were all associated with an increased risk of death. Schroll et al (1996) performed a longitudinal study of aging based on a population in Glostrup, Denmark. The results suggested that 5-year mortality was independently related to physical activity, pulmonary function in men, and muscle strength in women. The 5-year mortality rate was 10% in individuals with muscle strength above the mean value, but

22% with muscle strength below the mean value. In addition, stair mounting height and walking speed were also predictive of 5-year mortality.

While the relationships among physical activity, function, and mortality are somewhat strong, it is difficult to assume cause and effect inasmuch as increased incidence of chronic diseases, known to influence mortality, also have a direct influence on activity and function. The strongest evidence for these associations comes from longitudinal studies that have examined mortality rates associated with changes in activity and changes in function. For example, The Evergreen Longitudinal Study of Aging followed changes in physical activity over five years in men and women 75 and 80 years of age. The results indicate that physical activity decreased significantly in all groups, and that the mortality risk for each age group was lowest among the most active participants (Sihvonen et al, 1998).

Moreover, studies have also shown a significant relationship between functional decline and increased risk of death. Bernard et al (1997) followed 3,485 adults 65 years of age and older for self-rated functional ability and mortality. The 3-year change in self-rated functional ability was found to be an independent predictor of the risk of death among older adults.

2.2 The Influence of Disease on Physical Function

Chronic diseases are considered a primary cause of disability in older adults. Osteoarthritis is one of the leading causes of disability. Heart disease, cerebrovascular disease, hypertension, diabetes, osteoporosis, arthritis, visual impairment, and dementia have all been associated with disability (Carlson et al, 1999). Disease leads to disability by impairing physical ability in a manner similar to aging and disuse. Many studies have attempted to quantify the influence of disease on physical function (Bassey et al, 1992; Ferruzzi et al, 1997; Baker et al, 2001; Feldman et al, 2001). For example, Bassey et al (1992) found that subjects with neurological diseases had significantly poorer leg extensor power for body mass than the other subjects.

Sarcopenia is an age-related reduction in muscular mass and strength that can cause a decline in physical functioning and loss of autonomy. The threshold under which strength is most critical to function was examined by Ferruzzi et al (1997). The one-third most disabled women from a population of 1,002 women were tested for knee extensor and hip flexor strength and lower extremity performance. Those women who had better lower extremity performance had better strength. Therefore, the importance in maintaining strength for optimal function through exercise training programs is critical when trying to prevent the onset of sarcopenia.

The Disability Assessment for Dementia (DAD) scale has been validated as a measure of functional ability in dementia. Assessments of DAD were performed at baseline, 6-months, and 12-months on patients with mild to moderate Alzheimer's disease. The rate of decline was consistent across the domains of basic ADLs and I-ADLs. Therefore, as the severity of Alzheimer's disease increases, the rate of functional decline also increases (Feldman et al, 2001).

2.3 Other Influences on Physical Function

There are several other factors that influence physical functional ability in older adults. While these factors are certainly worth mentioning, it is not within the scope of this review of literature to provide detailed information regarding the potential associations of these factors with physical function. Rather, it is merely the intent of this document to acknowledge the existence of these potential sources of variability and to consider these in the development of the thesis study.

Beyond age and disease, there exist other health behaviors that may influence functional ability in older adults. For instance, LaCroix, Guralnik, Berkman, Wallace, and Satterfield (1993) studied the association of many health behaviors in relation to maintaining mobility during four years of follow-up. In this study of older adults with intact mobility at baseline, the likelihood of maintaining mobility in late life was significantly associated with being a nonsmoker and consuming small amounts of alcohol. The findings of this study suggest that positive health behaviors extend longevity and reduce the risk of losing independence and mobility in late life.

Another factor that might influence functional ability is dwelling status. For example, individuals from nursing facilities, assisted-living facilities, and the community performed the Physical Performance Test (PPT). Significant differences existed among the three groups in functional ability assessed by the PPT. Those individuals living in a nursing facility had poorer PPT scores than those individuals living in assisted-living facilities and the community. In addition, the individuals in assisted-living facilities had much lower PPT scores than individuals living in the community. The data from this investigation indicates that there are differences in functional ability among same-aged older adults living in nursing facilities, assisted-living facilities, and the community (Schroeder et al, 1998).

Still other factors that potentially influence functional ability include heredity, gender, race, social relationships or involvement, income, and education level (Wu et al, 1999). The degree to which all of these factors influence physical function is not well established, nor is there a clear consensus that all of these factors do, in fact, influence physical function. While it is not the purpose of this review to provide a lengthy discussion on all of these issues, it is clear that more work is needed to clarify the interaction of the many factors that contribute to functional decline.

2.4 Physical Function Assessment with ADLs and I-ADLs

Many studies focus on self-reported ADL and I-ADL values to assess functional ability in older adults (Jagger, Arthur, Spiers, & Clarke, 2001; Sonn et al, 1995; Nourhashemi et al, 2001; Elam et al, 1991; Hayes, Jette, Wolf, D'Agostino, & Odell, 1992). An interesting study by Jagger et al (2001) investigated the order in which ADLs are lost with age. Disability was measured by self-report performance in mobility, toileting, chair transfer, bed transfer, feeding, dressing, and bathing. The order of ADL restriction with age was bathing, mobility, toileting, dressing, transfers, and feeding. Therefore, ADLs requiring lower-extremity strength (bathing, mobility, toileting) appear to be lost before ADLs requiring upper-extremity strength (dressing, feeding) as age increases.

Performance of I-ADLs was examined by Nourhashemi et al (2001) to try and identify older women with clinical conditions associated with disability. Among the population studied, 32% had disability in at least one I-ADL, were significantly older, less socially active, and had a more frequent history of heart disease, stroke, depression, and diabetes. Therefore, women with disability in at least one I-ADL are more disabled because they have more clinical conditions associated with I-ADL disorders.

Sonn, Frandin, and Grimby (1995) analyzed in particular the association of physical impairments and functional limitations with dependence in I-ADLs in older adults. This study also established to what degree of disability with I-ADLs there is an association with physical impairments and functional limitations. Individuals that were I-ADL dependent had lower values of function compared to individuals that were I-ADL independent in maximum walking speed, grip strength, knee extensor strength, stair climbing capacity, and forward reach. This study demonstrated the impact of certain functional limitations and impairments on dependence in I-ADLs.

2.5 Performance-Based and Self-Report Measures of Physical Function

There have been several studies assessing functional status through performance-based measures and/or self-report measures (Kivinen, Sulkava, Halonen, & Nissinen, 1998; Reuben, Valle, Hays, & Siu, 1995; Guo, Matousek, Sonn, Sundh, & Steen, 2000; West et al, 1997; Elam et al, 1991; Rockwood et al, 2000; Cress et al, 1995; Hayes et al, 1992; Harada, Chiu, & Stewart, 1999). Many studies have found strong correlations between self-report and performance-based measures in assessing physical function. For example, in spite of the fact that self-report measures of ADL reflect disability and performance-based measures reflect functional limitations, Kivinen et al (1998) found that self-report and performance-based measures, in general, are strongly correlated with each other.

The relationship between self-report physical function and performance-based physical function was assessed by Cress et al (1995) by comparing the two methods of measuring physical function in individuals living in the community and individuals living in the nursing home who have a broad range of abilities. Self-perceived physical function was assessed using the Sickness Impact Profile comprised of three subscales: ambulation, mobility, and body care and movement. Performance-based physical function was assessed by self-selected gait speed, chair stand time, maximal grip strength, and a balance score. Cress et al also evaluated the effects of educational, cognitive, social, and age factors on the relationship between the two methods for measuring physical function. In conclusion, both self-perceived and performance-based measurements are strong indicators of physical function in a wide range of abilities and can be used to supplement each other.

Elam et al (1991) studied five performance-based ADL tasks among acute care hospital stay patients and compared them to self-report measures of function provided by the patient, the family, and the physician. The five ADLs studied were walking, dressing, eating, transferring, and telephoning. In general, the performance-based measures related to the self-report data. Interestingly, however, the patient ratings were significantly more accurate for walking, transferring, and telephoning compared to physician ratings. In addition, the patient ratings were more accurate for walking and telephoning compared to family ratings. However, the family and physician ratings were more accurate for eating and dressing compared to patient ratings. Elam concluded that overall, patient ratings compared most closely with performance-based measures, followed by the family and then the physician.

Harada et al (1999) determined the value of a performance-based test, the 6-minute walk, as an integrated measure of function in older adults. Along with the 6-minute walk test, the other assessments of function included chair stand, gait speed, body mass index, and self-reported physical functioning and basic health perceptions. The 6-minute walk test was found to be highly reliable and valid in both performance-based and self-report measures of function in older adults. Therefore, the 6-minute walk test could serve as an integrated measure of function in older adults along with both self-report and performance-based measures of function.

While some studies support the use of both self-report and performance-based measures for assessing physical function, there have been studies that do not support the use of both self-report and performance-based measures in measuring physical function. For example, Reuben et al (1995) found the relationship between self-report and performance-based measures to be inconsistent and weak suggesting that these measures are not measuring the same construct. Rockwood et al (2000) measured two performance-based tests of physical performance, the Functional Reach and the Timed Up and Go (TUG), for feasibility, reliability, and construct validity. Both performance-based measures were infeasible in many subjects. Test-retest reliability for the TUG was poor (.56 for all participants) and construct validity was substantial for both tests. In addition, correlations between self-report ADL measures and performance-based measures ranged from .40 to .70. The data from this study supports the observation that subsequent studies of measurement instruments typically reveal lower performance than the original reports. Therefore, even though performance-based measures do offer some advantages, a role does remain for self-report measures.

Hayes et al (1992) compared self-reported disability in six ADLs with the observation of functional limitations in the same six ADLs in a controlled setting. At least 89% of the time when there was a noticeable difference between self-report and observation, the subjects had ranked their disability greater than the functional limitations observed. Also, cognitively impaired subjects had discrepancies that occurred up to 11% of the time. Neurological impairments were associated with disability and functional limitations, and sociocultural factors were associated with disability only. This study concluded that functional limitations and disability in older adults are two distinct concepts and the method of measurement chosen to assess functional limitation should be determined by the type of population being studied and the research objectives.

While there exists a clear association between function and self-report ADLs, the relationship is not perfect. The study by Elam et al (1991) clearly indicates that the results of self-report measures (ADL surveys) are somewhat dependent upon the reporter. While ADLs reflect disability, performance-based measures reflect function limitation. Thus, objective performance-based measures appear to have the advantage of providing a potentially more stable measure of function, particularly when multiple sources of self/other report information are available. However, this is not meant to imply that an individual/other perception of ADL competency should not be considered in the overall treatment strategy.

2.6 Physical Function Assessment in Relation to QOL

QOL can be defined as "those attributes valued by patients, including: resultant comfort or sense of well-being; the extent to which they are able to maintain reasonable physical, emotional, and intellectual function; and the degree to which they retain their ability to participate in valued activities with the family, in the workplace, and in the community (Wenger & Furberg, 1990)." QOL is a criteria set and is evaluated by each human being. In order to evaluate QOL, an individual's personal opinion and satisfaction are very important (Armayor, 2000). Improved QOL helps to maintain personal independence and reduces the demands for acute and chronic care services (Shephard, 1993).

The effect functional decline has on social networks, life satisfaction, and depression was observed in older adults with high baseline functional capacity and statistically tested in a longitudinal study by Asakawa, Koyano, Ando, and Shibata (2000). Subjects who experienced a decline in function showed a greater decrease in the number of relatives, neighbors, and friends having frequent contacts, a larger increase in depression, and a larger decline in life satisfaction. These results confirm the importance of functional health status as a prerequisite for a better QOL in old age.

Another study by Wood, Reyes-Alvarez, Maraj, Metoyer, and Welsch (1999) examined physical and cognitive performance as related to QOL. The Nottingham Health Profile was used to assess QOL and physical function was assessed using the American Alliance for Health, Physical Education, Recreation, and Dance (AAHPERD) Functional Fitness Test for Older Adults (Osness et al, 1996). Significant relationships were found between the endurance item of the AAHPERD test and the physical mobility and pain components of QOL. Furthermore, the agility scores on the AAHPERD test were also related to the physical mobility component of QOL.

Grimby, Grimby, Frandin, and Wiklund (1992) also used the Nottingham Health Profile to assess QOL in men and women 76 years-old. For both women and men, increased physical activity corresponded to decreased problems with energy, pain, emotions, and physical mobility. In addition, increased physical activity also corresponded in men with less social isolation. Problems with sleep were also reported but were independent of physical activity.

