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Age Bias in Physicians' Recommendation for Physical Activity, Adherence, and Health Related Quality of Life Among Individuals with Arthritis

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AGE BIAS IN PHYSICIANS' RECOMMENDATION FOR PHYSICAL ACTIVITY, ADHERENCE, AND HEALTH RELATED QUALITY OF LIFE AMONG INDIVIDUALS WITH ARTHRITIS

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ABSTRACT

The association between individuals' ages, physicians' recommendations for physical activity, adherence, and health related quality of life among individuals with arthritis was examined using the 2007 Behavioral Risk Factor Surveillance System. The sample included 33,071 individuals with self-reported, physician-diagnosed arthritis who were 45 years or older. To answer the research questions, three sets of data were created: a whole sample (n=33,071), those 45-64 years old (n=17,607), and those 65 years or older (n=15,464). The conceptual framework for the study was based on the Behavioral Model of Health Services Utilization. The variables of interests were physicians' recommendations for physical activity, adherence to physical activity guidelines, health related quality of life (measured as physically and mentally unhealthy days), age, sex, race, education, marital status, employment, income, health insurance, personal physician, emotional support, body mass index, activity limitations, health status, and co-morbidities. The analysis included univariate, bivariate statistics, logistic regression, and negative binomial regression models. Results indicated that older adults were less likely (OR=0.86) to receive physicians' recommendations for physical activity compared to the group 45-64 years old. Those who did not receive physicians' recommendations were less likely (OR=0.94) to adhere to physical activity guidelines compared to those who adhered.

Those who did not adhere to physical activity guidelines had higher physically (14%) and mentally unhealthy days (12%) compared to those who adhered to physical activity guidelines. In both age groups, the number of physically unhealthy days was 12%-18% higher, for those who did not adhere to physical activity guidelines than those who adhered to physical activity guidelines. However, the associations between physicians' recommendations and adherence, and adherence and mentally unhealthy days, were different for the age groups.

Keywords: Age bias, physicians' recommendations, adherence, health related quality of life, arthritis

Dedicated to my parents

Annie and Augustine Joseph Alencherry

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TABLE OF CONTENTS

Page

TABLE OF CONTENTS (Continued)

Page

TABLE OF CONTENTS (Continued)

Page

APPENDICES

LIST OF TABLES

LIST OF TABLES (Continued)

Table *Page*

LIST OF FIGURES

LIST OF ABBREVIATIONS

ACR	American College of Rheumatology
ACSM	American College of Sports Medicine
BDI	Beck Depression Inventory Scores
BMI	Body Mass Index
BRFSS	Behavioral Risk Factor Surveillance System
CATI	Computer Assisted Telephone Interviewing
CDC	The Centers for Disease Control and Prevention
CJS	Chronic Joint Symptoms
CPG	Clinical Practice Guidelines
DSS	Disproportionate Stratified Sampling
HRQOL	Health Related Quality of life
HUI3	Health Utility Index 3
OR	Odds Ratio
PACE	People with Arthritis Can Exercise
PDA	Physician-Diagnosed Arthritis
PQOL	Perceived Quality of Life Scale
PSS	Perceived Stress Scale

RCT	Randomized Clinical Trial
SEM	Structural Equation Modeling
SPSS	Statistical Package for Social Sciences
TJS	Transient Joint Symptoms
WHO	World Health Organization

CHAPTER 1

INTRODUCTION

Background of the Problem

Arthritis is a condition of inflammation of the joints and/or the tissues surrounding the joints (Arthritis Foundation, 2010). It includes more than 100 conditions, characterized by pain and stiffness of the joints (Arthritis Foundation, 2010; Center for Disease Control and Prevention, 2009). The common forms of arthritis are osteoarthritis, fibromyalgia, gout, lupus and rheumatoid arthritis (Centers for Disease Control and Prevention, 2009). It is one of the most prevalent chronic conditions and a leading cause of disability in the United States (Abell, Hootman, Zack, Moriarity, & Helmick, 2005; Callahan et al., 2008). In 2005, about 46 million adults (18 years or older) had physician-diagnosed arthritis. It is projected that, by 2030, about 67 million Americans 18 years or older will have some type of physician-diagnosed arthritis, with one half of them being 65 years or older (Hootman & Helmick, 2006; National Health and Interview Survey, 2003-2005). Of the 46 million individuals reported with physician-diagnosed arthritis in 2005, about 18 million reported activity limitations attributable to arthritis (Centers for Disease Control and Prevention, 2006) and poor Health Related Quality of Life (HRQOL) (Currey, Rao, Winfield, & Callahan, 2003; Mili, Helmick, Zack, & Moriarty, 2003). This number is projected to increase to 25 million by 2030 (Hootman & Helmick, 2006).

The probability of being diagnosed with arthritis increases with age (Helmick et al., 2008). The prevalence of arthritis was reported at 50 percent in individuals 65 years or older and 29 percent in the age group 45-64 years old (Centers for Disease Control, 2006a). Treatment of arthritis includes medication, surgery, and non-pharmacological therapies, such as physical or occupational therapy, joint assistive aids, patient education and support, and weight loss (Center for Disease Control, 2009). Treatment is effective when pharmacological therapy is combined with non-pharmacological therapies, such as physical activity, weight control, and patient education. Together they are considered helpful in keeping the chronic condition under control and in improving individuals' HRQOL (American College of Rheumatology Subcommittee on Osteoarthritis Guidelines, 2000; Centers for Disease Control, 2007).

As mentioned before, one of the non-pharmacological therapies for arthritis is physical activity. Previous longitudinal and cross-sectional studies have indicated that physical activity is effective in improving HRQOL of individuals with arthritis (Abell et al., 2005; Brown et al., 2003; Callahan et al., 2008; Penninx et al., 2001; Stewart, 1995; Stewart, Sepsis, King, McLellan, & Ritter, 1997; Van Baar et al., 1998). According to Sokka and colleagues (2008), the importance of physical activity for people with chronic joint symptoms has been recognized only recently. Earlier, even minimal physical activity was considered inappropriate for this population. Similar to individuals with other chronic diseases, those with arthritis are at higher risk of physical inactivity. The goal of arthritis treatment is to control pain, minimize joint damage, enhance physical function, and improve quality of life (Center for Disease Control, 2009; Matsumoto, Bathon, & Bingham, 2008). Treatment, as previously mentioned, is a comprehensive

program of medical, social, and emotional support (Matsumoto et al., 2008). According to the Physical Activity Guidelines Advisory Committee Report (2008), the Musculoskeletal Health Subcommittee of the Department of Health and Human Services recommends that physicians should counsel patients to pursue activities that are of low-to-moderate impact, not painful, and do not have a high risk of joint injury. A recommendation of 30 minutes of physical activity for 5 days a week is considered appropriate for most individuals with arthritis. Participation in physical activity reduces pain and improves physical functioning, mental health, and quality of life for individuals with arthritis (Anderson, King, Stewart, Camacho, & Rejeski, 2005). Physical activity interventions will attenuate functional decline and disability leading to higher HRQOL. In addition to these benefits, physical activity decreases mortality and morbidity from cancer, diabetes, and cardiovascular diseases (Fontaine, Bartlett, & Heo, 2005). Thus, it would prevent unwarranted physician visits, would have a substantial positive effect on health, and thus lower health care costs.

Even though a moderate amount of physical activity is considered beneficial for reducing pain and improving the HRQOL for this population, there is a high prevalence of physical inactivity among this population (Fontaine, Heo, & Bathon, 2004). One of the reasons for the high prevalence of physical inactivity among this population could be lack of physicians' recommendations for physical activity. However, physicians' recommendations alone are not sufficient. Adhering to the physical activity guidelines is essential, which will ultimately improve the HRQOL among individuals with arthritis. Hence, achieving improved HRQOL is a sequence of processes for this population. The conceptual framework for the study is based on the Andersen Aday Behavioral Model of

Health Services Utilization. Based on this model, physicians' recommendations for physical activity for individuals with arthritis is a function of their activity limitations; body mass index (BMI); health status; co-morbidities (need-related factors); health insurance, income, and emotional support (enabling factors); and employment, marital status, education, sex, race, and age (predisposing factors). Further, adherence to physical activity guidelines is a function of physicians' recommendations for physical activity, need-related, enabling, and predisposing factors. Finally, HRQOL of an individual with arthritis is a function of physicians' recommendations for physical activity, need-related, enabling, predisposing factors, and adherence to physical activity guidelines.

A number of studies in the arthritis literature evaluated the individual characteristics associated with physicians' recommendations for physical activity (Fontaine et al., 2005; Fontaine, Haaz, & Bartlett, 2007; Honda, 2004). The studies were consistent in their finding that females, obese, those with some college education or higher, and those with activity limitations were more likely to receive the recommendations. However, results on whether older adults (65 years or older) were receiving physicians' recommendations were inconclusive. Some studies reported that older adults were more likely to receive physicians' recommendations compared to younger age groups (Fontaine et al., 2005; Fontaine et al., 2007; Honda, 2004). However, a few other studies in the arthritis literature reported that physicians were less likely to recommend physical activity to older adults (Hirvensalo, Heikkinen, Lintunen, & Rantanen, 2003, 2005; Schonberg, Marcantonio, & Wee, 2006). Thus, it was inconclusive whether physicians were recommending physical activity to older adults

with arthritis. The first part of this study analyzes the association between individuals' ages and physicians' recommendation for physical activity.

Physicians' recommendations act as a catalyst for change in health behavior related to physical activity (Petrella, 2003; Kreuter, Chheda, & Bull, 2000). However, physicians have failed to counsel patients on physical activity more than any other health promoting behavior. Some of the reasons may include a lack of time, training, and knowledge about physical activity counseling (Ananian et al., 2006; Petrella, Koval, Cunningham, & Paterson, 2003). Though benefits of exercise for arthritis patients are well-known, as mentioned previously, physical inactivity is high in this group (Alliance for Aging Research, 2003). Thus, it becomes important for health care researchers and policy makers to understand the factors that influence this population's participation in physical activity (Centers for Disease Control, 2006b).

The second part of the study examines the association between physicians' recommendations and adherence to physical activity guidelines. This part of the study assumes that an individual's adherence to physical activity guidelines is a function of physician's recommendation, need-related, enabling, and predisposing factors. Studies on exercise, weight loss, smoking cessation, alcohol consumption, and diabetes have reported that those who received a physician's recommendation for a behavior change were more likely to do so compared to those who did not receive a physician's recommendation (Bao, Duan, & Fox, 2006; Fleming, Barry, Manwell, Johnson, & London, 1997 ; Gilpin, Pierce, Johnson, & Bal, 1993; Kenkel & Terza, 2001; Kreuter, Chheda, & Bull, 2000; Loureiro & Nayga, 2006, 2007; Maddigan, Majumdar, & Johnson, 2005). However, studies involving individuals with arthritis have limited

information on the association between physicians' recommendations and adherence to physical activity guidelines and the influence of age on this association.