Bauman & Arthur (1997) studied the relationship between general QOL and functional exercise capacity in nonsurgical patients with lower-extremity peripheral arterial disease (PAD). Functional capacity was assessed three times by the 6-minute walk test. The SF-36 was administered to determine QOL and revealed lower scores on the physical dimension scale and physical component summary score compared with a general population. While functional exercise capacity did correlate significantly with the physical domains of general QOL on an individual basis, improving functional physical abilities was associated with improved QOL. Therefore, the investigators concluded that the 6-minute walk test and SF-36 provide useful, objective measurements of function in the management of nonsurgical PAD.

2.7 The Influence of Physical Activity on Physical Function

The influence that physical activity has on physical function has been of increasing importance as the population of older adults increases. Even very elderly residents of old people's homes can benefit from participation in regular seated exercise and improve their functional capacity (McMurdo & Rennie, 1993). Physical activity can play a major role in the prevention of many disabling chronic diseases. Exercise can prevent illness directly by affecting normal physiological functions or indirectly by limiting a condition that increases the risk of a disabling disease (Carlson et al, 1999).

Physical activity has many beneficial physiologic effects in older adults that include effects on strength, aerobic capacity, flexibility, and bone strength that may help to maintain independence (Buchner et al, 1997). Moreover, evidence suggests that physical activity can delay or possibly reverse the age-related decline in physical function, thereby avoiding the onset of disablement and reducing the risk and/or progression of hypo-kinetic diseases. Therefore, physical activity should be promoted as having a vital role in optimizing functional life span (Carlson et al, 1999).

There are problems in evaluating the literature due to different protocols that have been employed. Therefore, it is difficult to arrive at one general consensus with one set of guidelines for physical activity. The type and intensity of exercise, the health status of the individuals participating, and the outcomes measured differ widely across studies (Chandler & Hadley, 1996). For example, investigators have employed light intensity chair exercises, vigorous cardiovascular work, moderate intensity resistance training, and various combinations of the above. Nonetheless, the attempt will be made to provide a synthesis of the relevant studies in this area.

Strength loss in older adults is well established and has been consistently linked to poor functional performance and falls (Chandler & Hadley, 1996). Several studies have suggested that muscle strength is closely associated with physical function (Bassey et al, 1992; Evans, 1995; Skelton, Young, Greig, & Malbut, 1995; Weiss, Suzuki, Bean, & Fielding, 2000; Morris, Fiatarone, & Kiely, 1999; McCool & Schneider, 1999; Brill, Probst, Greenhouse, & Schell, 1998; Krebs, Jette, & Assman, 1998; Schilke, Johnson, Housh, & O'Dell, 1996). Strength training has been shown to cause significant increases in strength and muscle size in older adults. For example, in a population of 100 nursing home residents, a high-intensity strength training program resulted in significant gains in strength and functional status (Evans, 1995).

Another study, conducted by Skelton et al (1995), determined the effect that 12 weeks of progressive resistance strength training had on isometric strength, explosive power, and selected functional abilities in healthy women over 75 years of age. Pre and post-training measurements were made for isometric elbow flexor strength, handgrip strength, leg extensor power, isometric knee extensor strength, and anthropometric indices. Functional ability tests were rising from lying on the floor, a kneel rise, a chair rise, stair climbing, functional reach, stepping up and down, lifting weights onto a shelf, and a 118 meter self-paced walk. The conclusions drawn from this study were that a progressive resistance exercise program could produce significant increases in muscle strength and power in healthy and independent older women.

Several prospective studies have looked at the effects of physical activity on physical function (Young et al, 1995; Stearns et al, 2000; Lampinen, Heikkinen, & Ruoppila, 2000; Hirvensalo, Rantanen, & Heikkinen, 2000; Wu et al, 1999; Rantanen et al, 1999; Unger, Johnson, & Marks, 1997; McMurdo & Rennie, 1993). Hirvensalo et al (2000) found that impaired but independent living older adults can prevent further disablement through the engagement in physical activity. Another study by Unger et al (1997) found that physical activity and social interaction have unique preventive influences on functional decline.

The association of physical activity with both performance-based and self-report physical functioning measured three to five years later was examined by Young et al (1995). Those subjects who were highly active at baseline were more likely to have optimal function for ADLs and physical endurance tasks three to five years later. In addition, a significant linear trend was found across physical activity levels for time to walk 10 feet and grip strength. The study found that participating in physical activity is predictive of a greater amount of physical functioning. Therefore, a moderate amount of physical activity may increase the level of independence and the QOL in older adults.

The importance of physical performance in the maintenance of independence in I-ADLs was assessed by Judge et al (1996). Gait velocity, balance function, and grip strength were independently related to I-ADL deficits. Basic measures of physical performance were significantly associated with I-ADL independence after adjusting for several previously identified predictors of functional status including gait velocity, balance function, grip strength, and chair rise time. The data from this study supports testing interventions designed to improve physical performance to be able to determine whether improved physical performance can maintain or improve independence in I-ADLs.

The objective of the study by Gill et al (1997) was to determine whether an assessment of change over time in physical performance provided useful predictive information about future ADL limitations beyond that available from a single assessment in physical function. The participants who were ADL independent at baseline and 1-year interviews were evaluated. Participants who had declined in physical performance at 1-year were more likely to become ADL dependent at three years than those who showed no change or improved in physical performance at 1-year. However, after adjusting the scores after the 1-year interviews, changes in physical performance were no longer associated with ADL dependence. In addition, among the participants who were ADL independent at baseline interview, change in physical performance at 1-year was associated with the onset of ADL dependence. Therefore, when determining risk for ADL dependence, assessment of change in physical performance over a year does not provide useful predictive information beyond what is available from a single assessment. Even so, change in physical performance is independently associated with simultaneous ADL dependence and may be helpful in predicting future disability if measured over shorter intervals.

The benefits of physical activity are also important in preventing functional decline in individuals with diseases. For instance, a reduction in strength caused by sarcopenia may be reversed with specific interventions (Ferruzzi et al, 1997). Baker et al (2001) tested the effects of a high intensity strength training program on the clinical signs and symptoms of osteoarthritis. Physical function improved by 38% in the strength training group while the control group only increased 21%. Also, when compared to the control group, the strength training group had a 44% mean improvement in self-report physical function along with improvements in physical performance, QOL, and self-efficacy. Therefore, in patients with osteoarthritis, strength training can produce substantial improvements in many areas.

On another note, West et al (1997) determined the correlation between physical performance tasks carried out at home and in a clinic setting. The tasks consisted of a semitandem stand, functional reach, stair climb and descend, inserting a plug, looking up and dialing a telephone number, and reading. Performances on standardized tasks in a clinic setting do correlate with similar tasks performed at home.

Other studies look at the relationship of physical function and different types of physical activity (Wood, Reyes-Alvarez, & Welsch, 2001; King et al, 2000; Lazowski, 1999; Teixeira-Salmela, Olney, Nadeau, & Brouwer, 1999; Mangione, McCully, Gloviak, & Lefebvre, 1999; Ettinger et al, 1997). The Stanford Center for Research in Disease Prevention compared the effects of two different physical activity programs on measured and perceived physical functioning. Subjects were randomly assigned to 12 months of community-based, moderate-intensity endurance and strengthening exercises or stretching and flexibility exercises. While the endurance and strengthening exercises were better for improving physical function, the stretching and flexibility exercises helped to improve an important QOL outcome—bodily pain. Therefore, community-based physical activity of endurance and strength exercises and stretching and flexibility exercises can be administered through different combinations resulting in improvements in important QOL and functional outcomes (King et al, 2000).

Cress et al (1999) evaluated physical activity in independent older adults for meaningful and significant improvements in physical function undetected by commonly used measures of physical function. Subjects were randomized into a non-exercise control group and a combined endurance and strength training group. Exercise sessions were three times a week for six months at 75%-80% intensity. Outcome measures included health status, physical capacity, and physical function using a newly developed performance test known as the CS-PFP. Meaningful functional benefits were gained in independent older adults from several months of exercise training. The public health importance of physical activity relates to its role in enhancing physical function along with its role in preventing functional decline (Cress et al, 1999).

Functional ability was assessed in a study by Lazowski et al (1999) using the Functional Independence Measure for two groups. Individuals were classified as low or high mobility and randomized into either the seated range of motion (ROM) program or the Functional Fitness for Long-Term Care (FFLTC) program. Baseline scores for functional ability were high within the top quintile for both FFLTC and ROM conditions. However, while the functional ability scores of those individuals in the FFLTC program were maintained over time, those individuals in the ROM program had scores that declined by 5%. Older adults at any age and/or state of health can respond positively to a challenging exercise program. Therefore, the FFLTC program had noticeable benefits in maintaining functional ability over the ROM program.

Obviously, numerous studies have assessed the importance of physical activity in maintaining optimal physical function. Table 2.1 on the following page includes some of the studies discussed previously and overviews additional studies dating back to 1995 that have focused on physical activity and physical function. The studies vary on the type of physical activity (endurance, strength, etc.) compared to physical function and other important findings.

Regardless of age, musculoskeletal and cardiovascular systems can respond to both aerobic and resistance training as measured by impairments such as strength and maximal oxygen uptake. The most impaired older adults who participate in physical activity may help prevent further decline rather than significant gains. In addition, a lower intensity exercise program may not result in as great a magnitude of improvements in function as a high intensity exercise program. However, most studies suggest that physical activity in older adults is a potential means for reducing the burden of disability and improving physical function (Chandler & Hadley, 1996).

2.8 Summary

Due to the increasing amount of research, the ability to distinguish a difference in functional ability through self-report measures and performance-based measures of older adults living both independently and dependently is becoming more recognizable. The relation of QOL to both measures of physical function is also of interest to see how closely QOL is related to physical function. Therefore, the purpose of this thesis is to

Table 2.1-Physical Activity and Physical Function

Author and Year	Citation	Study Sample	Design	Major Findings
Wood, Reyes-Alvarez, and Welsch, 2001	MSSE	42 healthy older adults (60-84 years old)	12 week clinical trial	Concurrent CV and resistance training was more effective in enhancing functional fitness than either CV or resistance training alone.
Stearns et al, 2000	Am J Pub Hlth	National Random Sample >65	4-year prospective	Leisure and Structured Physical Activity associated with reduced Medicare costs for self-care services
Weiss et al, 2000	Am J Phys Med Rehabil	Stroke Patients >60 years (n=7)	12-wk, 2x/week, 70% 1RM Resistance Tr.	Improved leg strength on both sides, improved chair stand performance, and improved static and dynamic balance.
Lampinen, Heikkenen, and Ruoppila, 2000	Prev Med	633 seniors >65 years	8-year prospective	Depressive symptoms associated w/ reduced physical activity and ADL difficulty
King et al, 2000	J Gerontol: Med Sci	103 adults (65 years and older)	12-month exercise training: Endurance & Strength, vs. Stretch & Flexibility	More improvement in endurance & strength group; however, greater improvement in QOL outcome-bodily pain- in stretch & flexibility group.
Hirvensalo, Rantanen, and Heikkenen, 2000	J Am Geriatr Soc	1109 indep.-living (65-84 years).	8-year prospective	Impaired, but ind.-living seniors can prevent further disablement through engagement in physical activity.
Lazowski et al, 1999	J Gerontol: Biol Sci Med Sci	68 residents of LTC facilities (mean age =80)	4-month Randomized Controlled Trial Strength & Mobility, vs. Seated ROM	Functional fitness improved in the Strength & Mobility group, but deteriorated in the seated ROM group.
Morris, Fiatarone, and Kiely, 1999	J Gerontol: Biol Sci Med Sci	392 residents of nursing care facilities	Quasi-experimental 10-month weight training vs. usual care	Functional status declined more slowly in the exercise groups than in usual care.
Teixeira-Salmela et al, 1999	Arch Phys Med Rehabil	13 stroke survivors	Single group pre-test and post-test design: 10-week CV & Str. Training program	Exercise associated with all of multiple measures of functional ability.
Wu, Leu, and Li, 1999	J Am Geriatr Soc	1321 community dwelling seniors	6-year prospective study	Lack of activity strongly associated with decline in functional ability, unique from, but not as strong as effect of age.

Table 2.1 continued on next page

Brill et al, 1999	Home Care Provid		Clinical trial	
Cress et al, 1999	J Gerontol Bio Sci Med Sci	49 independent living seniors (age= 76 +/- 4 years)	6-month clinical trial. CV and Strength training.	Significant improvements in VO_2max (11%) strength (33%) and performance on the CS-PFP functional ability tasks (14%).
Mangione et al, 1999	J Gerontol Bio Sci Med Sci	39 osteoarthritis patients (71 +/- 7 years)	Low intensity vs. high intensity cycle ergometer training	Improvements in functional fitness in both groups. Magnitude of improvement was the same in both groups.
McCool and Schneider, 1999	Prev Med	22 primary care patients (age 85 +/- 6 years)	12 week of 3d/week leg strength training at home w/ 5 PT visits at regular intervals	Home program resulted in significant improvements in several functional fitness items.
Rantanen et al, 1999	Arch Phys Med Rehabil	1002 disabled women >65 years	Cross-sectional survey of activity pattern vs. functional performance items	LISREL results suggest that declines in muscle strength explain the relationship between inactivity and disablement.
Brill et al, 1998	J Am Board of Fam Pract	25 older adults aged 73-94	Quasi-experimental light hand and ankle weight activities.	Hand weight and ankle weight activities resulted in improved functional performance scores (Chair stand, stair climb, 6-meter walk).
Krebs, Jette, and Assmann, 1998	Arch PhysMed Rehabil	120 older adults (75.1 years) with functional limitations	Prospective, randomized trial. 6 months x 3d/wk resistance activities	Treatment resulted in improved gait stability, in particular, mediolateral stability.
Engels, Drouin, Zhu, and Kazmierski, 1998	Gerontology	23 community dwelling seniors	10 weeks x 3d/wk for 60 min: aerobic exer. training with/without wrist weights	Exercise training resulted in significant improvements in peak oxygen uptake, lower extremity muscle strength, and psychological vigor; no differences between training with/without wrist weights
Unger, Johnson, and Marks, 1997	Ann Behav Med	7000 follow-up respondents from the NHIS	Retrospective exam of social interaction, physical activity, and widowhood	Physical activity and social interaction have unique preventive influence on functional decline and buffer the influence of widowhood on functional decline.
Ettinger et al., 1997	JAMA	365 participants (> 60 years old) of the FAST trial	18 month randomized trial: aerobic vs. resistance vs. health education program	Either resistance or aerobic activities result in improved self-report of disablement, lower pain, and greater functional performance. Treatment group comparisons revealed no differences.

Table 2.1 continued on next page

Schilke et al, 1996	Nurs Res	20 osteoarthritis patients	8 week x 3d/wk leg extension and flexion 6 sets of 5 max contractions.	Treatment resulted in decreased pain and stiffness and increased mobility.
Skelton et al., 1995	J Am Geriatr Soc	40 women (76-93 years)	12 weeks x 3 sessions per week. Resistance exercise, 3 sets, 4-8 reps.	Small improvement on two functional tests (21% improvement normal pace kneel rise time and 5% improvement in step-up height) only.
Young, Masaki, and Curb, 1995	J Am Geriatr Soc	3640 Japanese-American men > 70 years of age	Population-based, 5-year longitudinal study. Assoc of physical-activity w/ physical function	Physical activity was associated with 10-foot walk time, grip strength, and home management skills.

examine the relationships among physical function, self-reported ADL competencies, and QOL with a particular interest in the relationships between the CS-PFP 10, ADL questionnaires, and QOL. In addition, the extent to which the dependent measures differ between independent-living and assisted-living status in a Continuing Care Retirement Community will also be examined with a particular interest in the physical functional ability and ADL scores.

CHAPTER 3—METHODS

3.1 Participants

A total of 40 adults of independent-living and assisted-living status aged 65 years and older were recruited to participate in this study. Each participant was screened for disease and/or chronic conditions that are recognized as contraindications for physical activity (ACSM, 1995). Also, physician as well as participant consents for participation in the study were obtained. Specifically, patients with a history of multiple myocardial infarction, poor left ventricular function (ejection fraction <30%), survivor of sudden arrhythmic death, presence of complex and uncontrollable cardiac rhythm disturbances, unstable angina, or the presence of high grade occlusive coronary lesions (>75%) known to influence cardiac function were excluded from the study. The institutional review board of Louisiana State University approved all of the following procedures.

3.2 Assessment

Participants were assessed on two occasions separated by approximately 2 weeks. The order of the sessions was as follows: (Session I) consent forms for the participant and physician, request for medical records, medical history, tobacco history, and selected questionnaires regarding physical activity and QOL; (Session II) questionnaires regarding ADLs and the administration of the CS-PFP 10. The tests are described below and the physical activity, QOL, and ADL questionnaires as well as instructions for scoring are included in the Appendix.

3.3 Session I: Tests of Health Behavior, Physical Activity, and QOL

3.3.1 Consent Forms and Medical Records. Session I required approximately 30 minutes. Each participant was read the informed consent in its entirety before signing it and received an extra copy of the informed consent. Information was gathered about his/her physician so that the physician consent form along with the request for medical records signed by the participant could be faxed to the physician.

3.3.2 Medical and Tobacco History Summary. Each participant gave a self-report of his/her medical history (medications, surgeries, falls, etc.) and tobacco history (smoker or non-smoker, type of tobacco, number of years as a smoker, etc.)

3.3.3 Physical Activity and Functional Ability in the Elderly. The Modified Baecke Physical Activity appropriate for older individuals (Voorips, Ravelli, Dongelsmans, Deurenberrg, & vanStaveren, 1991) was used to assess chronic activity level. This questionnaire asked each participant to consider the number of hours per week spent performing various activities during the past year. The questions inquired about participation in activities ranging from household chores to leisure-time activities to more vigorous activities such as sports. From the individual's responses an arbitrary activity score was derived to compare the scores of each individual.

3.3.4 Quality of Life. The SF-36 (Kaplan & Bush, 1982) and the Nottingham Health Profile (Hunt & McKenna, 1989) have been validated for assessing QOL in adults over 65 years of age and were used for this purpose in the present study. The SF-36 derives scores for eight components: physical functioning, role physical, bodily pain, general health, vitality, social functioning, role emotional, and mental health. From the eight components, a physical composite score and a mental composite score are derived. Also, a reported health transition score is obtained from the SF-36. The Nottingham Health Profile derives scores for six components: energy, pain, sleep, emotional, social well-being, and physical mobility.

3.4 Session II: Tests of ADLs and the Reduced CS-PFP

3.4.1 Activities of Daily Living. Session II required 30 and 45 minutes. The Functional Status Index (Jette, 1980) derived from the Katz Index and the Barthel Index (Mahoney & Barthel, 1965) were used to assess self-report of "need for assistance" with bathing, dressing, toileting, transfer, continence, and feeding. The Functional Status Index assesses both basic ADLs and I-ADLs based on the level of dependency in achieving the tasks, amount of pain experienced with each activity, and the difficulty in completing the tasks. The Barthel Index assesses toileting, bathing, eating, dressing, continence, transfers, and ambulation based on whether physical assistance is required to perform the tasks or if completion of tasks is achieved independently.

3.4.2 CS-PFP 10

For the purpose of this investigation, physical functional ability is operationally defined as performance on the CS-PFP 10. While there are other tests that measure various functional abilities, the CS-PFP 10 (Cress et al, 1996), arguably represents our best effort at introducing standardized tests that attempt to objectively measure ADL competency.

3.4.2.1 Weight Carry Test. This test consists of carrying two-5 pound sandbags from one counter to another counter approximately 63 inches away. At the command, "ready, set, go," the participant carries a pan with the sandbags from one counter to the other. The participant will be timed throughout the test. The participant can make two trips if necessary by carrying only one-5 pound sandbag each trip.

3.4.2.2 Scarves Test. The participant picks up four scarves, one at a time, from the floor. The participant begins at the command, “ready, set, go,” and is timed during the test.

3.4.2.3 Jacket Test. The participant is instructed to pick up a light "windbreaker" type jacket from a table, put it on, and pull the jacket together in the front. Then the participant takes off the jacket and sets it back on the table. The participant begins at the command, “ready, set, go,” and is timed during the test.

3.4.2.4 Reach Test. During this test, the participant reaches as high as possible and places a sponge on top of a shelf that is an 8-foot high adjustable shelf mounted on the wall. The participant then removes the sponge and places his/her hands by his/her side. The participant may go up on his/her toes and can use the wall to lean on only when taking the sponge off the shelf. This test is not timed.

3.4.2.5 Floor Sweep Test. This test is a timed test that requires balance and coordination, as well as strength. The participant is asked to sweep up a half cup of kitty litter in a 4 x 3 square-foot area into a dustpan. At the command, “ready, set, go,” the participant sweeps up the kitty litter into a dustpan as quickly as possible. Any kitty litter of a significant amount left over is recorded.

3.4.2.6 Laundry 1 and 2 Test. In this timed test, the participant empties the clothes and sandbags from a top-loading washer into a side-loading dryer for the laundry 1 test. The participant unloads and loads three 2 lb sandbags, one 3 lb sandbag, and 4 lbs of dry clothes. The dryer door is opened before the test begins; however, the participant is told to shut the dryer door after transferring the sandbags and the clothes. The participant begins at the command, “ready, set, go.” Then the participant is asked to unload only the clothes from the dryer and put the clothes into a laundry basket for the laundry 2 test. The participant then is asked to place the laundry basket on top of the dryer that is 36 inches high. The participant begins at the command, "ready, set, go."

3.4.2.7 Floor Down/Up Test. This test is a timed test. The participant is asked to start in the standing position with chairs on each side for support. At the command, "ready, set, go," the participant sits down on the floor, stretches his/her legs out in front of him/her, and then stands back up and put his/her hands by his/her side. The examiner stands close to the participant for assistance to keep the participant from falling at any time.

3.4.2.8 Stair Climb Test. This test requires the participant to climb one flight of stairs; however, timing will be stopped when the participant reaches the 11th step. The steps are 12 inches in depth and 6.5 inches high. This test is timed, and the participant may use the handrail but cannot pull himself/herself up the steps.

3.4.2.9 Grocery Test. This test is a timed test in which the participant carries the amount of groceries he/she can comfortably carry 16.3 yards to the bus steps consisting of three steps with handrails. The participant then ascends the bus steps, turns around, descends the steps, and carries the bag back to the door. The participant then opens and closes the door. Next, the participant walks over to the counter, 26 yards away from the bus steps, and places the bag on the counter. The total walking distance is 42.3 yards, excluding the steps. Participants may make more than one trip, and the maximum weight allowed is 65 pounds over two trips.

3.4.2.10 Endurance Walk Test. In this test, the participant is asked to walk for six minutes. The total distance covered in the six minutes is recorded. The examiner walks with the participant for assistance if needed.

3.5 CS-PFP 10 Retesting

Five participants were chosen at random from the independent-living residents, and 5 were chosen at random from the assisted-living residents. These participants were retested on the CS-PFP 10 approximately 4 weeks following the administration of the first CS-PFP 10 test. Two investigators administered the CS-PFP 10, and did so in such a fashion as to alternate responsibilities from test to test. During the retest condition, the responsibilities of the investigators during each participant evaluation were switched so as to allow investigators to assess both the test/retest reliability of the CS-PFP 10, as well as the inter-tester reliability.

3.6 Data Reduction

The procedures for scoring the various questionnaires (Modified Baecke Physical Activity Questionnaire, Functional Status Index, Barthel Index, Nottingham Health Profile, and SF-36) can be found in the Appendix. The CS-PFP 10 data was reduced according to the algorithm provided by Dr. Elaine Cress. This algorithm provides a composite score for the CS-PFP 10 items.

3.7 Statistical Analysis

For the comparison of independent-living versus assisted-living participants, analysis of variance (ANOVA) was used to assess dwelling-status related differences in the CS-PFP 10, ADL, and QOL scores. In cases where dependent measures demonstrated a non-normal data distribution the Mann-Whitney U non-parametric test for group differences was employed.

For examining the strength of the relationships among physical function, ADLs, and QOL, the Pearson product-moment correlation was used to examine the relationships among the dependent measures, except in the cases where non-normal data was examined. In these instances the Spearman rank-order correlation was used. Alpha was set a-priori at $p<0.005$ for examining the CS-PFP 10 individual task scores with QOL, and alpha was set a-priori at $p<.05$ for examining the CS-PFP 10 composite score and ADL scores with QOL.

In addition, an examination of the influence of medication and disease was included. In order to simplify the approach to this analysis patient medical histories were examined for the number of medications taken. With respect to disease, participant medical histories were examined for the presence of a.) cardiovascular diseases; b). cancer/ immunological diseases or conditions, c.) neuro-degenerative/ emotional/ sensory diseases or conditions and d.) osteoarthritis/ orthopedic diseases or limitations. The Spearman rank-order correlation was also used for examining the associations of the numbers of medications taken and disease categories present of each participant with age, dwelling status, and CS-PFP 10, QOL, and ADL scores. Multiple regression was used to examine the CS-PFP 10 and ADL questionnaires with respect to the QOL questionnaires. Finally, for analyzing inter-tester and test/retest reliability, repeated measures ANOVA was employed to derive intraclass correlation coefficients across days (test/retest) and testers.