The adherence literature indicates that reasons for individuals with arthritis not adhering to treatment may be attributable to their lack of confidence in the diagnosis, fear of making the disease condition worse, lack of physicians' recommendations, lack of time, and low self-motivation (Becker, 1983; Fontaine et al., 2004). Prevalence studies indicate that only about 36% of older adults and 43% of those between 45-64 years old met the recommended guidelines of the Centers for Disease Control (CDC) and American College of Sports Medicine (ACSM) for physical activity (Umstattd, Saunders, Wilcox, Valois, & Dowda, 2006). According to Fontaine and colleagues (2004), fewer than four out of ten adults with physician-diagnosed arthritis met physical activity adherence levels. The highest rates of non-adherence were found among patients with less formal education, African Americans, Hispanics, and those 65 years or older. Studies in adherence literature have focused on an individual's non-adherence to a recommended treatment regimen, whereas information on an individual's non-adherence due to a physician's lack of recommendation was limited. The study assumes that individuals' adherence to physical activity guidelines may be associated with physicians' recommendations.

The third part of the study examines the association between the adherence to physical activity guidelines and HRQOL. The desired outcome of any clinical or behavioral intervention is to have a better HRQOL (Brown et al., 2003; Martin, Williams, Haskard, & Dimatteo, 2005). HRQOL is an indicator of physical health, mental health, and a population's chronic disease burden. It is a good indicator to assess the impact of

arthritis as it seldom causes death but causes pain to individuals with arthritis and affects their ability to function (Abell et al, 2005). Assessing HRQOL helps to monitor health and provides guidance for health interventions (Freelove-Charton, Bowles, & Hooker, 2007). This study assumes that HRQOL for an individual with arthritis is a function of physician's recommendation; need-related, enabling, and predisposing factors; and adherence to physical activity guidelines. Previous studies in arthritis literature reported lower HRQOL for individuals with arthritis compared to those who did not have arthritis. In addition, those who adhered to physical activity guidelines reported higher HRQOL (Abell et al., 2005; Brown et al., 2003; Dominick, Ahern, Gold, & Heller, 2004; Freelove-Charton et al., 2007; Mili et al., 2003). These studies, which evaluated the association between adherence to physical activity guidelines and HRQOL, lacked a theoretical framework. Hence, this study examines the association between adherence to physical activity guidelines and HRQOL based on a theoretical framework. Further, the study examined whether age influenced this association.

Significance of the Study

Most of the literature on disparities is based on race. Further, studies focused on characteristics of patients, such as their ability to afford care and their knowledge, beliefs, and preferences, whereas information on the contribution of physicians to disparities in access and utilization is limited.

Research on the correlates of physical activity adherence, especially among older adults, is limited. The study of such correlates will help to identify important barriers as well as contributors to physical activity participation by older adults with arthritis, thus

leading to more effective interventions. The arthritis literature clearly indicates that physical activity is an important intervention for reducing the pain and discomfort and improving HRQOL in this population (Hirvensalo, 1998; Penninx, 2001; Hirvensalo, 2003; Petrella, 2003). Despite the findings, the subgroup of the population that is most inactive is older adults (65 years or older). In this study, one of the important reasons for the lack of physical activity in older adults is assumed to be the lack of physicians' recommendations. Physicians may not recommend physical activity to older adults because they think that arthritis in this population is a part of the aging process (Alliance for Aging Research, 2003) and older adults may not follow their recommendations (Fontaine et al., 2005).

This study was conducted based on the 2007 Behavioral Risk Factor Surveillance System (BRFSS) data set, a nationally representative sample of the United States population. The three major findings that this study will add to the arthritis literature are: a) the association between physicians' recommendations for physical activity and individuals' ages; b) the association between physicians' recommendations and adherence to physical activity guidelines, and whether this association was the same for the two age groups—45-64 years and 65 years or older; and c) the association between adherence to physical activity guidelines and HRQOL, and whether this association was the same for the two age groups.

Research Questions

1. Are individuals' ages associated with physicians' recommendations for physical activity?
2. Are physicians' recommendations associated with adherence to physical activity guidelines?

3. Is adherence to physical activity guidelines associated with HRQOL (measured as physically unhealthy days, and mentally unhealthy days) of individuals with arthritis?

Plan of Work

Chapter two provides a comprehensive literature review on the importance of physical activity among individuals diagnosed with arthritis, physicians' recommendations for physical activity and the age of the individual, adherence to physical activity guidelines, and HRQOL. Chapter three describes the conceptual framework for the study based on the Behavioral Model of Health Services Utilization, and outlines the hypotheses to be tested. In addition, data and methods used in this study are discussed in chapter three. Chapter four details the results of the statistical analyses conducted. A discussion on the results, conclusions, limitations of the study and policy implications is presented in chapter five.

CHAPTER 2

LITERATURE REVIEW

This chapter provides a comprehensive literature review on the importance of physicians' recommendations for physical activity, and its relation to the adherence to physical activity guidelines, and HRQOL. The sections of this chapter include the significance of physical activity in individuals with arthritis, the patient-physician relationship, the impact of physicians' recommendations, age bias and physicians' recommendations, physical activity adherence, and the association between adherence to physical activity guidelines and HRQOL. The review identified gaps in arthritis literature examining the associations among individuals' ages, physicians' recommendations for physical activity, and adherence to physical activity guidelines, and subsequently HRQOL. Finally, the literature review was put in the context of the Behavioral Model of Health Services Utilization to have a broader perspective on the associations.

Physical Activity Among Individuals With Arthritis

One of the prevention interventions frequently overlooked in older adults is physical activity. Physical activity benefits the physical, mental, and functional health of an individual and delays the onset of functional limitations and loss of independence (Alliance for Aging Research, 2003). The American College of Rheumatology (ACR), recommends physical activity for the maintenance of joint health for both normal and

arthritic joints. Despite the benefits of physical activity, more than 60% of adults with arthritis who are 18 years or older do not meet the recommended levels of physical activity. For individuals with arthritis, about 30 minutes of low-to-moderate physical activity on 5 or more days per week is recommended (Physical Activity Guidelines Advisory Committee, 2008). The reasons why the majority of individuals with arthritis do not meet physical activity recommendations may be due to arthritis-specific barriers to physical activity, such as fear of making their arthritis worse, the lack of a physical activity recommendation from their physician/rheumatologist, and fatigue (Fontaine, Heo, & Bathon, 2004; Iversen, Fossel, & Daltroy, 1999). Some general barriers to physical activity are lack of self-motivation and time (Fontaine et al., 2004). In a prevalence estimate study based on the 2001 BRFSS, Fontaine and colleagues (2004) reported that only 38.3% of individuals with arthritis adhered to physical activity guidelines, and the highest prevalence of physical inactivity was found among those 65 years or older. Hence, the prevalence of physical activity is low despite research findings that physical activity not only improves arthritis-related symptoms but also overall health in individuals with arthritis.

Kaplan and colleagues (2003) focused on the characteristics of physically inactive older adults with arthritis using the Canadian National Health Population Survey 1996-1997. The study found that those who were physically inactive included females, individuals with lower education, those who were 75 years or older, unmarried, both underweight and overweight individuals, those with lower levels of social support, and those with more co-morbidities.

An Australian study by Busija and colleagues (2007) examined the prevalence of arthritis, the characteristics of individuals with arthritis, and the relationship between arthritis, self-reported health and psychological distress. About 23% of the sample had arthritis. For both men and women, higher arthritis prevalence was associated with old age, lower education and income, and higher BMI. High prevalence was also associated with poor self-reported health and high psychological distress. Age and BMI independently predicted arthritis for men and women.

A focus group study examined the perceptions about exercise among exercisers and non-exercisers prior to and after their diagnosis of arthritis. The study found that the exercisers changed the type, intensity, and duration of their exercise after an arthritis diagnosis, whereas non-exercisers completely stopped any kind of physical activity after the onset of their disease (Ananian et al., 2006). Exercise was defined as leisure time physical activity repeated on a regular basis for an extended period, and physical activity was any bodily movement by skeletal muscles that results in a substantial increase in energy expenditure (Courneya et al., 2004).

The People with Arthritis Can Exercise (PACE) program for arthritis patients, an 8-week multicenter randomized clinical trial (RCT), found that adults with arthritis who attended PACE had improvements in symptoms, self-efficacy in arthritis management, and upper and lower extremity functions. The program was considered safe for sedentary older adults to start exercising without worsening their symptoms. Arthritis symptoms improved in this population (Callahan, 2008).

Physical activity studies in non-arthritis literature indicated that the prevalence of physical inactivity was highest among older adults. A study on the prevalence of

physical inactivity and its relation to social class in U.S. adults based on the National Health and Nutrition Examination Survey III (1988-1994) found that social class was associated with physical inactivity. Physical inactivity was more prevalent among less educated, those who had household incomes below $20,000, the unemployed, and retired individuals. In all categories of social class, women had a higher prevalence of physical inactivity than men, and those 65 years or older had the most number of physically inactive people (Crespo, 1999). However, there were confounders, such as race, health insurance, social support, BMI, activity limitations, co-morbidities, and physicians' recommendations that may influence an individual's physical activity.

A study on the patterns of physical activity among minority women found that compared to Whites, Hispanics were more likely to be active and African Americans were less likely to be active when all domains of physical activity were considered. Physical activity was measured as leisure time activity, regular physical activity, vigorous physical activity, occupational physical activity, housework physical activity, and a composite measure. Occupational physical activity was the most common among American Indians/Alaskan Natives and among college graduates. Housework activity was more common among American Indians/Alaskan Natives and Hispanics. African American and American Indians/Alaskan Natives reported no difference in leisure time physical activity compared to Whites. Individuals with lower education, older adults, and rural residents were more likely to be physically inactive. Having no leisure time activity was common among those overweight, who were smokers, and individuals who were not consuming five servings of fruits and vegetables per day. Walking was the most common type of leisure time activity reported, followed by aerobics, gardening, bicycling,

calisthenics, swimming, and treadmill use. The variables included in the model were age, race/ethnicity, and education (Brownson et al., 2000). The possible confounders for physical activity include physicians' recommendations, health insurance, social support, BMI, activity limitations, and co-morbidities.

Chogahara (1999) studied the positive and negative social influences on physical activity among older adults and categorized social influences into family, friends, and health care professionals. He found that the positive influences of family and friends decreased as age increased. In addition, the correlation was negative for healthcare professional's positive influence and age. However, it was not statistically significant.

An 8-year (1988-1996) follow-up study on the involvement in various types of physical activity by older adults in Finland, the motives of their participation, and obstacles encountered was conducted. The study found that involvement in supervised exercise classes and calisthenics increased among males during the follow-up period, but physical activity generally declined among females. Health promotion and social reasons were the motivating factors behind involvement in physical activity, whereas the barriers mentioned were poor health and lack of interest (Hirvensalo, Paivi, & Rantanen, 1998).

The reviews in this section indicated a majority of individuals with arthritis did not meet recommended levels of physical activity. The highest prevalence of physical activity was among older adults with arthritis. Those who participated in physical activity/exercise had improvements in functional health. Physical activity was also associated with social class, race, poor health, and previous exercise experience.

Patient-Physician Relationship

The relationship between patient and physician has been described by the traditional sick-role perspective and modern consumerist perspective. According to the sick-role perspective, the physician is in charge, and the patient has to adhere to the physician's prescribed regimen. The physician's assumption of authority and the patient's trust, confidence, and norm of obedience are justified by the differences in knowledge between the two. However, in the consumerist perspective, neither of the individuals involved is in charge; they bargain over the terms of the relationship. The consumerist perspective challenges the physician's authority. It focuses on the patient's rights and the physician's obligation to the patient and not on the physician's right to direct and the patient's obligation to follow the directions (Huag & Lavin, 1981). Huag & Lavin (1981) assessed the extent to which the consumerist perspective was adopted by patients, the physicians' response to such authority, and the variables that explain the consumerist outlook. About 60% of the patients adopted the consumerist perspective in their medical encounters. On the other hand, only 8% of the physicians claimed to accept their patients' demands for participation in decision-making. This showed that physicians desired to be in control of the situation. Patients who were younger, had poor health, and were better educated adopted the consumerist outlook. Better health and old age were associated with the traditional sick-role stance. Based on the traditional sick-role stance, the study assumes that, if physicians recommend physical activity to older adults, they are more likely to adhere to it.