CHAPTER 4—RESULTS

Thirty-six of the forty participants completed all aspects of the investigation. Two participants did not obtain physician's consent, one participant was excluded on the basis of a history of chronic heart failure, and one participant was hospitalized (cellulitis) during the course of the investigation. Participant characteristics can be found in the following table (table 4.1).

Table 4.1-Participant Characteristics

Characteristic	Independent-Living	Assisted-Living
N	22	14
Age*	81.6 years-old +/- 6.0	81.0 years-old +/- 7.8
Height*	165.0 cm +/- 9.8	166.0 cm +/- 9.6
Weight*	66.8 kg +/- 14.3	65.5 kg +/- 11.2
Gender	18 females, 4 males	10 females, 4 males
Diseases*	1.6 +/- 0.9	1.7 +/- 0.8
Medications*	4.6 +/- 3.0	5.1 +/- 3.8

*Values are mean +/- standard deviation

A number of acronyms will be used throughout the results section. For ease of definition, the following table (Table 4.2) presents a number of these acronyms and their corresponding definitions.

Table 4.2-Acronyms

SF-36-RP=Role Physical	NHP-EM=Emotional
SF-36-BP=Bodily Pain	NHP-PM=Physical Mobility
SF-36-GH=General Health	NHP-P=Pain
SF-36-VT-Vitality	NHP-SO=Social Well-Being

Table 4.2 continued on next page

SF-36-SF=Social Functioning	NHP-SL=Sleep
SF-36-RE=Role Emotional	NHP-EN=Energy
SF-36-MH=Mental Health	FSI-A=Assistance
SF-36-PF=Physical Functioning	FSI-D=Difficulty
SF-36-PCS=Physical Composite Score	FSI-P=Pain
SF-36-MCS=Mental Composite Score	

4.1 Reliability of the CS-PFP 10

In order to assess the reliability of the CS-PFP 10, test/retest and inter-tester reliabilities were calculated by reassessing ten participants (5 independent-living and 5 assisted-living) within approximately one-month of the first CS-PFP 10 testing session. Two testers administered the CS-PFP 10 throughout, and with respect to reliability each tester collected one set of data on the ten participants. As the order of tester was random, repeated measures ANOVA on day 1 vs. day 2 was used to estimate test/retest reliability and repeated measures ANOVA on tester1 vs. tester 2 was used to estimate inter-tester reliability. The mean scores for the CS-PFP 10 items and composite scores for Days 1 and 2 of testing and ICCs can be found in Table 4.3. And these values according to tester are located in Table 4.4. For test/retest reliability the range of (ICC) is r = 0.91-0.99, and for inter-tester reliability the range was also r = 0.91-0.99.

Table 4.3-Test/Retest Reliability

CS-PFP 10	Day 1	Day 2	ICC
Weight Carry*	15.2 +/- 12.2	15.3 +/- 14.5	.98
Scarves*	11.0 +/- 7.0	11.5 +/- 8.1	.98

Table 4.3 continued on next page

Jacket*	21.9 +/- 5.7	19.0 +/- 5.0	.91
Reach	198.3 cm +/- 12.0	202.9 cm +/- 12.4	.95
Floor Sweep*	37.8 +/- 16.3	36.6 +/- 16.3	.99
Laundry 1*	59.3 +/- 23.0	56.6 +/- 21.3	.97
Laundry 2*	26.6 +/- 15.7	24.3 +/- 12.5	.99
Floor Down/Up*	4.7 +/- 10.1	4.5 +/- 10.0	.99
Stair Climb*	11.3 +/- 9.8	10.8 +/- 10.2	.99
Grocery*	37.9 +/- 76.3	34.6 +/- 69.1	.99
Endurance Walk	658 feet +/- 406	668 feet +/- 437	.96
Composite Score	25.5 +/- 11.4	24.2 +/- 11.2	.98

Values are mean +/- standard deviation
ICC = intraclass r
* Scores recorded in seconds

Table 4.4-Inter-Tester Reliability

CS-PFP 10	Tester 1	Tester 2	ICC
Weight Carry*	15.3 +/- 12.1	15.2 +/- 14.6	.98
Scarves*	10.9 +/- 7.0	11.5 +/- 8.1	.98
Jacket*	21.6 +/- 5.8	19.2 +/- 5.1	.91
Reach	199.0 cm +/- 12.2	202.2 cm +/- 12.5	.95
Floor Sweep*	37.4 +/- 15.8	37.0 +/- 16.8	.99
Laundry 1*	59.2 +/- 23.1	56.7 +/- 21.2	.99
Laundry 2*	26.5 +/- 15.8	24.4 +/- 12.4	.97
Floor Down/Up*	4.4 +/- 9.7	4.8 +/- 10.3	.99
Stair Climb*	11.3 +/- 9.8	10.8 +/- 10.2	.99
Grocery*	37.4 +/- 76.1	35.1 +/- 69.4	.99
Endurance Walk	662 feet +/- 411	664 feet +/- 433	.96
Composite Score	25.5 +/- 11.4	24.3+/- 11.3	.98

Values are mean +/- standard deviation
ICC = intraclass r
* Scores recorded in seconds

4.2 Dwelling Status and Age as Related to Function, ADLs, and QOL

Independent-living and assisted-living participants did not differ significantly in age (see table 4.1) and most QOL scores. The exception was the NHP-EM score, although the NHP-PM score was close (p=.052). There were several significant differences according to dwelling status in the CS-PFP 10 scores and ADL inventories. Table 4.4 shows the CS-PFP 10, ADL, and QOL mean scores according to dwelling status. Here it is important to note that the mean score for the Floor Down/Up and Grocery Test for the assisted-living are higher because fewer participants were able to do the tasks.

Table 4.5-CS-PFP 10, ADL, and QOL Scores According to Dwelling Status

Functional Tasks/ADLs	Independent-Living	Assisted-Living	**QOL Indicator**	Independent-Living	Assisted-Living
***Weight Carry**	**5.3 +/- 3.7**	**13.9 +/- 12.8**	**SF-36 PF**	69.4 +/- 23.2	58.3 +/- 22.0
Scarves	8.2 +/- 5.1	10.8 +/- 6.9	**SF-36 RP**	79.0 +/- 32.8	83.3 +/- 36.2
***Jacket**	**15.8 +/- 5.4**	**30.6 +/- 29.2**	**SF-36 BP**	71.4 +/- 24.7	78.4 +/- 22.4
***Reach**	**204.4 +/- 12.4**	**200.1 +/- 10.9**	**SF-36 GH**	76.5 +/- 15.8	75.1 +/- 20.3
Floor Sweep	38.4 +/- 11.6	45.1 +/- 13.3	**SF-36 VT**	71.0 +/- 20.6	68.0 +/- 16.9
Laundry 1	42.1 +/- 11.8	71.7 +/- 45.2	**SF-36 SF**	89.5 +/- 22.4	85.0 +/- 31.4
Laundry 2	17.5 +/- 5.1	27.6 +/- 15.4	**SF-36 RE**	94.7 +/- 15.8	88.9 +/- 27.2
***Floor D/U**	**19.5 +/- 10.9**	**17.8 +/- 3.2**	**SF-36 MH**	89.4 +/- 9.2	84.0 +/- 11.9
Stairs	9.1 +/- 4.2	13.1 +/- 7.1	**SF-36 PCS**	44.5 +/- 10.4	44.7 +/- 9.4
***Grocery**	**91.3 +/- 49.5**	**43.9 +/- 38.8**	**SF-36 MCS**	59.3 +/- 4.8	56.8 +/- 9.3
***Walk**	**1088.6 +/- 286.3**	**714.8 +/- 233.4**	**NHP-EN**	9.4 +/- 19.1	21.4 +/- 38.3
***Composite**	**42.3 +/- 15.0**	**23.7 +/- 14.4**	**NHP-P**	12.5 +/- 25.4	13.7 +/- 21.2
***FSI-D**	**21.2 +/- 4.5**	**26.8 +/- 4.3**	**NHP-SL**	14.5 +/- 22.8	21.6 +/- 27.6

Table 4.5 continued on next page

FSI-P	20.3 +/- 5.5	18.5 +/- 1.1	***NHP-EM**	**0.4 +/- 2.0**	**3.1 +/- 5.8**
***FSI-A**	**20.3 +/- 3.9**	**29.3 +/- 8.1**	**NHP-SO**	3.2 +/- 12.4	9.8 +/- 10.9
***Barthel**	**99.1 +/- 2.5**	**88.2 +/- 9.5**	**NHP-PM**	11.7 +/- 16.4	26.1 +/- 29.1

* Significant (p<.05)
Acronyms are defined in Table 4.2
Values are mean +/- standard deviation

Age was not associated with QOL or the individual tasks of the CS-PFP 10. However, there were associations for age with the CS-PFP 10 composite score, FSI-A, and FSI-D ($p \leq 0.05$). Table 4.6 shows both the p-value and Pearson product-moment correlation for these three components. These associations suggest that increased age was associated with poorer performance on the CS-PFP 10, and greater perceived difficulty (FSI-D) and need for assistance (FSI-A).

Table 4.6-Age Associations with the CS-PFP 10 Composite Score and FSI

Component	P-Value	Pearson "r"
CS-PFP 10 Composite Score	.01	-.41
FSI-A	.03	.36
FSI-D	.05	.33

Acronyms are defined in Table 4.2

4.3 Number of Diseases and Medications as Related to Function, ADLs, and QOL

The following tables (tables 4.7 and 4.8) show the Spearman correlation coefficients that were significant between diseases and medications with ADLs, function, and QOL. Alpha was set at 0.05 for the following correlations. In addition to those listed in the tables, there were several associations that were significant at the p<0.10 level. These potentially important associations include number of medications with NHP-pain, SF-36 role emotional, SF-36 physical composite score, and associations between number of diseases with FSI-assistance and Barthel scores.

Table 4.7-Significant Associations Between Number of Medications and QOL

Component	P-Value	Spearman "r"
NHP-SL	.04	.40
SF36 GH	.01	-.40

Acronyms are defined in Table 4.2

Table 4.8-Significant Associations Between Number of Diseases and QOL, ADLs, and CS-PFP 10 Composite Score

Component	P-Value	Spearman "r"
SF-36 VT	.05	-.23
SF-36 GH	.03	-.26
SF-36 BP	.04	-.22
SF-36 PF	.002	-.41
NHP-PM	.001	.63
NHP-P	.003	.60
Composite	.02	-.28
FSI-P	.03	.48
FSI-D	.01	.46

Acronyms are defined in Table 4.2

4.4 Associations Between Physical Function and QOL

The following tables show the Pearson correlation coefficients between CS-PFP 10 scores and the SF-36, and the Spearman correlation coefficients between the CS-PFP 10 scores and the NHP. When comparing the CS-PFP 10 components to QOL indicators, an alpha of 0.005 was used to correct for multiple comparisons, as the individual items of the CS-PFP 10 may represent overlapping constructs. However, when comparing the CS-PFP 10 composite score to ADL indicators, alpha was set at 0.05. The strength of many of the associations were found to be significant as indicated in tables 4.9 and 4.10.

Table 4.9-CS-PFP 10 and SF-36 Correlations

	Wgt. Carry	Scarves	Jacket	Reach	Floor Sweep	L 1	L 2	Floor D/U	Stair Climb	Grocery	Walk	Comp. Score
SF36 PF	**.54***	**-.55***	-.43	.24	.06	-.46	-.33	.09	**-.50***	-.29	**.64***	**.67****
SF36 RP	<.01	**-.57***	.08	-.07	-.16	<.01	-.13	-.12	-.29	-.42	.24	.22
SF36 BP	-.06	-.15	-.09	.05	.07	-.22	-.25	.03	-.12	-.50	.27	.24
SF36 GH	.02	-.39	-.09	-.07	.02	-.03	-.06	.18	-.28	-.17	.21	.24
SF36 VT	-.21	-.34	-.09	-.04	-.05	-.12	<.01	.09	-.47	-.14	.29	.25
SF36 SF	-.12	**-.50***	.11	-.08	-.02	.01	-.16	-.06	-.40	**-.57***	.19	.20
SF36 RE	.07	-.20	.08	-.03	-.09	.17	.03	-.04	-.32	-.55	.06	.09
SF36 MH	.07	-.27	.05	.03	.02	<.01	<.01	.32	-.38	-.37	.22	.15
SF36 PCS	-.28	**-.54***	-.24	.08	<.01	-.31	-.30	.02	-.37	-.40	.48	**.50****
SF36 MCS	.12	-.21	.20	-.10	-.06	.20	.10	.13	-.40	-.44	-.04	-.04

Values are Pearson product-moment correlation coefficients
Acronyms are defined in Table 4.2
* Significant (p<.005)
** Significant (p<.05)

Table 4.10-CS-PFP 10 and NHP Correlations

	Wgt. Carry	Scarves	Jacket	Reach	Floor Sweep	L 1	L 2	Floor D/U	Stair Climb	Grocery	Walk	Comp. Score
NHP EN	.21	.20	.13	.10	.07	.07	.23	-.04	.21	-.13	-.18	-.31
NHP P	.15	.05	**.36***	-.04	-.24	.23	.29	-.21	-.22	-.15	-.11	**-.47****
NHP SL	-.20	.09	-.10	.08	-.11	-.13	.01	-.25	-.03	-.13	-.13	-.05
NHP EM	.04	.18	.06	.21	.10	.07	.03	**-.39***	.24	**-.39***	-.12	-.14
NHP SO	-.08	.23	.18	-.05	-.03	.03	.03	-.25	.18	-.19	-.11	-.20
NHP PM	**.49***	.18	.28	-.23	-.31	**.33***	.16	-.31	-.02	-.32	-.15	**-.50****

Values are Spearman rank-order correlation coefficients
Acronyms are defined in Table 4.2
* Significant (p<.005)
** Significant (p<.05)

The strongest correlation between the CS-PFP 10 and QOL scores was the SF-36 PCS score and the scarves test; however, there was also a significant correlation between the SF-36 PCS score and CS-PFP 10 composite score. The figures on the following page (figures 4.1 and 4.2) illustrate these relationships.

4.5 Associations Between ADLs and QOL

Table 4.11 and 4.12 show the correlations of the ADL inventories with the SF-36 scores again using the Pearson product-moment correlation and NHP scores again using the Spearman rank-order correlation. Many of the correlations were found significant and are indicated in the following tables.

The strongest associations between the ADL and QOL scores were the FSI-D with SF-36 PCS score (figure 4.3) and the FSI-P with SF-36 PCS score (figure 4.4). However, the strength of the relationship between the FSI-P and the SF-36 PCS scores are strengthened by a potential point of influence. While this may be a valid data point, additional data sets will be helpful in verifying the strength of the association.

4.6 Comparison of the SF-36 and the NHP

The comparison of the SF-36 and NHP was analyzed using the Spearman rank-order correlation. Many significant associations were found between the two measures of QOL and are indicated in the following table (table 4.13). In addition to the associations listed in the table, there were many that were significant at the $p<0.10$ level, including the NHP-emotional and SF-36 role emotional, the NHP-social and the SF-36 social function, the NHP-emotional and the SF-36 mental composite score, and the NHP-physical mobility and the SF-36 role physical.

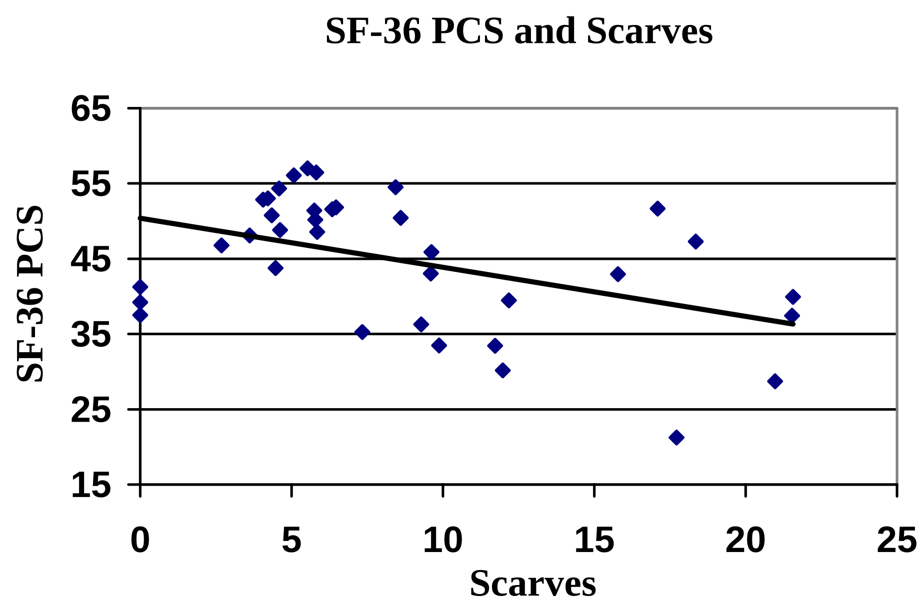

Figure 4.1-"Scarves" vs. SF-36 PCS

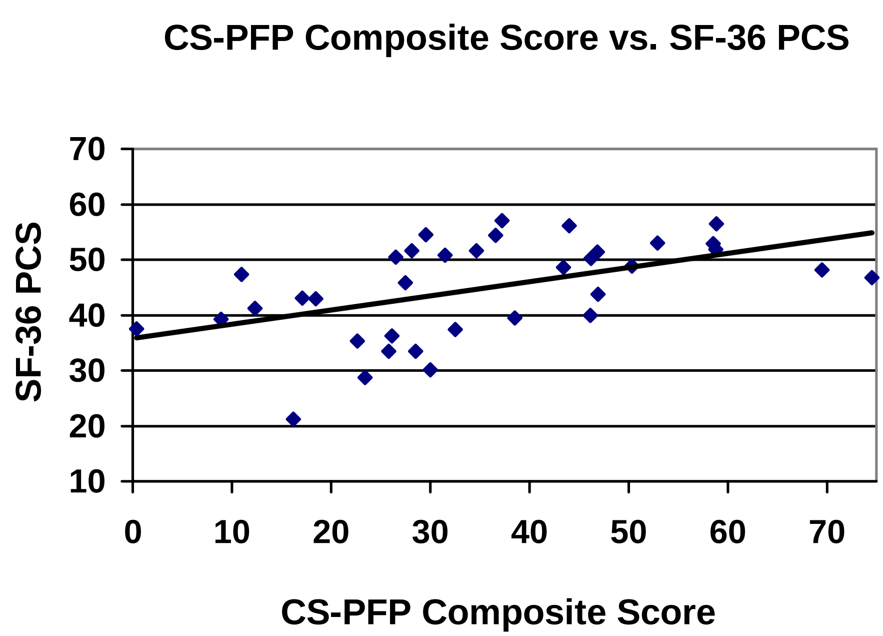

Figure 4.2-CS-PFP 10 Composite Score vs. SF-36 PCS

Table 4.11-Correlation Coefficients for ADL and SF-36 Scales

	FSI A	FSI P	FSI D	Barthel Index
SF36 PF	**-.57***	**-.47***	**-.66***	**.55***
SF36 RP	-.02	-.15	-.24	-.12
SF36 BP	.02	**-.43***	-.18	-.07
SF36 GH	-.15	-.25	**-.36***	.06
SF36 VT	-.20	-.15	-.28	.13
SF36 SF	-.13	-.21	-.30	<.01
SF36 RE	.05	**-.38***	-.14	-.03
SF36 MH	.06	**-.35***	-.16	-.09
SF36 PCS	-.33	**-.37***	**-.51***	.22
SF36 MCS	.12	-.19	-.05	-.16

Values are Pearson product-moment correlation coefficients
Acronyms are defined in Table 4.2
* Significant (p<.05)

Table 4.12-Correlation Coefficients for ADL and NHP Scales

	FSI A	FSI P	FSI D	Barthel Index
NHP EN	.26	.21	**.34***	-.21
NHP P	.18	.31	.30	-.28
NHP SL	.19	.06	.29	-.20
NHP EM	.31	-.11	.16	-.20
NHP SO	**.36***	-.29	**.41***	**-.34***
NHP PM	**.58***	**.35***	**.69***	**-.53***

Values are Spearman rank-order correlation coefficients
Acronyms are defined in Table 4.2
* Significant (p<.05)

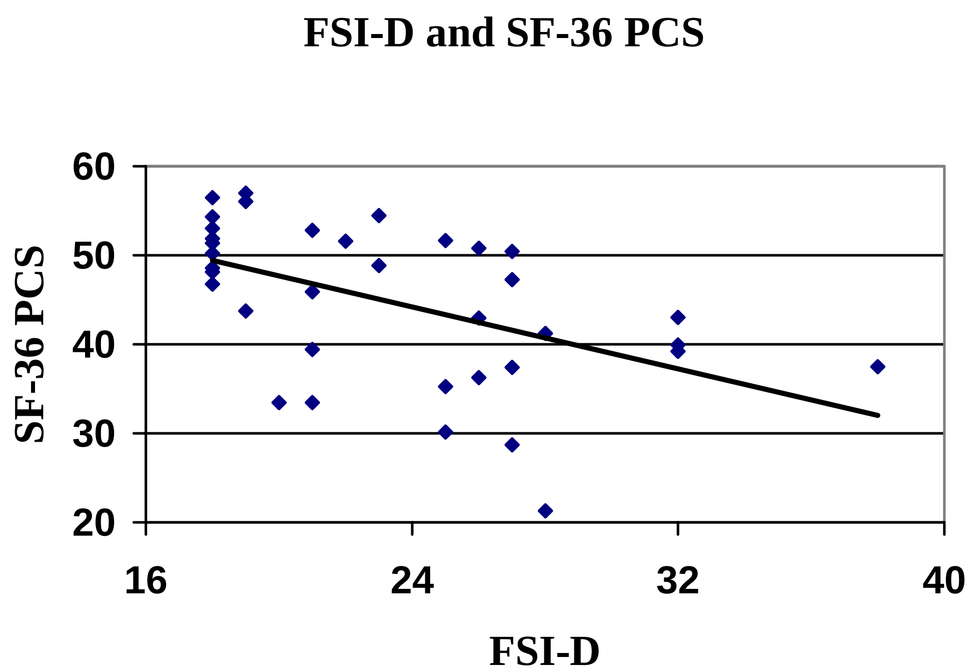

Figure 4.3-Association Between Perceived Difficulty and Physical QOL

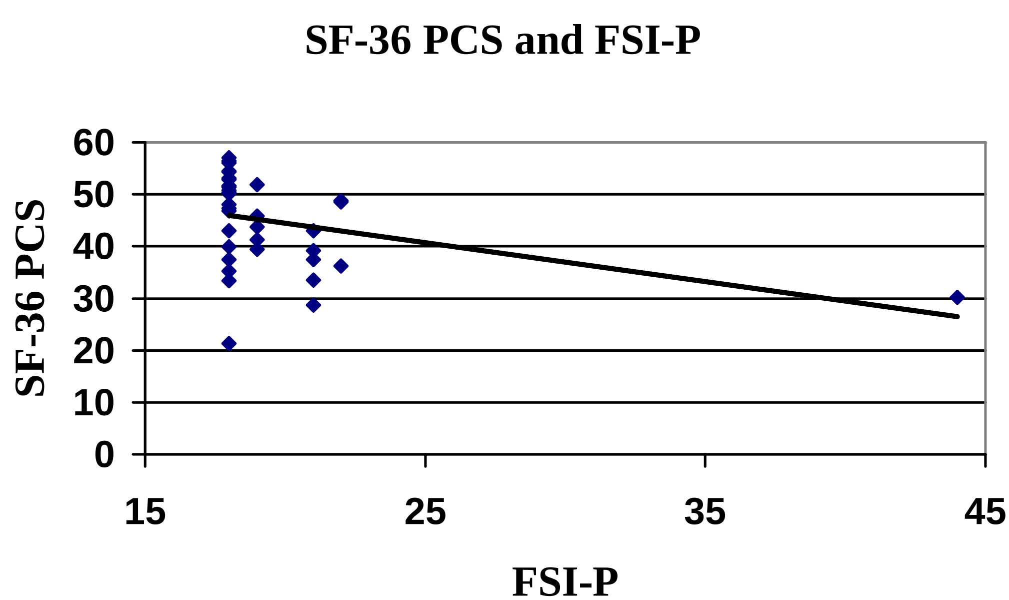

Figure 4.4-Association Between Perceived Pain and Physical QOL

Table 4.13-Comparison of the SF-36 and NHP

Components	P-Value	Spearman "r"
NHP-P and SF-36 BP	.0001	-.40
NHP-EN and SF-36 VT	.0003	-.23
NHP-SL and SF-36 GH	.003	-.37
NHP-EM and SF-36 MH	.04	.16
NHP-PM and SF-36 PF	.0001	-.48
NHP-PM and SF-36 PCS	.0009	-.42

Acronyms are defined in Table 4.2

4.7 Modeling QOL with Function and Self-Report of ADL Competency

Specific physical function scores (scarves and CS-PFP 10 composite score) and ADL scores (FSI-D, and possibly FSI-P) correlated well with the SF-36 PCS score. These items were employed in a stepwise multiple regression to model QOL as defined by the SF-36 PCS. The result indicated that the scarves and the FSI-D score provided a strong model of the SF-PCS component ($F=9.15$, $p<.008$). Including the CS-PFP 10 composite and FSI-P scores in the model added no further predictive value to the model.