Hooper and colleagues (1982) examined whether four patient characteristics—age, ethnicity, gender, and appearance —influenced physicians' behaviors. Physician

behavior was measured in terms of interviewing, non-verbal attention, courtesy, information giving, and empathy. Physicians' information-giving behavior and empathy were higher with female patients and Whites. Patients' physical appearance influenced medical care. Non-verbal attention and courtesy were higher with better-groomed patients. Across age groups, there was no difference in ratings of physician behaviors, except that patients 75 years or older had higher ratings on courtesy. This study indicates that physician's behavior was influenced by patient characteristics. Papper (1970) indicated that characteristics associated with receiving inferior care were aged, dirty, and ungrateful patients. Physicians find these individuals undesirable to treat. Hall and colleagues indicated that an expression of concern and interest, warmth, information sharing and explanation had a positive impact on patient satisfaction and adherence (Hall, Roter, & Rand, 1981). Another study by Hall on provider behavior in medical encounters reported that females, higher income groups, and older adults experienced more information sharing from their physicians (Hall, Roter, & Katz, 1988).

Maddigan and colleagues (2005) in their Canadian study on the association among physician-patient relationships, self-care behaviors, and HRQOL in patients with Type-2 diabetes found that physician-patient relationship was positively associated with adherence to exercise behavior, and this was positively associated with HRQOL. In addition, adherence to exercise, diabetes management attitudes, and BMI were direct significant predictors of HRQOL. A review of 143 articles on effective physician-patient communication and health outcomes by Stewart (1995) concluded that most of the studies demonstrated a correlation between effective physician-patient communication and improved health outcomes for patients.

The above studies indicated that there was a positive association between physician-patient relationship and adherence to health-promoting behavior, and subsequently an improved HRQOL. However, the studies had mixed results on physician-older adult relationship and health-promoting behavior.

Impact of Physicians' Recommendations

Physicians' recommendations for health behaviors such as exercise, weight loss, smoking cessation, and alcoholism treatment have been extensively studied. Using the 1995 National Health Interview Survey, Wee and colleagues (1999) examined the factors associated with physicians' recommendations for exercise and found that physicians' recommendations for exercise were low nationally. Physicians' recommended physical activity to individuals in the age group 40-49 years, with income greater than or equal to $50,000, with higher levels of physical activity, females, college graduates, married, overweight and obese, with cardiac problems, and with diabetes. Uninsured patients or those with Medicaid insurance were less likely to be advised to exercise. Recommendations did not vary by physician specialty or patient race. Kreuter and colleagues (1997) analyzed the characteristics of individuals who received physicians' recommendations for physical activity and low-fat diet. They found that approximately 49% of patients were engaged in less than the recommended level of physical activity. Patients with diabetes, high blood pressure (140/90 mmHg), BMI ($\geq$ 30), and cholesterol ($\geq$ 240mg/dL) were more likely to receive a recommendation for physical activity. Those who had a personal history and those with a family history of heart disease were more likely to receive a recommendation for physical activity and diet. Patients' health-related

behaviors, age, education, gender, race, and marital status were not associated with physicians' recommendations for physical activity. The strongest predictors for receiving a recommendation for physical activity and a low-fat diet were BMI and cholesterol level. These results add to the literature that physicians' recommendations for health promotion were more likely for individuals who had poor health status than those who were disease-free. In a RCT by Kreuter and colleagues (2000), it was found that individuals who received advice for behavior changes were more likely to follow it than those who did not.

Physicians' recommendations were also investigated in weight loss studies. Loureiro and colleagues (2006) investigated the relationship between an individual's response to a physician's recommendation on weight loss (physical exercise and eating fewer calories and fat) and found that the individuals who received physicians' recommendations to lose weight had a significant increase in exercise and had a lower intake of calories and fat. Except for obese people, the effect of a recommendation was significant. Compared to more highly educated individuals, those who had not completed a high-school education were less likely to adopt a low-calorie and fat-free diet and to exercise. In addition, people who made $25,000 or less of household income were less likely to eat fewer calories and fat and to exercise compared to those who earned at least $75,000 annually. African Americans who were overweight and obese were less likely to eat fewer calories or fat. Age had a nonlinear effect on the likelihood of the intake of fewer calories, exercising, and physician advice. This study indicates that physicians and other healthcare providers have an opportunity to recommend weight control. However, resistance was seen among physicians when it comes to doing so. The reasons for

physicians not giving recommendations may be the lack of time, training, or confidence; limited staff support; and perceived success rate. The study indicates that physicians' and other healthcare providers' recommendations had an effect in changing the health behaviors of their patients.

Another study by Loureiro on the effect of physicians' recommendations on the adoption of a desirable dietary behavior using the 2003 BRFSS dataset found an association between the receipt of physicians' dietary recommendations and the tendency of the patient to adopt the desirable dietary behavior. Overall, only 23.6% of individuals received recommendations from physicians to change their dietary behaviors. Females, low-income individuals, those who had a personal physician, those who were overweight and obese, had been diagnosed with diabetes, Hispanics, Blacks and other races were more likely to receive recommendations, whereas the less educated, retirees, and those who had a good perception of their health status were less likely to receive physicians' recommendations (Loureiro, 2007).

Studies in primary care settings on physical activity interventions have shown favorable results in an individual's adherence to physical activity due to physicians' recommendations. Glasgow and colleagues (2001) assessed whether primary care physicians advised individuals on physical activity. They also examined the relationship between physical activity planning and follow-up, and patient characteristics. The study found that 28% of individuals received advice for physical activity, of which only 40% received assistance from their physician in planning an exercise routine. Those who received advice for physical activity were likely to be older, non-white, had co-morbidities, and frequent contact with their physician. Sinclair and colleagues (2008)

analyzed whether patient characteristics, familiarity with a clinic, and the relationship with their physician predicted patients' receipt of physician advice based on the Canadian Primary Care Practice Survey data. The study found that only 42% of the respondents received advice on physical activity. Males, those older than 35 years, those who reported their health as good, had co-morbidities, and those who reported having better relationships with their providers were associated with receiving advice (Sinclair, Lawson, & Burge, 2008).

Nawaz and colleagues (2000), in a cross-sectional study (n= 433) on patient-physician interaction regarding diet, exercise, and smoking in a routine healthcare check-up, found that physicians can bring about behavioral changes in their patients by counseling them. In this study, individuals who were asked about their diet, weight, and exercise were assessed for behavior change. They found that individuals who were asked about their diet and weight were more likely to lose weight. However, no change was found in their exercise and smoking behaviors. Podl and colleagues (1999) assessed the prevalence of exercise counseling by family practitioners by directly observing outpatient visits. They also assessed patient and visit characteristics associated with the provision of counseling. The study indicated that only 20% of patients received advice. Race, health status, the number of years with the practice, the number of visits in the past year, smoking status, new patients, and patient satisfaction were not associated with exercise counseling. Age, gender, the reason for visit, the length of visit, diseases (hypertension, diabetes, depression, joint disease, ischemic heart disease, low back pain, obesity, fibrositis, and myalgia) were associated with exercise counseling. A cluster randomized control study on the effectiveness of physical activity counseling in general practice by

Elley and colleagues (2003) found that counseling caused a significant improvement in physical activity, and quality of life in the intervention group.

Physicians' recommendation has shown positive results in smoking cessation programs. A study based on the 2001 National Health Interview Survey on the association between physicians' recommendations and smoking cessation by Bao and colleagues found that physicians' recommendations provided in a routine care setting have a significant effect on patients' smoking cessation behavior (Bao, Duan, & Fox, 2006). Gilpin and colleagues (1993) found that smokers who were recommended by their physicians to quit were more likely (OR=1.6) to quit smoking than smokers who were never asked by their physicians to do so.

Studies in the area of alcohol consumption have shown that physicians' recommendations were influential in the reduction of alcohol consumption by individuals (Kenkel & Terza, 2001). In a randomized clinical trial, physicians' recommendations have been found useful in a 33.4% reduction in 7-day alcohol use, a 74% reduction in binge-drinking episodes, and a 62% reduction in the percentage of older adults drinking more than 21 drinks per week in community-based primary-care practices (Fleming, Manwell, Barry, Adams, & Stauffacher, 1999). A multicenter study by the World Health Organization (WHO) to evaluate the relative effects of the recommendations and brief counseling for heavy drinkers indicated that brief interventions involving advice and counseling had a significant reduction on individuals' average alcohol consumption and the amount consumed per occasion in males, even after controlling for sociocultural and demographic factors. Five minutes of advice was as effective as brief and extended counseling (up to three follow-up sessions). The control group reduced their daily

consumption by 7%, whereas the advice group and counseling group reduced daily drinking by 21% and 27%, respectively. The intensity of alcohol consumption for individuals in the advice and counseling groups decreased by 43.5% and 46.4%, respectively (WHO brief interventions study group, 1996).

Physicians' recommendations for health-promoting behavior in patients with heart diseases had positive results. Greenlund and colleagues (2002) examined the prevalence of physicians' recommendations for lifestyle behavior changes in individuals with prior stroke, and individuals' engagement in lifestyle behavior changes. They also evaluated whether lifestyle-related changes were associated with HRQOL. The study found that men, non-Hispanic African Americans, those less educated, and adults 65 years and older were more likely to report stroke. People with a stroke history were more likely to receive a recommendation for exercise and a low-fat diet. Physicians' recommendations for health promotion were low for individuals who had prior stroke. People who engaged in physical activity to lower future risk of stroke had a better HRQOL. The results suggest that counseling was directed towards high-risk patients only. Hence, physicians' recommendations were more therapeutic than preventive.

Studies in arthritis literature showed that very few individuals received recommendations for physical activity from their physicians. Fontaine and colleagues (2005) studied the proportion and characteristics of individuals with physician-diagnosed arthritis who received physical activity recommendations using the 2003 BRFSS. They reported that only 42% of individuals with physician-diagnosed arthritis received recommendations from their physicians. Further, individuals in the age group 35-64 years old were more likely to receive recommendations compared to a younger group of 18-24

years old. Older adults (65 years or older) were likely to receive physicians' recommendations for physical activity compared to the group 18-24 years. A few limitations with this study were that it did not include such variables as co-morbidities, activity limitations, health status, emotional support, income level, and health insurance, which are important confounders for recommendations of physical activity. Another study by Fontaine and colleagues (2007) examined the proportion and characteristics of adults with physician-diagnosed arthritis who received advice from their physicians to lose weight and assessed whether receiving advice was related to weight loss. They found that less than 45.7% of overweight and obese individuals received advice to lose weight. Those who received advice were more likely to be females, older adults, obese, college graduates, and had activity limitations due to joint symptoms. Overweight and obese patients who received advice were more likely (OR=3.75) to lose weight than those who did not receive advice. Similarly, Mehrotra and colleagues (2004) examined the relationship between body weight and arthritis in the U.S. population. They found that physicians failed to advise their patients to lose weight, but those who received the advice were three times more likely to report weight loss efforts.