CHAPTER 5—DISCUSSION

The primary purpose of this investigation was to examine relationships among physical function, self-report ADL competencies, and QOL in a population of older adults residing in a continuing care retirement community. Of particular interest here were the examination of associations between the CS-PFP 10 physical functional performance test, the Barthel and Functional Status Index ADL surveys, and QOL as defined by the SF-36 and Nottingham Health Profile scores. An additional purpose of this investigation was to examine the extent to which these functional measures (CS-PFP 10, Barthel, and FSI) differ between independent-living and assisted-living dwelling status among the continuing care retirement community residents.

In general, the observed of scores for the variables of interest appear to be as expected. The range of ADL scores for the Barthel and FSI are consistent with earlier findings (Granger et al, 1979; Jette, 1980), and suggest that the study population included participants with a wide range of ADL scores. The ADL scores on the FSI revealed a wider range of ADL competency than the Barthel for this population, perhaps indicating that the FSI is the more sensitive measure of ADL competency between the two. While there was quite a range of ADL scores, the majority of the participants tended to be fairly functional, possibly as a result of excluding participants who were at high risk for adverse responses to exercise.

Similarly, the range of QOL scores for the SF-36 and NHP were consistent with earlier studies (Cress et al, 1996; Bauman & Arthur, 1997; Grimby et al, 1992; Wood et al, 1999), and while a large range of scores was observed, the majority of the participants reported a moderate QOL. The associations between the NHP and SF-36 were also of interest to see how well the two measures of QOL correlated with each other. Similar components of each measure did correlate well with each other. Thus, both these instruments appear to assess QOL in this population even though the questions and components may vary somewhat.

With respect to physical function, the CS-PFP 10 data appear similar to the data published by Dr. Elaine Cress and colleagues during the 1990s (1996; 1999). The majority of the individual task scores as well as composite scores for the CS-PFP 10 were within the range of expected values (Cress et al, 1996; Cress et al, 1999). However, there were a few test scores that were slightly outside the published ranges (Cress et al., 1996; Cress et al., 1999). These test items included the “weight carry”, “scarves”, “jacket”, “grocery”, and “endurance walk”. In each case, data from the present investigation included performances that were both slightly better and slightly worse than the published ranges. Therefore, one could surmise that the present study sample represents a slightly wider array of functional ability than that of Cress et al (1996; 1999). It should also be mentioned that several participants (n=15), both independent-living and assisted-living, were able to perform all of the CS-PFP 10 tasks while others (n=21) were not. The test that was not performed by many of the participants (n=17), regardless of dwelling status, was the floor down/up test. Many of the participants feared that once they sat down on the floor, they would not be able to get back up by themselves to complete the task. In addition, the grocery test was not performed by most of the assisted-living participants (12 out of 14) due to the weight of the grocery bags and the difficulty of the task. Nonetheless, non-completion of an item is not problematic as “zero” scores are valid and not unexpected (Cress et al, 1996). Despite the slightly wider range of values and the non-completion of test items, the data generally fit well with Cress et al (1996; 1999).

Earlier reports of the full CS-PFP (Cress et al, 1996) indicate that the full model provides excellent test/retest and inter-tester reliability. Reliability data on the modified version, i.e. the CS-PFP 10, however, were not available at the time of this investigation. Therefore, the present investigation also sought to examine the reliability of the CS-PFP 10 on a subset of the study sample (n=10). Similar to the results reported by Elaine Cress (Cress et al, 1996) for the full CS-PFP, the present investigation revealed very high test/retest reliability (ICC in the range of r= 0.91- 0.99), as well as very high inter-tester reliability (ICC in the range of r= 0.91- 0.99). In the case of several of the heavy effort test items, the intraclass reliability coefficients are somewhat amplified by the occasional presence of non-completion or "zero" scores. Non-completion of the same item on both testing days clearly strengthens the correlation coefficients. This was particularly the case with the "floor down/up" task, where 7 out of the 10 test/retest participants were unable to perform the task.

Nonetheless, the high reliability of the CS-PFP 10 suggests that the test offers investigators a reasonable option for measuring function across time, as in the case of intervention studies such as exercise training studies (Cress et al, 1999) where functional improvements among older adults are an important health outcome. Moreover, this evidence is helpful in establishing the overall validity of the test as an appropriate assessment of physical functional ability.

Much of the reason for developing valid tests of physical function for older adults has come from the notion that physical function deteriorates with age. There exists an abundance of cross-sectional, as well as a handful of longitudinal studies that have reported age-related decrements in physical function (Young et al, 1995; Guralnik et al, 1993; Wu et al, 1999). For example, one study found that a lower level of physical function was associated with older ages for performance-based variables (Young et al, 1995). The results of the present study are consistent with this notion inasmuch as chronological age was inversely associated with the CS-PFP 10 composite score (Figure 5.1), indicating that the older the participant, the poorer the overall performance. Interestingly, however, age was not associated with the individual tasks of the CS-PFP 10. Therefore, one can hypothesize that a combination of several functional tasks may be necessary to detect age-related changes in function.

Age was also related to the FSI-A and the FSI-D scores in such a fashion to suggest that assistance or difficulty with ADLs increases with age. This is consistent with the literature in this area (Wu et al, 1999; Jagger et al, 2001). For example, Jagger et al (2001) found that the risk of ADL disability rose significantly with age. Furthermore, in comparison with the youngest group of participants (75-79 years-old), those 80-84 years-old were at least 1.5 times as likely to become ADL disabled while the oldest group of participants (85 years and older) were at least two times as likely to become ADL disabled (Jagger et al, 2001).

While age was associated with function as measured by functional fitness tasks as well as by self-report of ADL competencies, it is interesting that there was no clear age association with QOL. The implication of such a finding is that while age may influence function, QOL being a rather complex issue is not necessarily influenced by age itself. Rather, there are factors known to change with age, such as disease morbidity, physical

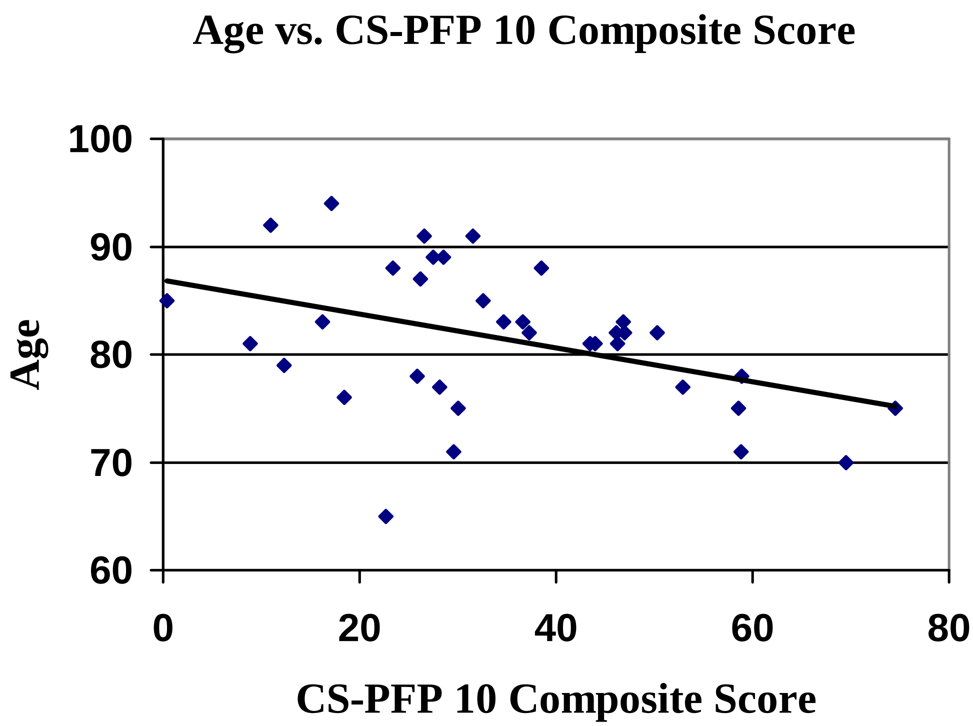

Figure 5.1-Age vs. CS-PFP 10 Composite Score

function and cognitive function that along with associated attitudes and personal choices may be more specific to an individual's reported QOL.

Similar to age, were the results with respect to dwelling status. That is, dwelling status (independent vs. assisted) was associated with differences in functionality, but with respect to QOL, only the NHP "emotional" component differed between the two groups. While a weak association between dwelling status and QOL was found in this study, Cress et al (1996) found a fairly strong association between dwelling status and QOL. The present study had many overlapping CS-PFP 10 composite scores between those participants of independent-living and assisted-living status; therefore, the CS-PFP 10 composite scores of the independent-living participants in this study was similar to the long-term care residents rather than the community-dwellers in the study by Cress et al (1996), thus affecting the associations of dwelling status with QOL.

In contrast, ADL scores and CS-PFP 10 scores were different between the independent-living and assisted-living participants. As expected the results of the ADL inventories and the CS-PFP 10 suggest that the independent-living residents had a higher degree of functionality than the assisted-living residents. The mean CS-PFP 10 composite scores were different between the two groups (ind.=42.3 & asst.=23.7). This finding is perfectly consistent with Cress et al (1999) who reported mean scores for independent-living and assisted-living of 42.3 and 23.6 respectively. Taken together, the absence of age differences between dwelling status groups, but appearance of clear differences in functional fitness imply that physical function is a more important determinant of living status than age (Cress et al, 1996; Cress et al, 1999).

While the CS-PFP 10 composite scores were different between independent-living and assisted-living residents, the performances of many of the individual tasks were not different between the groups. This may be an indication that a combination of several functional tasks may be necessary to truly distinguish the level of needs of older adults. Specific individual tasks may not be difficult for assisted-living participants and not distinguish well between the groups; however, an in-depth measure of overall physical function of several tasks may be more useful for characterizing the level of need for assistance.

With respect to predicting need for assisted care, the CS-PFP 10 composite score was compared against the probability of receiving assisted care (Figure 5.2). Below a composite score of about 40 on the CS-PFP 10, there seems to be some indication of a greater risk for assisted care needs. The finding that a potential threshold exists around a CS-PFP 10 composite score of about 40 is consistent with what Cress has found in studying participants of various dwelling status (Cress et al, 1996).

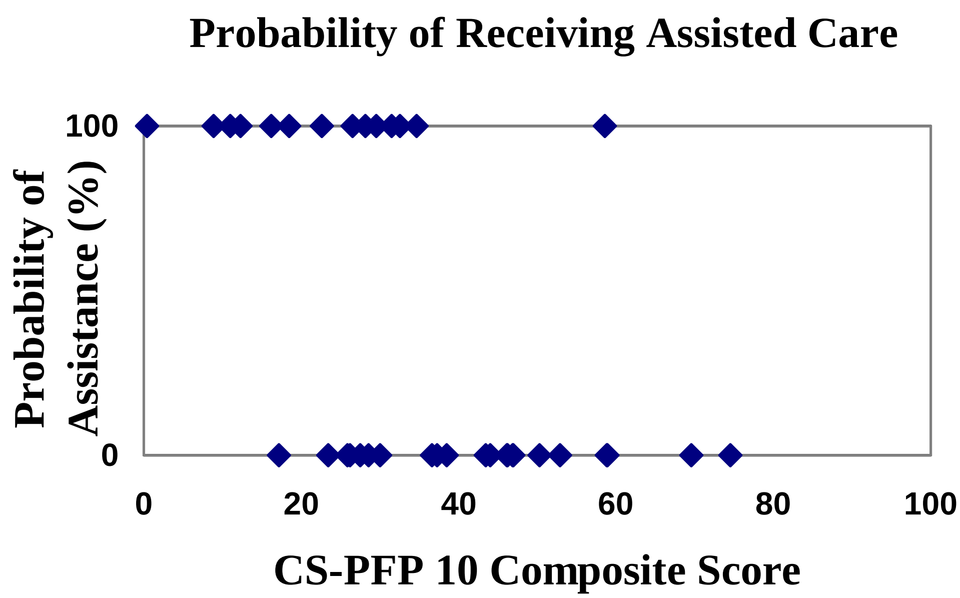

Figure 5.2-Probability of Receiving Assisted Care

In addition to the possibility of age and dwelling status affecting function, ADLs, and QOL, the number of diseases and medications of individuals may also influence function, ADLs, and QOL. Diseases of the participants were categorized into four groups: a.) cardiovascular diseases; b). cancer/ immunological diseases or conditions, c.) neuro-degenerative/ emotional/ sensory diseases or conditions and d.) osteoarthritis/ orthopedic diseases or limitations. While there was a clear association between the number of diseases and medications ($p<.04$), neither variable had a significant association with age. In addition, there were no significant associations between the number of diseases and medications with dwelling status.

In contrast to the findings of no associations between the number of diseases and medications with age or dwelling status, many significant associations were found between the number of medications with QOL, and the number of diseases with function, QOL, and ADLs. The relationship of disease and QOL identified in this study is consistent with others (Bauman & Arthur, 1997), as is the inverse association between presence of disease and function (Feldman et al, 2001; Bassey et al, 1992; Ferruzzi et al, 1997).

The primary purpose of this investigation was to model QOL using physical functional performance scores and self-reported ADL competency surveys. It has been suggested that both objective and subjective scales may provide a unique contribution to describing function as it relates to QOL. Indeed the results of the present investigation support such an hypothesis.

The CS-PFP 10 composite score, as well as some of the individual tasks, were associated with a number of QOL indicators. As indicated previously in tables 4.6 and 4.7, there were specific relationships with the SF-36 physical function, role physical, social functioning, and physical composite scores and the NHP pain, emotion, and physical mobility scores. Cress et al (1996) also found significant relationships between the CS-PFP and the SF-36. Particularly impressive was the relationship between the performance of the scarves test from the CS-PFP 10 and the PCS score of the SF-36. The NHP-PM surprisingly was not associated with the scarves test. However, results of non-parametric correlation tests are influenced tremendously by potential outliers. Identification of one subject that appeared to be an outlier subsequently revealed a significant relationship between the NHP-PM and scarves test scores ($r=.47$, $p=.02$).

Moreover the SF-36 may be a more sensitive test of perceived physical QOL inasmuch as this instrument affords the participant the opportunity to respond according to a Likert scale fashion, whereas the NHP asks for a "yes" or "no" response.

In general, the finding of an association between physical function and QOL is not new. In fact, previous work in the laboratory at Louisiana State University (Wood et al, 1999) supports the existence of significant relationships between both the self-report (NHP physical mobility and pain components) and performance-based measures (AAHPERD test endurance and agility scores) of physical function and QOL.

While the association between function and QOL has been established, an understanding of the specific components of functional fitness and QOL has been somewhat more elusive. However, the data from the present investigation may provide some clues as to fitness concepts that may explain this association. In particular, the strong association between the scarves test and QOL may be an indication that low-back strength is of particular importance in QOL issues. According to Cress et al (1996), the scarves test loads heavily for low-back strength and hip flexibility. Such an hypothesis is consistent with two previous reports linking low-back strength and QOL (Deyo et al, 1994; Bouter, van Tulder, & Koes, 1998). These authors found that the treatment of low-back pain can improve certain health outcomes including QOL.

In addition to the associations between CS-PFP 10 scores and QOL, there were strong associations between all of the subjective self-report of ADL scores (Barthel, FSI-A, FSI-D, & FSI-P) with QOL scores. In particular, ADLs were associated with the SF-36 physical function, bodily pain, general health, role emotional, mental health, and physical composite scores and the NHP energy, social, and physical mobility scores (see tables 4.8 and 4.9). The relationship of QOL with the FSI-D was particularly impressive and consistent with other studies. This relationship is such that greater perceived difficulty of ADLs is associated with poorer QOL (Kemp, 1999). This finding implies that perception of functionality plays an important role into whether an individual has a positive or negative QOL.

One of the premises of incorporating both objective (CS-PFP 10) and subjective (ADL) measures of function is the notion that both types of measures provide unique information relative to an older adult's QOL. The results of the present investigation support such an hypothesis inasmuch as when the scarves test, the composite CS-PFP 10, FSI-P, and FSI-D scores were included in a stepwise multiple regression, the scarves test and FSI-D score provided the strongest model of the SF-36 PCS score. Such a finding suggests that low-back strength and perceived difficulty in performing tasks are two specific issues that explain a considerable degree of variation in QOL scores.

A small handful of other studies have also found that the combination of both performance-based and self-report measures is needed to accurately assess function, ADLs, and QOL (Cress et al, 1995; Kivinen et al, 1998; Elam et al, 1991; Harada et al, 1999; Rockwood et al, 2000). Performance-based measures help control for errors in judgment and/or memory, and the ability and willingness to answer questions correctly (Rockwood et al, 2000). While self-report measures may provide greater insight not so much to function, but need for assistance, difficulty, and pain with certain tasks. Therefore, both self-report and performance-based measures are needed to accurately assess function in individuals.

It should be reasserted that the external validity of the present investigation is limited in accordance with several important factors. First, all the participants came from a Continuing Care Retirement Community where many services are offered that the average community-dwelling, independent-living older adult may not have access to on a daily basis. In addition, all the participants are Caucasian, affluent older adults that are well-educated. The majority of the participants that were tested were female. Also, the participants did not have cardiac symptoms and were not at risk for any adverse responses during exercise. Finally, this study included a small number of subjects limiting the significance of the various associations.

In summary, there are several conclusions that can be drawn from this investigation. First, because the CS-PFP 10 reliably assesses a broad range of functional tasks essential for living independently, it may prove to be an excellent tool for recording improvements or declines in function over time with the combination of self-report measures. Second, functional measures appear to be closely related to dwelling status, disease morbidity, number of medications, and QOL, while age itself is not. The implication here being that while advancing age may predispose individuals to functional limitations, its influence on need for assistance, disease, number of medications, and QOL is not direct. And, lastly, the primary finding from this study was that the scarves test from the CS-PFP 10 and the FSI-D score were the best predictors of QOL as defined by the SF-36 PCS score, suggesting that objective and subjective measures of function provide unique information about QOL in older adults, a very important health outcome.

Future studies should look at structural linear equation modeling and path analysis to more specifically conclude that age mitigates an influence on QOL only through age-related changes in function that appear to be modifiable. In addition, exercise training interventions for older adults should include low-back and hip strength and flexibility activities, and should be examined for their potential to enhance functionality as defined by the CS-PFP 10 and other subjective measures of function.

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APPENDIX A

Modified Baecke Physical Activity Questionnaire
(Courtesy of Voorips et al, 1991)

INSTRUCTIONS: Indicate your response to each of the following questions by circling the number next to the answers provided.

HOUSEHOLD ACTIVITIES

1. Do you do the light household work? (dusting, washing dishes, repair clothes, etc.)
    0. Never (less than once a month)
    1. Sometimes (only when partner or help is not available)
    2. Mostly (sometimes assisted by partner or help)
    3. Always (alone or together with partner)

2. Do you do the heavy housework? (washing floors and windows, carrying trash disposal bags, etc.)
    0. Never (less than once a month)
    1. Sometimes (only when partner or help is not available)
    2. Mostly (sometime assisted by partner or help)
    3. Always (alone or together with partner)

3. For how many persons do you keep house? (including yourself; fill in "0" if you answered "never" in Q1 and Q2) _____

4. How many rooms do you keep clean? (including kitchen, bedroom, garage, bathroom, ceiling, etc.; fill in "0" if you answered "never" in Q1 and Q2)

5. If any rooms, on how many floors? (fill in "0" if you answered "never" in Q1) _____

6. Do you prepare warm meals yourself, or do you assist in preparing?
    0. Never
    1. Sometimes (once or twice a week)
    2. Mostly (3-5 times a week)
    3. Always (more than 5 times a week)

7. How many flights of stairs do you walk up per day? (one flight of stairs is 10 steps)
    0. I never walk stairs
    1. 1-5
    2. 6-10
    3. More than 10

8. If you go somewhere in your hometown, what kind of transportation do you use?
    0. I never go out
    1. Car
    2. Public transportation

3. Bicycle
4. Walking

9. How often do you go out for shopping?
   0. Never or less than once a week
   1. Once a week
   2. Twice to four times a week
   3. Every day

10. If you go out for shopping, what kind of transportation do you use?
   0. I never go out for shopping
   1. Car
   2. Public transportation
   3. Bicycle
   4. Walking

INSTRUCTIONS: Using the appendix provided, fill in the appropriate code next to the items provided.

SPORT ACTIVITIES--Do you play a sport?

Sport 1: Name_______________________
Intensity (code)_______________
Hours per week (code)________
Period of the year (code)_______

Sport 2: Name_______________________
Intensity (code)_______________
Hours per week (code)________
Period of the year (code)_______

LEISURE TIME ACTIVITIES--Do you have other physically active activities?

Activity 1: Name_______________________
Intensity (code)_______________
Hours per week (code)________
Period of the year (code)_______

Activity 2: Name_______________________
Intensity (code)_______________
Hours per week (code)________
Period of the year (code)_______

Activity 3: Name_______________________
Intensity (code)_______________
Hours per week (code)________
Period of the year (code)_______

Activity 4: Name_______________________
Intensity (code)_______________
Hours per week (code)________
Period of the year (code)_______

Intensity Code

0. Lying, Unloaded	Code 0.028
1. Sitting, Unloaded	Code 0.146
2. Sitting, Movements hand/arm	Code 0.297
3. Sitting, Body movements	Code 0.703
4. Standing, Unloaded	Code 0.174
5. Standing, Movements hand/arm	Code 0.307
6. Standing, Body movements, Walking	Code 0.890
7. Walking, Movements hand/arm	Code 1.368
8. Walking, Body movements, Cycling, Swimming	Code 1.890

Hours Per Week

1. less than 1 hr/wk	Code 0.5
2. 1,2>hr/wk	Code 1.5
3. 2,3>hr/wk	Code 2.5
4. 3,4>hr/wk	Code 3.5
5. 4,5>hr/wk	Code 4.5
6. 5,6>hr/wk	Code 5.5
7. 6,7>hr/wk	Code 6.5
8. 7,8>hr/wk	Code 7.5
9. more than 8 hr/wk	Code 8.5

Months A Year

1. less than 1 month/yr	Code 0.04
2. 1-3 months	Code 0.17
3. 4-6 months	Code 0.42
4. 7-9 months	Code 0.67
5. more than 9 months/yr	Code 0.92

Functional Status Index
(Courtesy of Jette, 1980)

Activity	Assistance(1-5)	Pain(1-4)	Difficulty(1-4)
Mobility			
Walking inside			
Climbing up stairs			
Rising from a chair			
Personal care			
Putting on pants			
Buttoning a shirt/blouse			
Washing all parts of the body			
Putting on a shirt/blouse			
Home chores			
Vacuuming a rug			
Reaching into low cupboards			
Doing laundry			
Doing yardwork			
Hand activities			
Writing			
Opening a container			
Dialing a phone			
Social activities			
Performing your job			
Driving a car			
Attending meetings/appointments			
Visiting with friend/relatives			

Barthel Index
(Courtesy of Mahoney & Barthel, 1965)

FEEDING
10=Independent. Able to apply any necessary device.
Feeds in reasonable time.
5=Needs help (e.g. for cutting).

BATHING
5=Independent

PERSONAL TOILET
5=Independently washes face, combs hair, brushes teeth,
shaves (manages plug if electric).

DRESSING
10=Independent. Ties shoes, fastens fasteners, applies braces.
5=Needs help, but does at least half of work in reasonable time.

BOWELS

10=No accidents. Able to use enema or suppository, if needed.
5=Occasional accidents or needs help with enema or suppository.

BLADDER
10=No accidents. Able to care for collecting device if used.
5=Occasional accidents or needs help with device.

TOILET TRANSFERS
10=Independent with toilet or bedpan. Handles clothes, wipes,
flushes, or cleans pan.
5=Needs help for balance, handling clothes, or toilet paper.

TRANSFERS—CHAIR AND BED
15=Independent, including locks wheelchair, lifts footrests.
10=Minimum assistance or supervision.
5=Able to sit, but needs maximum assistance to transfer.