Damush and colleagues (1999) explored the prevalence and factors associated with physicians' recommendations to exercise in a sample of older adults. They found that only 48.3% reported being advised by physicians to exercise. Those who were advised were younger, more likely to have diabetes, heart disease, stroke or hypertension, higher BMI, poor physical health, psychological distress, and a sedentary life. Gender, minority status, income, marital status, having arthritis, smoking, and having exercise knowledge were not associated with receiving recommendations.

Stewart and colleagues (1997) evaluated the effectiveness of an intervention promoting physical activity among older adults (62-91 years). They found that an intervention promoting increased physical activity using existing community resources showed an increase in physical activity among older adults. The intervention group was more active and had greater self-esteem than the comparison group. Those who maintained physical activity over the 6-month intervention period reported improvements in anxiety, depression, and overall psychological well-being relative to those who did not participate in physical activity.

A longitudinal study by Hirvensalo and colleagues (2003) on the effect of advice of healthcare professionals on increasing physical activity in older adults (65-84 years) found an association between the advice of healthcare professionals and an increase in physical activity among older adults. Men who received physicians' recommendations were two times and women 1.4 times more likely to do calisthenics at home compared to those who did not receive recommendations. Women who recalled having received recommendations from a healthcare professional were three times more likely to participate in supervised exercise than those who did not receive advice. Another study by Hirvensalo and colleagues (2005) indicated that a high proportion of older adults did not get any physical activity recommendations from their physicians. Those who recalled not receiving recommendations were older, more sedentary, had no heart condition, had musculoskeletal diseases and physical symptoms, and had less contact with healthcare professionals than those who received advice.

Arthritis literature as well as general health services research literature indicates that the percentage of patients receiving physicians' recommendations for physical

activity was low, but physicians' recommendations had a positive effect on the adoption of health-promoting behavior by their patients. However, whether physicians recommended physical activity to older adults was inconclusive.

Age Bias and Physicians' Recommendations

Healthcare costs for older adults in the U.S. are three to five times more than costs for individuals younger than 65 years (Centers for Disease Control and Prevention and The Merck Company Foundation, 2007). As old age approaches, chronic diseases affect individuals, and old age is associated with disability, poor quality of life, and increased healthcare costs (Alliance for Aging Research, 2003). If healthcare costs have to be reduced, and we want this population to stay healthy, the focus should be on preventing diseases and promoting health (Center for Disease Control, 2007). Any discrimination based on age is known as ageism. In behavioral research, a study by Palmore (2001) examined the prevalence of ageism in older adults (n= 84), and found that 77% of the older adults experienced one or more types of ageist behavior. About 43% of older adults reported that their physician or nurse assumed that their ailments were due to old age. Hajjar and colleagues (2002), in their cross-sectional study, surveyed the opinions and self-reported practices of physicians who were associated with the care of older adults with hypertension. According to the study, 35% of the physicians thought that hypertension in older adults were a part of the ageing process. One quarter thought that treating hypertensive older adults has more risks than benefits. In addition, they were more likely to give lifestyle recommendations to young-older adults (65-74 years) than old-older adults (85 years or older). The study found that physician understanding of

hypertension with age, counseling, and lifestyle modifications diverged from national recommendations, especially for older adults. Control of geriatric hypertension and similar issues among older adults is possible only when there is an effort made to improve these opinions of physicians.

In cancer research, according to Liang and colleagues (2006), older women were screened less often than younger women despite the known recommendations for the use of mammography for early detection of breast cancer. Competing health risks, uncertainty of age-specific disease, conflicting guidelines for women older than 69 years, biology, costs, and acceptability by older women were the indicated reasons for this trend. Under-treatment for older adults has been reported by a systematic review conducted by Bouchardy and colleagues (2007) in female cancer patients. The objective reasons stated for under-treatment of older adults were co-morbidities, lowered life expectancy, absence of data on treatment efficacy in clinical trials, lack of systematic referrals to specialists, and increase in adverse effects of treatment. Subjective reasons identified were lowered benefits of treatment, less aggressive cancers, social marginalization, pain (a natural consequence of aging), and physicians' beliefs.

In arthritis research, Harrison and colleagues (2005) investigated age bias and aggressive treatment of older adult patients with rheumatoid arthritis based on a secondary analysis of prospectively collected data. The study indicated no bias in the use of aggressive rheumatoid arthritis treatment for older adults when compared to younger controls. The study also found that the older rheumatoid arthritis patients did as well as younger patients. A retrospective analysis of clinical trials by Fleischmann and colleagues (2003) investigating the safety and efficacy of Etanercept (an injection drug

for rheumatoid arthritis) in older patients found that the treatment was tolerated well by those 65 years or older and those less than 65 years. In addition, the rates and types of adverse drug events reported were comparable in both groups.

According to Butler (1977), all negative attitudes towards older adults held by our society constitute ageism. One of the ways to improve the attitudes of the society towards aging is to improve the physical well-being of older adults. Behavioral studies indicate the prevalence of ageism, and clinical studies emphasize the fact that older adults and their younger counterparts equally tolerate aggressive therapy. These studies indicate that physicians consider arthritis in older adults to be part of growing old. Since old age is accompanied by co-morbidities, activity limitations, and poor social or emotional support, physicians may not consider physical activity recommendation to this group. However, physicians should not underestimate the impact of their professional advice and should recommend physical activity at moderate levels to all arthritis patients (Fontaine & Haaz, 2006).

Physical Activity Adherence Among Individuals With Arthritis

Adherence to recommended guidelines of physical activity is a problem among individuals with arthritis. In arthritis literature, Fontaine and colleagues (2004) investigated whether U.S. adults were adherent to recommended levels of physical activity based on 2001 BRFSS data. More than 60% of adults with arthritis did not adhere to recommended levels of physical activity of 30 minutes per day or 150 minutes per week. Another study by Fontaine and colleagues compared the 2001 and 2003 BRFSS data sets for physical activity prevalence estimates and concluded that there was only a

small change in the prevalence of adherence to recommended physical activity from 2001 to 2003 (38.3% to 39.2%), although self-reported arthritis increased from 23% to 31.8% (Fontaine, Bartlett, & Heo, 2005). Adherence in these studies was measured as meeting the recommended levels of physical activity, having insufficient levels of physical activity, or being physically inactive.

In a cross-sectional study, Sokka and colleagues (2008) investigated the prevalence of physical activity and its association with demographics and disease-related variables in patients with rheumatoid arthritis across 21 countries. They reported that a majority of patients were physically inactive, with only 13.8% reporting physical activity three or more times a week. Hence, adherence to physical activity in this population was very low. Physical inactivity was associated with females, old age, lower education, obesity, and co-morbidities. Feinglass and colleagues (2005) used the 2001 BRFSS data to compare health status and activity limitation among five different groups who reported arthritis: those who had undiagnosed transient joint symptoms (TJS), those with chronic joint symptoms (CJS), those with physician-diagnosed arthritis (PDA), those with both CJS and PDA, and the general population. The reference group for this study was the general population without arthritis. The group with CJS and PDA reported the greatest burden of activity limitation and fair-to-poor health status compared to the general population. The study may be confounded by variables, such as co-morbidities, social/emotional support, health insurance, having a personal physician, marital status, and employment.

A prospective study design by McAuley and colleagues (2007) assessed the contribution of self-efficacy and affect in predicting long-term physical activity at 2 and 5

years following a 6-month RCT in older adults. Both self-efficacy in exercise participation and exercise effect were significant predictors of long-term maintenance of physical activity controlling for age, race, sex, education, and income. In addition, individuals with a more positive effect and a higher self-efficacy at year 2 were more likely to continue to be active at year 5.

A meta-analysis study of 116 articles on adherence and disease severity by DiMatteo and colleagues (2007) found that adherence was positively related to patients' beliefs in the severity of the disease to be prevented. The patients with less severe diseases (such as arthritis and cataract) and those who were in poor health were more likely to be adherent than patients in better health. In serious disease conditions (cancer, HIV, and heart ailments), patients who were more severely ill were significantly less likely to be adherent. Thus, adherence depended on the patient's beliefs about the disease severity and awareness about the severity. According to Martin and colleagues (2005), the factors that affect adherence are health beliefs, health literacy, anxiety, depression, social-support, and patient-physician partnership (knowing the physician well, physicians' recommendations, better interpersonal relationships, and satisfaction with the medical visits). Of all the factors that influence patient adherence, the patient-physician relationship was the core to improve adherence behavior.

A review of RCT studies on interventions to improve medication adherence in older adults indicated that most of the adherence studies had methodological flaws related to small sample sizes, measurement, and validity issues. The authors emphasized that future adherence studies should examine the persistence of adherence behavior and test

theory-based interventions delivered by diverse providers (Russell, Conn , & Jantarakupt, 2006).

Arthritis literature indicates that not adhering to recommended levels of physical activity was a major issue among individuals with arthritis. This study assumes that failure to adhere to recommended levels of physical activity by individuals with arthritis may be because of physicians' lack of recommendations for physical activity (Fontaine et al., 2005). The majority of adherence studies have evaluated why individuals' did not adhere to a treatment regimen. However, arthritis literature does not report any research on the association between individuals' adherence to recommended levels of physical activity and physicians' recommendations. In addition, information on the influence of age on adherence to recommended levels of physical activity and physicians' recommendations is limited.

Adherence to Physical Activity Guidelines and HRQOL

Adherence to recommended treatment regimen leads to better HRQOL (Brown et al., 2003; Martin, Williams, Haskard, & Dimatteo, 2005). The effects of adherence to lifestyle changes on health outcomes such as HRQOL has received less attention when compared to the effects of clinical and biomedical interventions (Greenlund et al., 2002).

In the arthritis literature, the studies on the association of HRQOL and adherence to recommended levels of physical activity based on the BRFSS data indicate that people with arthritis had poor HRQOL. Those who were inactive and engaged in insufficient physical activity were more likely to have more physical and mental unhealthy days (Abell, Hootman, Zack, Moriarity, & Helmick, 2005; Mili, Helmick, Zack, & Moriarty,

2003). Based on the 2003 BRFSS data, Freelove-Charton and colleagues (2007) assessed HRQOL by levels of physical activity in adults with arthritis 50 years or older with and without activity limitations. They found that among individuals with arthritis without activity limitations and with activity limitations, those who were physically active were less likely to report poor physical days, mental days, and activity limitations compared to physically inactive individuals. The covariates included in this study were age, race/ethnicity, education, gender, and BMI. Some of the important confounders for an individual's adoption of physical activity were marital status income, previous involvement in exercise, employment, social/emotional support, having a personal physician, health insurance, and co-morbidities.

Dominick and colleagues (2004) analyzed the association of HRQOL with osteoarthritis and rheumatoid arthritis conditions among older adults in Pennsylvania. The study used the CDC's healthy day measure to assess HRQOL. They found that the disease had a significant impact on physical and mental health and activity limitations in this population. Older age, lower income, non-White race, nursing home residence, and higher co-morbidities were associated with lower scores of HRQOL.

Anderson and colleagues (2005) conducted a multicenter RCT to study the effect of physical activity on HRQOL. HRQOL was measured using the Perceived Quality of Life Scale (PQOL), Perceived Stress Scale (PSS), Beck Depression Inventory Scores (BDI), and satisfaction with body appearance scale and disability days scale. The study had three arms: physical activity advice only, advice and optional onsite health education, and advice and onsite health education. The study found that women in the advice and health education arms received the benefits of coping with stress, while men in all three

arms had decreased stress. However, the study did not find an effect of physical activity intervention on HRQOL measures, such as the PQOL, BDI, and disability days among women.