AMBULATION
15=Independent for 50 yards. May use assistive devices, except for rolling walker.
10=With help 50 yards.
5=Independent with wheelchair for 50 yards if unable to walk.

STAIR CLIMBING
10=Independent. May use assistive devices.
5=Needs help or supervision.

Nottingham Health Profile
(Courtesy of Hunt & McKenna, 1989)

Listed below are some problems that you may have in your daily life. Look down the list and write YES for any problem you have at the present time. For any problem you do not have, write NO. Please answer every question. If you are not sure whether to say YES or NO to a problem, write whichever answer you think is MORE true at the present time.

1. I am tired all the time
2. I have pain at night
3. I take pills to help me sleep
4. Things are getting me down
5. I find it painful to change position
6. I am feeling on edge
7. I feel lonely
8. I can walk about only indoors
9. I have unbearable pain
10. I find it hard to bend
11. Everything is an effort
12. I am unable to walk at all
13. I am waking up in the early hours of the morning
14. I have forgotten what it is like to enjoy myself
15. I am finding it hard to make contact with people
16. I am in pain when I walk
17. The days seem to drag
18. I have trouble getting up and down stairs

19. I find it hard to reach for things
20. I lose my temper easily these days
21. I lie awake for most of the night
22. I feel as if I am losing control
23. I am in pain when I am standing
24. I feel there is nobody I am close to
25. I find it hard to get dressed by myself
26. I soon run out of energy
27. I find it hard to stand for long
28. I am in constant pain
29. It takes me a long time to get to sleep
30. I feel I am a burden to people
31. Worry is keeping me awake at night
32. I feel that life is not worth living
33. I sleep badly at night
34. I need help to walk about outside
35. I am in pain when walking up and down stairs
36. I wake up feeling depressed
37. I am finding it hard to get along with people
38. I am in pain when I am sitting

Now please got back and make sure you have answered YES or NO to every question.
Thank You!

The SF-36 Health Survey
(Courtesy of Kaplan & Bush, 1982)

Instructions for completing the questionnaire: Please answer every question. Some questions may look like others, but each one is different. Please take the time to read and answer each question carefully by checking next to the answer that best represents your response.

1. In general, would you say your health is:

    Excellent
    Very good
    Good
    Fair
    Poor

2. Compare to one year ago, how you would you rate your health in general now?

    Much better now than one year ago
    Somewhat better now than one year ago
    About the same as one year ago
    Somewhat worse now than one year ago
    Much worse now than one year ago

3. The following items are about activities you might do during a typical day. Does your health now limit you in these activities? If so, how much?

	Yes, Limited a lot	Yes, Limited a little	No, Not limited
a. Vigorous Activities: such as running, lifting heavy objects, participating in strenuous sports			
b. Moderate Activities: such as moving a Table, pushing a vacuum cleaner, bowling, or playing golf			
c. Lifting or carrying groceries			
d. Climbing several flights of stairs			
e. Climbing one flight of stairs			
f. Bending, kneeling, or stooping,			
g. Walking more than a mile			
h. Walking several blocks			
i. Walking one block			
j. Bathing or dressing yourself			

4. During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of your physical health?

	Yes	No
a. Cut down on the amount of time you spent on work or other activities		
b. Accomplished less than you would like		
c. Were limited in the kind of work or other activities		
d. Had difficulty performing the work or other activities (for example, it took extra time)		

5. During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of any emotional problems (such as feeling depressed or anxious)?

	Yes	No
a. Cut down on the amount of time you spent on work or other activities		
b. Accomplished less than you would like		
c. Didn't do work or other activities as carefully as usual		

6. During the past 4 weeks, to what extent has your physical health or emotional problems interfered with your normal social activities with family, friends, neighbors, or groups?

Not at all
Slightly
Moderately
Quite a bit
Extremely

7. How much bodily pain have you had during the past 4 weeks?

None
Very mild
Mild
Moderate
Severe
Very severe

8. During the past 4 weeks, how much did pain interfere with your normal work (including both work outside the home and housework)?

Not at all
A little bit
Moderately
Quite a bit
Extremely

9. These questions are about how you feel and how things have been with you during the past 4 weeks. For each question, please give the one answer that comes closest to the way you have been feeling. How much of the time during the past 4 weeks….

	All of the time	Most of the time	A good bit of the time	Some of the time	A little of the time	None of the time
a. did you feel full of pep?						
b. Have you been a very nervous person						
c. have you felt so down in the dumps nothing could cheer you up?						
d. have you felt calm and peaceful?						
e. did you have a lot of energy?						
f. Have you felt downhearted and blue?						
g. did you feel worn out?						
h. have you been a happy person?						
i. did you feel tired?						

10. During the past 4 weeks, how much of the time has your physical health or emotional problems interfered with your social activities (like visiting friends, relatives, etc.)?

All of the time
Most of the time
Some of the time
A little of the time
None of the time

11. How TRUE or FALSE is each of the following statements for you?

	Definitely True	Mostly True	Don't Know	Mostly False	Definitely False
a. I seem to get sick a little easier than other people					
b. I am as healthy as anybody I know					
c. I expect my health to get worse					
d. My health is excellent					

APPENDIX B

Scoring The Modified Baecke Physical Activity Questionnaire

There are 10 questions dealing with household activities and point values vary by the answer to each question. Add the points for all 10 questions together and divide by 10. This will give you an average score for the household activities. The scores on this section have no specific meaning. They are just useful to compare a group of individuals based on their set of scores in the area of household activities.

Next, there is a section where you fill out intensity, frequency, and duration of activity in the areas of sport and leisure time activities. Each intensity, frequency, and duration has a certain code to give them a point value. For each activity section and each individual activity, multiply intensity x frequency x duration.

Add all activities in each section together to derive a score for sport and leisure time activities. Once again, the scores on these two sections have no specific meaning. They are just useful to compare a group of individuals based on their set of scores in the areas of sport and leisure time activities.

Scoring The Functional Status Index

The Functional Status Index assesses both basic ADLs and I-ADLs based on the level of dependency in achieving the tasks, amount of pain experienced with each activity, and the difficulty in completing the tasks. Therefore, the lower score, the more independence in I-ADLs and ADLs. Assistance scores are as follows: 1=independent, 2=uses devices, 3=uses human assistance, 4=uses devices and human assistance, and 5=unable or unsafe to do the activity. Pain scores are as follows: 1=no pain, 2=mild pain, 3=moderate pain, and 4=severe pain. Difficulty scores are as follows: 1=no difficulty, 2=mild difficulty, 3=moderate difficulty, and 4=severe difficulty.

Scoring The Barthel Index

The Barthel Index assesses feeding, toileting, bathing, dressing, continence, transfers, and ambulation based on whether physical assistance is required to perform the tasks or if completion of tasks is achieved independently. The total score can be as high as 100 for totally independent individuals. Therefore, a higher score represents greater independence in ADLs.

Scoring The Nottingham Health Profile

There are 38 questions and each question has an individual component. The 6 components are the following: EN=energy, P=pain, SL=sleep, EM=emotional, SO=social well-being, PM=physical mobility. Each component is worth 100 points. So, a total of 600 points is possible on the health profile. The lower the score in each component, the better the QOL; therefore, the higher the score in each component, the poorer the QOL. If an individual answers "yes" to a question, they receive the allotted points for that question; however, if an individual answers "no" to a question, they receive a score of zero for that question.

Question #	Weight	Code	Question #	Weight	Code
1	39.20	EN1	20	9.76	EM5
2	12.91	P1	21	27.26	SL3
3	22.37	SL1	22	13.99	EM6
4	10.47	EM1	23	8.96	P5
5	9.99	P3	24	20.13	SO3
6	7.22	EM3	25	12.61	PM6
7	22.01	SO1	26	24.00	EN3
8	11.54	PM1	27	11.20	PM7
9	19.74	P2	28	20.86	P6
10	10.57	PM2	29	16.10	SL4
11	36.80	EN2	30	22.53	SO4
12	21.30	PM3	31	13.95	EM7
13	12.57	SL2	32	16.21	EM8
14	9.31	EM2	33	21.70	SL5
15	19.36	SO2	34	12.69	PM8
16	11.22	P4	35	5.83	P7
17	7.08	EM4	36	12.01	EM9
18	10.79	PM4	37	15.97	SO5
19	9.30	PM5	38	10.49	P8

Scoring The SF-36 Health Survey

There are 11 questions with several answers to choose from on each question. There are different components for each question as follows: 3-physical functioning, 4-role physical, 7&8-bodily pain, 1&11-general health, 9 (aegi)-vitality, 6&10-social functioning, 5-role emotional, 9(bcdfh)-mental health, 2-reported health transition. Each question and letter has a precoded item value (PIV) and final item value (FIV). The FIV is used for calculating scores within each component. The lower the score in each component, the poorer the QOL; therefore, the higher the score in each component, the better the QOL. The FIV scores for each component are recorded on a spreadsheet (not included) that calculates scores for each component along with a physical component score (PCS) and mental component score (MCS).

	PIV	FIV
Question 1 (GH)		
Excellent	1	5.0
Very good	2	4.4
Good	3	3.4
Fair	4	2.0
Poor	5	1.0
Question 2 (HT)		
Much better	1	1
Somewhat better	2	2
About the same	3	3
Somewhat worse	4	4
Much worse	5	5
Questions 3a-3j (PF)		
Yes, limited a lot	1	1
Yes, limited a little	2	2
No, not limited at all	3	3
Questions 4a-4d (RP)		
Yes	1	1
No	2	2

Questions 5a-5c (RE)			
Yes	1		1
No	2		2
Question 6 (SF)			
Not at all	1		5
Slightly	2		4
Moderately	3		3
Quite a bit	4		2
Extremely	5		1
Question 7 (BP)			
None	1		6.0
Very mild	2		5.4
Mild	3		4.2
Moderate	4		3.1
Severe	5		2.2
Very severe	6		1.0
Question 8 (BP)	If #8 PIV &	#7 PIV	FIV
Not at all	1	1	6
Not at all	1	2-6	5
A little bit	2	1-6	4
Moderately	3	1-6	3
Quite a bit	4	1-6	2
Extremely	5	1-6	1
Questions 9a & 9e (VT)			
All of the time	1		6
Most of the time	2		5
A good bit of the time	3		4
Some of the time	4		3
A little of the time	5		2
None of the time	6		1
Questions 9g & 9i (VT)			
All of the time	1		1
Most of the time	2		2
A good bit of the time	3		3
Some of the time	4		4
A little of the time	5		5
None of the time	6		6

Questions 9b, 9c, & 9f (MH)		
All of the time	1	1
Most of the time	2	2
A good bit of the time	3	3
Some of the time	4	4
A little of the time	5	5
None of the time	6	6
Questions 9d & 9h (MH)		
All of the time	1	6
Most of the time	2	5
A good bit of the time	3	4
Some of the time	4	3
A little of the time	5	2
None of the time	6	1
Question 10 (SF)		
All of the time	1	1
Most of the time	2	2
Some of the time	3	3
A little of the time	4	4
None of the time	5	5
Questions 11a & 11c (GH)		
Definitely true	1	1
Mostly true	2	2
Don't know	3	3
Mostly false	4	4
Definitely false	5	5
Questions 11b & 11d (GH)		
Definitely true	1	5
Mostly true	2	4
Don't know	3	3
Mostly false	4	2
Definitely false	5	1

APPENDIX C

QualityMetric
INCORPORATED

September 25, 2001

Ms. Amy Dunbar
Louisiana State University
Baton Rouge, Louisiana

Via Email: amydunbar@juno.com

Dear Amy:

I would first like to thank you for your continued interest in the SF-36® Health Survey. Please know that we are pleased to grant you permission to reproduce our tool in the appendices section of your of thesis—**"A Comparison of Self-Report and Performance-Based Measures of Function in Older Adults"**.

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If I can be of further assistance to you, please feel free to contact me at (401) 334-8800, extension 241 or via email at racherry@qmetric.com.

Again, thank you for your continuing support and interest in our work.

Sincerely,

Rosamaria Amoros-Cherry
Licensing Coordinator

VITA

Amy Elizabeth Dunbar was born in Zachary, Louisiana, on March 12, 1978. She spent most of her childhood in Louisiana before moving to Texas at the age of 15. She then came back to Louisiana for college and received a Bachelor of Science in Health and Physical Education from Louisiana Tech University on May 20, 2000. She will receive her Master of Science in Kinesiology from Louisiana State University on May 24, 2002. After graduation, she will be marrying Bryan Hester on August 3, 2002, and will reside in Bossier City, Louisiana.