In the diabetes literature, Maddigan and colleagues (2005) studied the complex association between the patient-provider relationship, self-care behavior, and HRQOL in Type 2 diabetes patients in rural health regions of Canada. The self-care behaviors addressed in the study were exercise adherence, diet adherence, and BMI. The HRQOL was measured using the RAND-12 and the Health Utility Index 3 (HUI3) indices. They found that there was an association between a positive patient-provider relationship and adherence to diet and exercise. Those who reported better adherence to exercise were males, older individuals, and individuals with higher incomes. Exercise had a positive effect on HRQOL in this group.

The arthritis literature, as well as other studies, indicated that those who adhered to physical activity guidelines had better HRQOL. The majority of these studies did not have a theoretical approach. Further, information on the influence of age on the association between adherence to guidelines and HRQOL was limited.

Behavioral Model of Health Services Utilization

A comprehensive model in health services research focusing on health care utilization and access is the Behavioral Model of Health Services Utilization (Aday & Andersen, 2005). It was developed in the late 1960s to evaluate families' use of health services. Subsequently, it has been modified, expanded, and applied to examine the predictors of an array of health care behaviors (Aday & Andersen, 2005; Andersen, 1995;

Gochman, 1997). The model has been used to display and test complex causal models of health services utilization and as a framework to simply order and array relevant predictors and indicators of utilization (Gochman, 1997). Andersen differentiated utilization into discretionary and non-discretionary. Discretionary utilization is that where the seriousness of illness is not such that it compels one to follow medical advice. On the other hand, non-discretionary utilization is that where the seriousness of the illness compels one to follow medical advice (Gochman, 1997). In this study, we assume that adherence to physical activity is discretionary, which would require strong physicians' recommendations. The Phase-4 Behavioral Model of Health Services Utilization used for this study is an emerging behavioral model. This model highlights the multiple influences on physical activity adoption and subsequently on health outcomes (Andersen, 1995).

The Behavioral Model of Health Services Utilization was used by Honda (2004) to study the predictors of the receipt of physicians' recommendations for diet and exercise. According to the model, physical activity is important to improve the HRQOL among individuals with arthritis. Individuals may be less likely to adhere to physical activity unless their physicians recommend it to them. The factors that contribute to the receipt of physicians' recommendations for physical activity are predisposing, enabling, and need-related factors (Honda, 2004).

Physicians may tend to recommend physical activity to some individuals rather than others. The inclination of the recommendations can be predicted by the individuals' characteristics that existed prior to the onset of a specific illness. These are the predisposing factors, which include socio-demographic characteristics, such as age, sex,

race, and marital status (Andersen, 1995; Andersen & Newman, 2005; Breslow & Cengage, 2002). Enabling factors include such resources as income, availability of health insurance, and having a personal physician. These factors facilitate the receipt of physicians' recommendations (Aday & Andersen, 2005). The health conditions and related factors that prompt the physician to recommend physical activity are the need-related factors. These include conditions such as self-rated health status, medical diagnosis, BMI, and co-morbidities (Honda, 2004). Inclusion of provider-related variables in the model is important because provider characteristics interact with patient characteristics to influence health behavior adoption. Provider-related variables are contextual variables because they measure the context under which adherence occurs. Their influence on adherence to health-promoting behavior has not been explored extensively (Phillips, Morrison, Andersen, & Aday, 1998). Physicians' recommendations may be responsible for physical activity adherence in the arthritis population. Hence, it is important to understand provider-related variables. However, recommendations alone are not sufficient to have an effective health outcome. Adherence to the recommendations ultimately improves the HRQOL of an individual. Adherence to physical activity guidelines is a function of physicians' recommendations, and predisposing, enabling, and need-related factors; predictors of HRQOL are physicians' recommendations; predisposing, enabling, and need-related factors; and adherence to a recommended regimen. Hence, having a better HRQOL is a continuum of individual characteristics, physicians' recommendations, and adherence in this population.

Summary

Utilization studies are important to understand the processes through which medical care is distributed. This helps in the development of policies that will mitigate the current problems of utilization and access to care. Most utilization studies have concentrated on individual determinants and less on healthcare system factors, such as physicians (Andersen & Newman, 2005). This comprehensive literature review indicates that physical activity is effective in improving the functional and psychological well-being of individuals with arthritis. According to Physical Activity Guidelines and ACR, 30 minutes of low-to-medium impact physical activity 5-days a week is recommended for individuals with arthritis. However, physical inactivity is an issue in this population. The prevalence of inactivity is highest among the group 65 years or older. However, literature studies are inconclusive on whether physicians were recommending physical activity to older adults.

The review indicates that physicians consider arthritis in older adults to be part of growing old. With co-morbidities, activity limitations, and poor social and emotional support, physicians may not be recommending physical activity to their older patients. Hence, older adults' adherence to physical activity may be associated with physicians' recommendations. Studies in the areas of weight loss, smoking cessation, alcohol abuse, and diabetes indicate that physicians' recommendations had a positive effect on adherence to health-promoting behavior. However, information on the association between physicians' recommendations for physical activity and adherence to guidelines in arthritis literature and the influence of age on this association was limited.

Studies on the association between adherence and HRQOL have indicated that those who adhered to recommended levels of physical activity had better HRQOL. This association is well-studied, but physicians' recommendation, which may be a confounder in these studies, was not included in the model. A majority of these previous studies had no theoretical framework. In addition, studies on the influence of age on adherence to physical activity guidelines and HRQOL in individuals with arthritis are limited.

CHAPTER 3

METHODOLOGY

This chapter provides a description of the research questions and hypotheses, data source, study instrument, sampling design, study population, and sample involved. In addition, the operationalization of the dependent and independent variables is discussed, and the analysis approach is explained.

Research Questions and Hypotheses

Although there are studies predicting the characteristics of individuals who received physicians' recommendations for physical activity (Fontaine, Bartlett, & Heo, 2005; Honda, 2004), results on whether older adults with arthritis received physicians' recommendations remained inconclusive. The association between physicians' recommendations for physical activity and adherence has been investigated in other areas of health services research (Elley, Kerse, Arroll, & Robinson, 2003; Glasgow, Eakin, Fisher, Bacak, & Brownson, 2001; Kreuter, Chheda, & Bull, 2000; Loureiro & Nayga, 2006, 2007). These studies reported that individuals who did not receive physicians' recommendations for physical activity were less likely to adhere to physical activity guidelines compared to those who received physicians' recommendations. However, in the arthritis literature, information is limited on the association between physicians'

recommendations and adherence, and the influence of age on this association. Further, a number of studies examined the association between adherence to physical activity guidelines and HRQOL in individuals with arthritis (Abell, Hootman, Zack, Moriarity, & Helmick, 2005; Brown et al., 2003). However, these studies lacked a theoretical approach.

The following conceptual model (Figure 1) was developed to test the association between individual characteristics, physicians' recommendations for physical activity, adherence, and HRQOL. In particular, the analyses will highlight whether individuals' ages, given other individualized characteristics, are a predictor for physicians' recommendations for physical activity, and how attaining better HRQOL in the arthritis population is a sequence of processes including receiving physicians' recommendations, followed by adherence to physical activity, which ultimately is associated with better HRQOL for individuals with arthritis.

The study will draw attention to the relationship between individuals' ages, physicians' recommendations for physical activity, adherence to physical activity guidelines, and HRQOL in individuals with arthritis by answering the following research questions:

1. Are individuals' ages associated with physicians' recommendations for physical activity?
2. Are physicians' recommendations associated with adherence to physical activity guidelines?
3. Is adherence physical activity guidelines associated with HRQOL (measured as physically unhealthy days, and mentally unhealthy days) of individuals with arthritis?

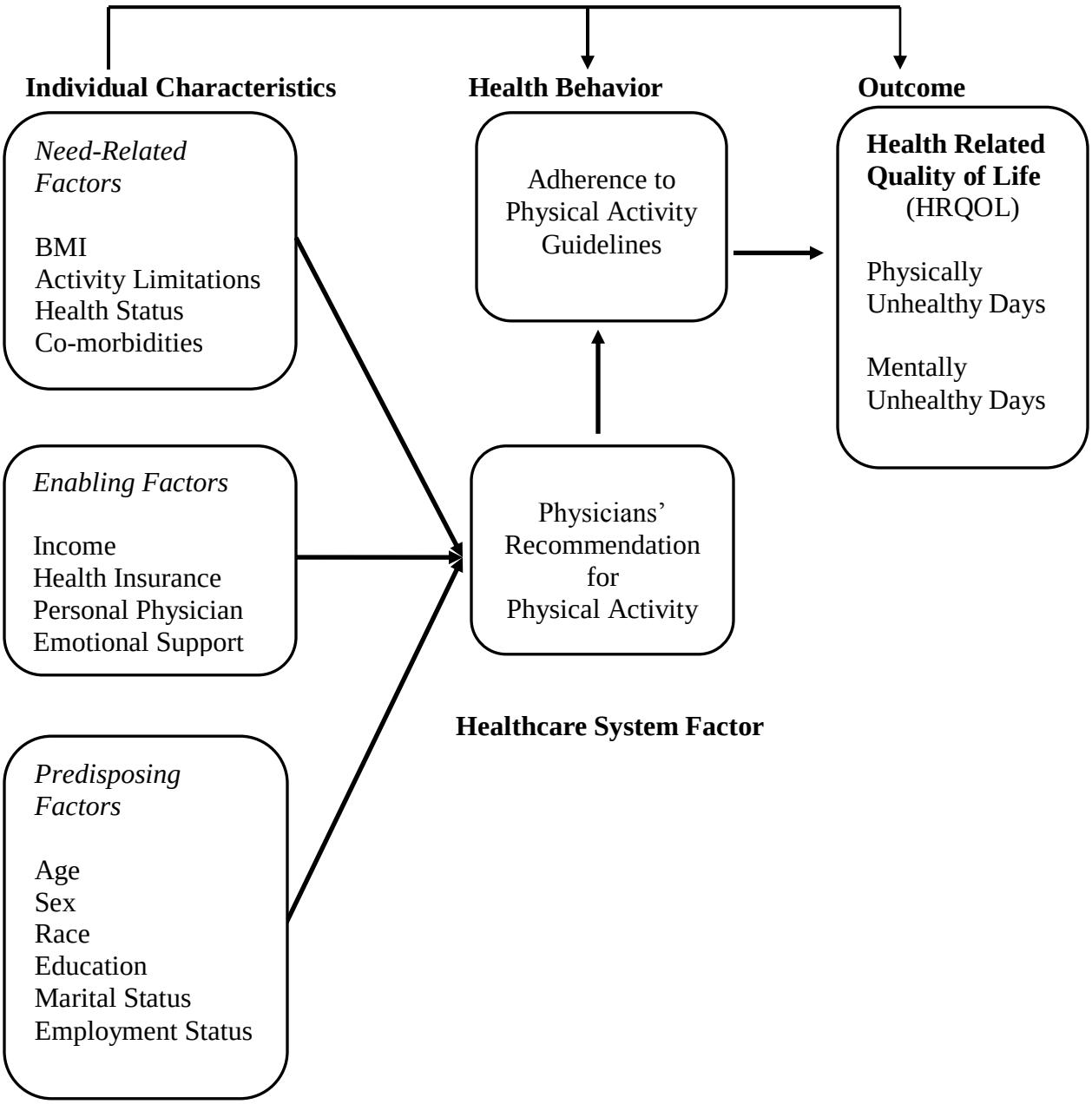

Figure 1. Conceptual framework for the study.

The aim of any pharmacological or non-pharmacological treatment is to improve the HRQOL of an individual. Empirical research in health services supports the association between physicians' recommendations and adherence, which in turn is associated with the HRQOL of an individual (Maddigan, Majumdar, & Johnson, 2005). The Andersen Aday Behavioral Model of Health Services Utilization theoretically supports this logic. According to the model, the receipt of physicians' recommendations for an individual with arthritis is a function of individual characteristics (Figure 1). The model is used to explain the inequitable receipt of physical activity recommendations by older adults (≥ 65 years of age) compared to younger adults (45-64 years of age). Physicians tend to recommend physical activity to some and not to others. They recommend physical activity to individuals who are more likely to follow their recommendations. Old age is accompanied by co-morbidities, activity limitations, and poor social or emotional support (Alliance for Aging Research, 2003). Hence, physicians may think that older adults might not follow their recommendations for physical activity (Fontaine et al., 2005). Therefore, physicians may be less likely to recommend physical activity to older adults compared to younger adults. Thus, hypothesis (1.1) is as follows:

> *Hypothesis 1.1: Older adults with arthritis are less likely to receive physicians' recommendations for physical activity compared to adults 45-64 years of age after controlling for need-related, enabling, and other predisposing factors.*

However, physicians' recommendations alone are not sufficient. Physicians' recommendations act as a catalyst for adherence (Kreuter et al., 2000; Petrella, Koval,

Cunningham, & Paterson, 2003). Since adherence is a self-care process which involves individual characteristics and healthcare system factors, such as physicians' recommendations, the Andersen Aday Behavioral Model of Health Services Utilization can be used to explain it (Murray et al., 2004). Adherence to guidelines for individuals with arthritis is a function of individual characteristics and health system factors (physicians' recommendations). Thus, hypothesis (2.1) is as follows:

> *Hypothesis 2.1: Those who do not receive physicians' recommendations are less likely to adhere to physical activity guidelines compared to the individuals who receive physicians' recommendations after controlling for need-related, enabling, and predisposing factors.*

As discussed previously, advancing age brings changes in the physical, mental, and social life of an individual with arthritis. Physicians may think that older adults might not follow their recommendations for physical activity compared to younger adults. Therefore, physicians may not recommend physical activity to older adults. The lack of physicians' recommendations for physical activity may lead to non-adherence in older adults. Hence, this study proposes to examine whether the association between physicians' recommendations and adherence to guidelines is the same for older and younger age groups after controlling for need-related, enabling, and other predisposing factors. Hence, hypothesis (2.2) is as follows:

Hypothesis 2.2: The association between physicians' recommendations for physical activity and adherence will be the same for older and younger adults after controlling for need-related, enabling, and predisposing factors.

One of the expected outcomes of any medical treatment or health-promoting behavior is to have a better HRQOL. Based on the conceptual framework for this study, the relationship between individual characteristics, health system factors (physicians' recommendations), and adherence to physical activity guidelines as a process determines an individual's HRQOL (Murray et al., 2004). In the model presented here, individuals achieve better HRQOL when physicians recommend physical activity and the recommendation is followed by adherence. Thus, adherence to physical activity guidelines will lead to a better HRQOL. In this study, HRQOL was measured as physically unhealthy days and mentally unhealthy days. Hence, research question 3.1 has two parts, i.e., (a) and (b). In part 3.1(a), HRQOL was measured as physically unhealthy days, and, in part 3.1 (b), HRQOL was measured as mentally unhealthy days.

Hypothesis 3.1 (a): Those who do not adhere to physical activity guidelines have higher physically unhealthy days compared to the individuals who adhere to guidelines after controlling for physicians' recommendations and need-related, enabling, and predisposing factors.

Hypothesis 3.1 (b): Those who do not adhere to physical activity guidelines have higher mentally unhealthy days compared to the individuals who adhere to

guidelines after controlling for physicians' recommendations and need-related, enabling, and predisposing factors.

Advancing age has an effect on the HRQOL of an individual, as it brings changes in the physical, mental, and social life of an individual with arthritis (Alliance for Aging Research, 2003). Therefore, older adults will be less likely to adhere to recommended levels of physical activity compared to younger adults and may have poor HRQOL. Hence, this study proposes to examine whether the association between adherence to guidelines and HRQOL will be the same for older and younger age groups after controlling for physicians' recommendations and need-related, enabling, and other predisposing factors. Hence, hypotheses 3.2 (a) and (b) are as follows:

Hypothesis 3.2 (a): The association between adherence to physical activity guidelines and physically unhealthy days will be the same for older and younger adults after controlling for physicians' recommendations and need-related, enabling, and predisposing factors.

Hypothesis 3.2 (b): The association between adherence to physical activity guidelines and mentally unhealthy days will be the same for older and younger adults after controlling for physicians' recommendations and need-related, enabling, and predisposing factors.

Data Source

This study is based on the 2007 Behavioral Risk Factor Surveillance System. The BRFSS is a CDC-established random-digit dial telephone survey of the non-institutionalized civilian United States adult population who are 18 years of age or older. This survey is conducted annually in all 50 states and Washington D.C., Guam, the Virgin Islands, and Puerto Rico. State health departments conduct the BRFSS with technical and methodological assistance from the CDC. Information on risk behaviors and health practices among adults is collected monthly by states using the standard questionnaire; the information collected is then forwarded to the CDC. The CDC aggregates the monthly data from all states, which are then returned to each state with standard tabulations and published by the states at year's end (Centers for Disease Control and Prevention, 2006). A five-question module on arthritis and activity limitations is included with the core survey in odd numbered years (2001, 2003, 2005, 2007 and so on). The aim of the survey is to collect information on prevalence data on risk behaviors and preventive health practices that affect individuals' health status (Centers for Disease Control and Prevention, 2006, 2008). The BRFSS is used by the states to identify emerging health problems, establish and track health objectives, develop and evaluate public health policies and programs, and support health-related legislative efforts (Centers for Disease Control and Prevention, 2008).

Study Instrument

The BRFSS questionnaire is designed by the CDC's Behavioral Surveillance Branch and by a working group of state coordinators (Centers for Disease Control and

Prevention, 2006). The BRFSS questionnaire has three parts: a) the core component with fixed, rotating, and emerging cores; b) optional modules; and, c) state-added questions. The core component is administered in all states without any change in wording. Questions on current health behaviors and demographic characteristics are included in the fixed core. The rotating core is administered in alternating years by all states, addressing different topics. The topics in the rotating core may be added as an optional module in the alternating years when they are not included in the core. The emerging core includes questions on recent health issues. They are part of the core for one year, and their inclusion in future surveys are based on an evaluation at the end of the year. The specific questions that states elect to use on their questionnaire are included in the optional modules. The modules are optional; however, if states decide to use them, they should be used without any modification. If the states decide to modify these optional questions, then they are included as state added questions. In addition, the states are encouraged to develop questions and gather data on health issues specific to the states. These questions are included under the state-added questions (Centers for Disease Control and Prevention, 2008). States have the discretion to add or delete the questions from the optional module or state-added questions after the core set of questions. The state-added questions are tested for their validity, reliability, and suitability by first pre-testing the questionnaire and then conducting a pilot study every year (Centers for Disease Control and Prevention, 2006).

Sampling Design

The BRFSS is a cross-sectional telephone survey opting for a Disproportionate Stratified Sampling (DSS) technique. Here the sample is divided into two strata: a) high

density strata for presumed density of telephone numbers and b) medium density strata for residential telephone numbers. In each state, the sample of all available telephone numbers in both strata is divided into blocks of 100. The telephone numbers are selected from the high-density stratum at a higher rate than from medium-density stratum. The sampling ratio of 1.5:1 is the standard BRFSS policy from year 2003 onward. This means that the high-density stratum is sampled at 1.5 times the rate at which the medium-density stratum is sampled (Centers for Disease Control and Prevention, 2006).

The study sample is selected randomly from each stratum using the Computer Assisted Telephone Interviewing (CATI) method. An eligible household for interviewing is one that has a separate entrance; occupants eat separately from other persons on the property; and, the place is a primary or secondary residence for the occupants. Non-eligible households include institutions such as nursing homes; dormitories; group homes, such as sororities and fraternities; halfway houses; shelters; and vacation homes not occupied by household members for more than 30 days per year. If there is only one person and that person is answering the phone, then the interviewer proceeds with the interview. If there is more than one adult in the household, the interviewer asks for the total number of males and females in the household who are 18 years of age or older. The CATI system then randomly selects one of the adults in the household to be interviewed (Centers for Disease Control and Prevention, 2006).

Study Population and Sample

The population for this study were individuals with arthritis who were 45 years of age or older. Being a rotating core, the arthritis management module is administered every odd year of the survey. The arthritis management module was administered by 19

states in the year 2007. These were Alabama, Alaska, Arizona, California, Connecticut, Florida, Georgia, Illinois, Indiana, Iowa, Kentucky, Minnesota, New Mexico, New York, Pennsylvania, Rhode Island, South Carolina, Virginia, and West Virginia. The total number of respondents in the 2007 BRFSS survey was 430,912. Individuals aged 45 years or older with physician-diagnosed arthritis in the 19 states, that administered the arthritis management module in 2007 numbered 49,706. Only those respondents who had complete information on all the variables in our model were included in this analysis. Thus, the final sample size was reduced to 33,071, with 46.8% of individuals with arthritis belonging to the group 65 years or older, and 53.2% belonging to the group 45-64 years old (Figure 2). We did not find the individuals in our study to be significantly different from those who were excluded on age (Φ=0.01, p=0.10), and co-morbidities (Φ=0.007, p=0.36). However, the groups were different by sex (Φ=0.01, p<0.05); the excluded group (n=16,635) had more females relative to the included group.

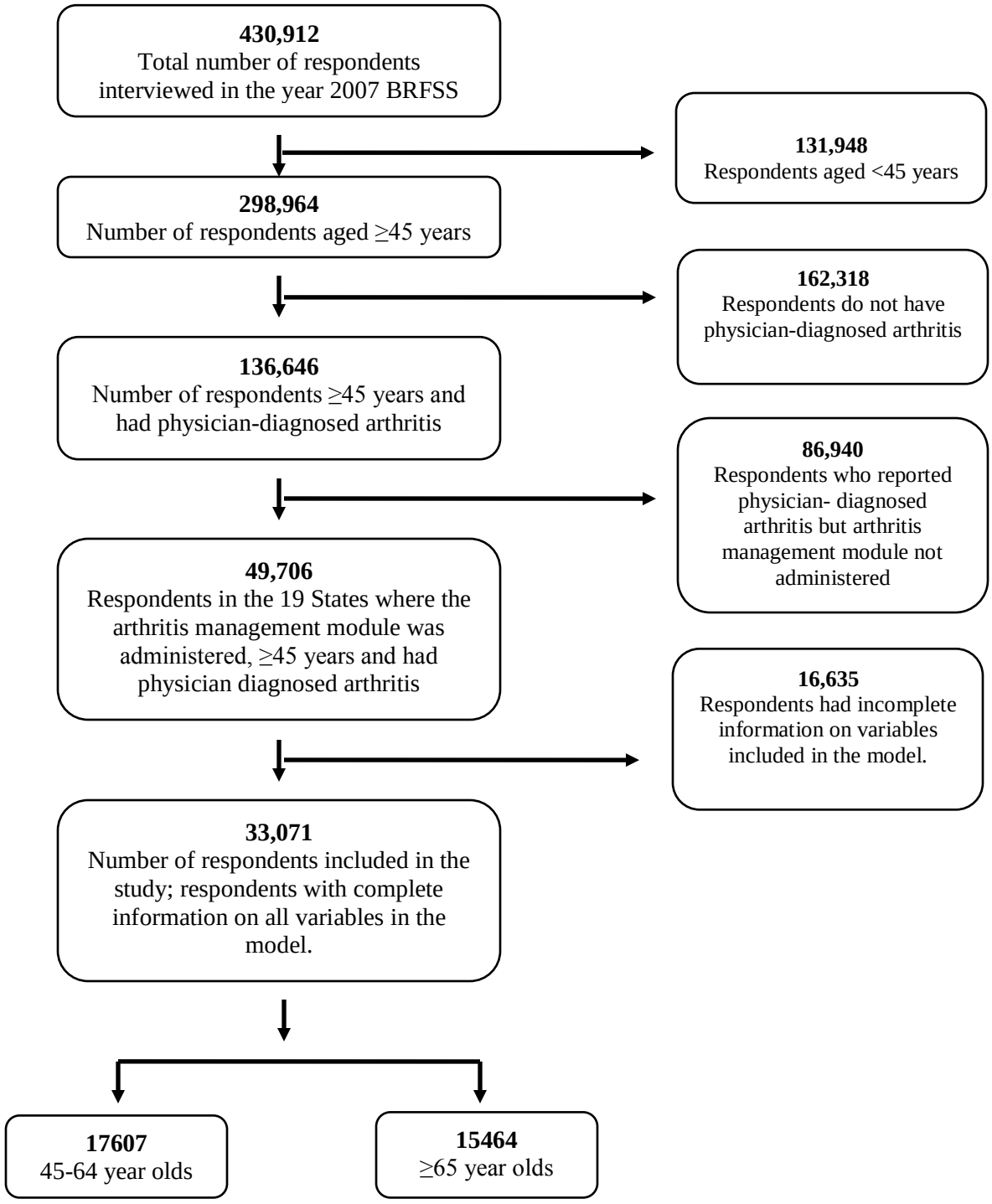

Figure 2. Flow chart for inclusion of individuals in the study.

Variables and Measurements

The study includes a three-step analyses process of determining the association between age and physicians' recommendations for physical activity, the association between physicians' recommendations and adherence to physical activity guidelines, and the association between adherence to physical activity guidelines and HRQOL. The dependent variable in step one was an independent variable in step two and a covariate in step-three.

Step one (Figure 3) answers the research question on the association between individuals' ages and physicians' recommendations for physical activity. The dependent variable for the research question was physicians' recommendations for physical activity. This variable was measured using the item "has a doctor or other health professional ever suggested physical activity or exercise to help your arthritis or joint symptoms." The response to this item was dichotomous (yes/no). The independent variable was the age of the individual with arthritis. Age was categorized into two groups as 45-64 years and 65 years or older. The study did not include the younger age (18-44 years) group since an individual's probability of acquiring arthritis increases with age. The covariates for the study were sex, race, education, marital status, employment (predisposing factors), income, health insurance, having a personal physician, emotional support (enabling factors), BMI, activity limitations, health status, and co-morbidities (need-related factors).

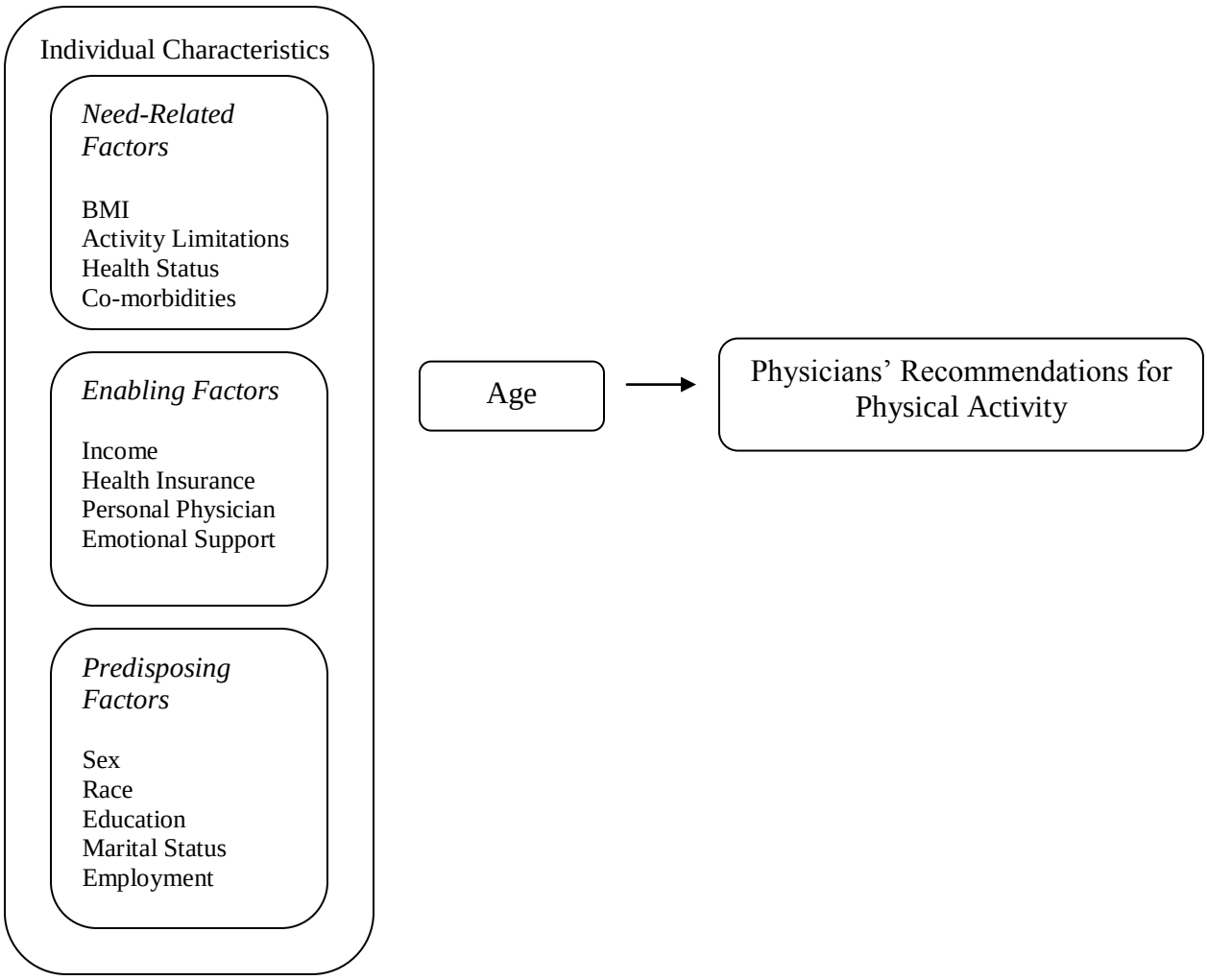

Figure 3. Association between individuals' ages and physicians' recommendations for physical activity controlling for covariates.

Predisposing factors

Sex. Both males and females were included in the analyses. Review of the literature indicated physicians' recommendations might vary by the sex of the individual. Females were more likely to be recommended physical activity by physicians than males (Fontaine et al., 2005; Fontaine, Haaz, & Bartlett, 2007; Honda, 2004).

Race. Race was categorized as Whites and non-Whites. Previous studies indicated physicians' recommendations varied by the race of an individual. Physicians were more likely to recommend physical activity to non-Whites compared to Whites (Fontaine et al., 2005; Glasgow et al., 2001).

Education. Previously conducted studies indicated that physicians' recommendations varied by the educational level of an individual. Those who had an education higher than high school were more likely to receive physicians' recommendations for physical activity (Fontaine et al., 2005; Glasgow et al., 2001; Honda, 2004) . Education was categorized as those having an education less than or equal to high school, or greater than high school education.

Marital status. Married people were more likely to receive recommendations for physical activity by physicians compared to those who were not married (Glasgow et al., 2001; Honda, 2004). Physicians may perceive that these individuals may follow the recommendation since they have spouses to encourage them to do so. Marital status was categorized as married and unmarried.

Employment Status. Unemployed individuals were more likely to receive physicians' recommendations for diet and exercise compared to employed individuals (Loureiro & Nayga, 2006). Since a majority of the individuals in the age group 65 years of age or older may be retirees, they may be more likely to receive recommendations for physical activity.

Fontaine and colleagues (2005) indicated that the reason why demographic variables were associated with physicians' recommendations was not clear. Probably, physicians recommended physical activity to only those individuals whom they thought were more likely to follow their recommendation.

Enabling factors

Income. Previous studies showed that physicians' recommendations for physical activity varied by individuals' annual household income (Loureiro & Nayga, 2007; Wee, McCarthy, Davis, & Phillips, 1999). Since a majority of older adults are retirees, they might have low annual household income compared to their younger counterparts. Hence, they might be less likely to receive recommendations for physical activity. Originally, in this study, income was to be categorized based on the 2007 annual household income (average income $50,233) (DeNavas-Walt, Proctor, & Smith, 2008). However, the annual household income variable in 2007 BRFSS was categorized as less than $10,000, $10,000-14, 999, $15,000-$24,999, $25,000- $34,999, $35,000-$49,999 $50,000-$74,999, and $75,000 and more. Hence, it was not possible to categorize the income as less than $50,233 and greater than $50,233. Based on the categorization of income in previously conducted studies, this study categorized annual household income as less than $50,000 and greater than or equal to $50,000 (Glasgow et al., 2001; Wee et al., 1999) .

Health Insurance. Individuals with health insurance were more likely to receive physicians' recommendations compared to those who did not have health insurance

(Glasgow et al., 2001; Honda, 2004). Those who had health insurance may use physician services more compared to individuals who did not have health insurance and are more likely to receive recommendations for physical activity. Thus, older adults who are Medicare beneficiaries may be more likely to receive recommendations for physical activity. Health insurance was categorized as a binary variable (yes/no).

Personal Physician. Individuals who have a personal physician may get regular and better care from their physician. These individuals are more likely to receive recommendations for physical activity from physicians than those who do not have a personal physician. Having a personal physician was categorized as a binary variable (yes/no).

Emotional Support: Based on the suggestion by Fontaine and colleagues, physicians were more likely to recommend physical activity to those who had emotional support from family and friends compared to those who did not have support. Physicians may perceive that these individuals may follow the recommendation since they had family and friends to encourage them to do so. This variable was measured based on the item "how often do you get the social and emotional support you need?" The responses were measured as "always, usually, sometimes, rarely and never." For this study, emotional support was categorized as those who received emotional support (always, usually, sometimes), and those who did not (rarely and never).

Need-Related Factors

BMI. Physicians' recommendations for physical activity varied based on whether an individual was obese or not. Physicians were more likely to recommend physical activity to obese individuals compared to non-obese individuals (Wee et al., 1999). BMI was categorized as non-obese (BMI<30) and obese (BMI ≥30).

Activity Limitations. Individuals with arthritis-attributable activity limitations are more likely to be physically inactive (Kaplan, Huguet, Newsom, & McFarland, 2003). Physicians may not recommend physical activity to this group, as they perceive these individuals may not follow their recommendations. Activity limitation was measured using the item "Are you now limited in any of your usual activities because of arthritis or joint symptoms?" The response to this item was a binary variable (yes/no).

Health Status. Individuals with poor health status were more likely to receive physicians' recommendations for physical activity compared to those with good health status (Honda, 2004). A majority of the older adults might have more diseases with advancing age. Hence, they may have poor health status and be more likely to receive physicians' recommendations for physical activity. Health status was categorized as good or poor.

Co-morbidities. Physicians were more likely to recommend physical activity to individuals with co-morbidities compared to those who did not have co-morbidities (Glasgow et al., 2001). The variable co-morbidities was computed by summing up the

responses on diabetes, hypertension, high cholesterol, myocardial infarction, angina/CHD, stroke, and asthma. All affirmative responses were coded as "1", and negative responses were coded as "0", such that co-morbidities for an individual ranged from 0 —7 when summed up. It was measured as a binary variable (those who had co-morbidities and those who did not). Glasgow and colleagues (2001) adopted this classification in a study on physician counseling behaviors regarding physical activity.

Step two (Figure 4) examined the association between adherence to physical activity guidelines and physicians' recommendations. The dependent variable was adherence to physical activity guidelines. Adherence to physical activity guidelines was measured based on a computed variable "recommended physical activity levels calculated" from the 2007 BRFSS. The responses were "adhered to the physical activity guidelines" and "did not adhere to the physical activity guidelines." This classification was based on ACR's recommendations for physical activity. Those who adhered to physical activity guidelines were individuals with at least 30 minutes of low-to-moderate physical activity on 5 or more days per week. Those who did not adhere to the physical activity guidelines included individuals who did not meet the recommended levels and those who were physically inactive.

The independent variable for this phase was physicians' recommendations for physical activity (measurement as explained in step one). Studies in health services have shown that individuals who received physicians' recommendations were more likely to adhere (Kreuter et al., 2000; Loureiro & Nayga, 2007). The covariates for the model were predisposing factors (age, sex, race, education, marital status, and employment), enabling

factors (income, health insurance, personal physician, and emotional support), need-related factors (BMI, activity limitations, health status, and co-morbidities).

Control Variables

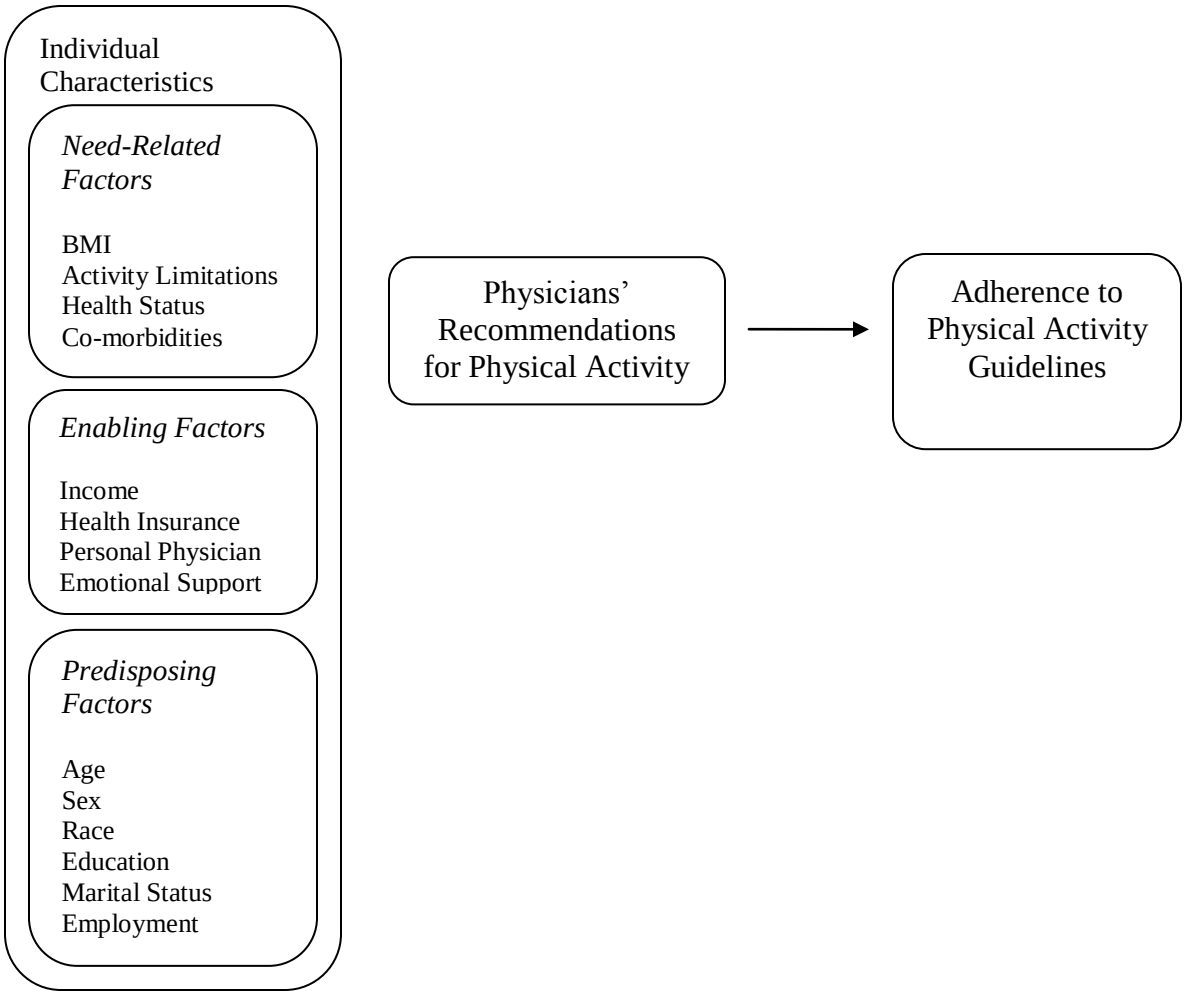

Figure 4. Association between physicians' recommendations for physical activity and adherence to physical activity guidelines controlling for covariates.

Older adults with arthritis have more numbers of co-morbidities and poor social and emotional support (Alliance for Aging Research, 2003). Physicians' recommendations for physical activity may be based on the physicians' perceived health need of the individual and the likelihood of the individual to follow the recommendations (Fontaine et al., 2005). However, there is a need for physical activity

recommendations in this population. Physicians might not recommend physical activity to this group compared to their younger counterparts because the patients might not follow their recommendations. Because of a lack of recommendation, older adults may not adhere to physical activity. Hence, another part of step two (Figure 5) was to examine whether the effect of physicians' recommendations for physical activity on adherence was the same for older and younger age groups after controlling for need-related, enabling, and other predisposing factors.

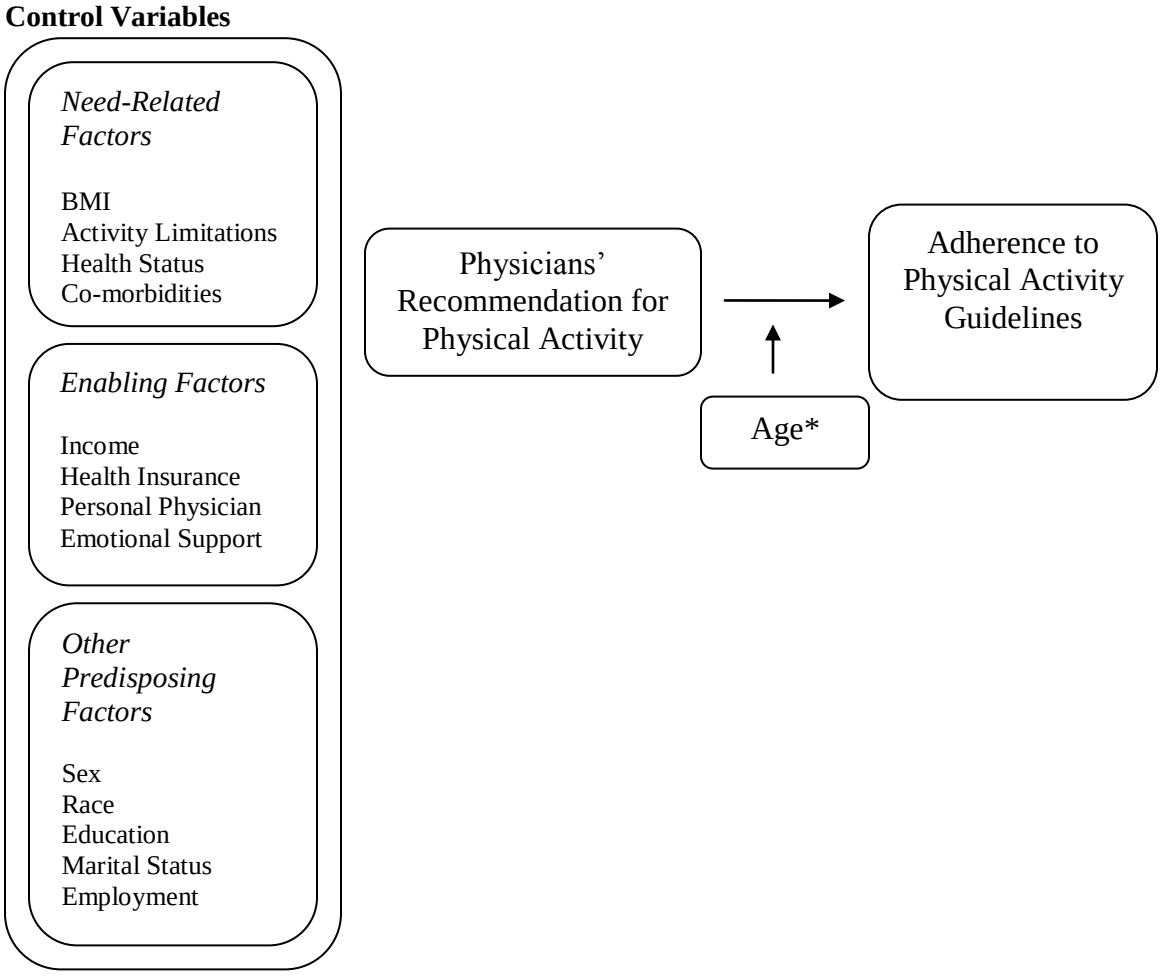

Figure 5. Influence of individuals' ages on the association between adherence and physicians' recommendations for physical activity controlling for covariates.
*The analysis for the two age groups (45-64 years old and 65 years or older) were conducted as separate independent models and compared.

Step three (Figure 6) examined the association between adherence to physical activity guidelines and HRQOL. The dependent variable was HRQOL. It is defined as the extent to which physical, emotional, and social well-being are affected by a medical condition or treatment (Fairclough & Ganz, 2005). The HRQOL was measured as the number of physically unhealthy days and mentally unhealthy days in the arthritis population. Abell and colleagues adopted this method of calculating HRQOL. Both physically and mentally unhealthy days were included in the model as count variables. For physical health, increasing days of unhealthy days is associated with higher levels of activity limitations. Higher numbers of mentally unhealthy days are considered an indicator of anxiety and clinical depression by clinicians and clinical researchers (Abell, Hootman, Zack, Moriarty & Helmick, 2005). The independent variable was adherence to recommended levels of physical activity measured as explained in step two.

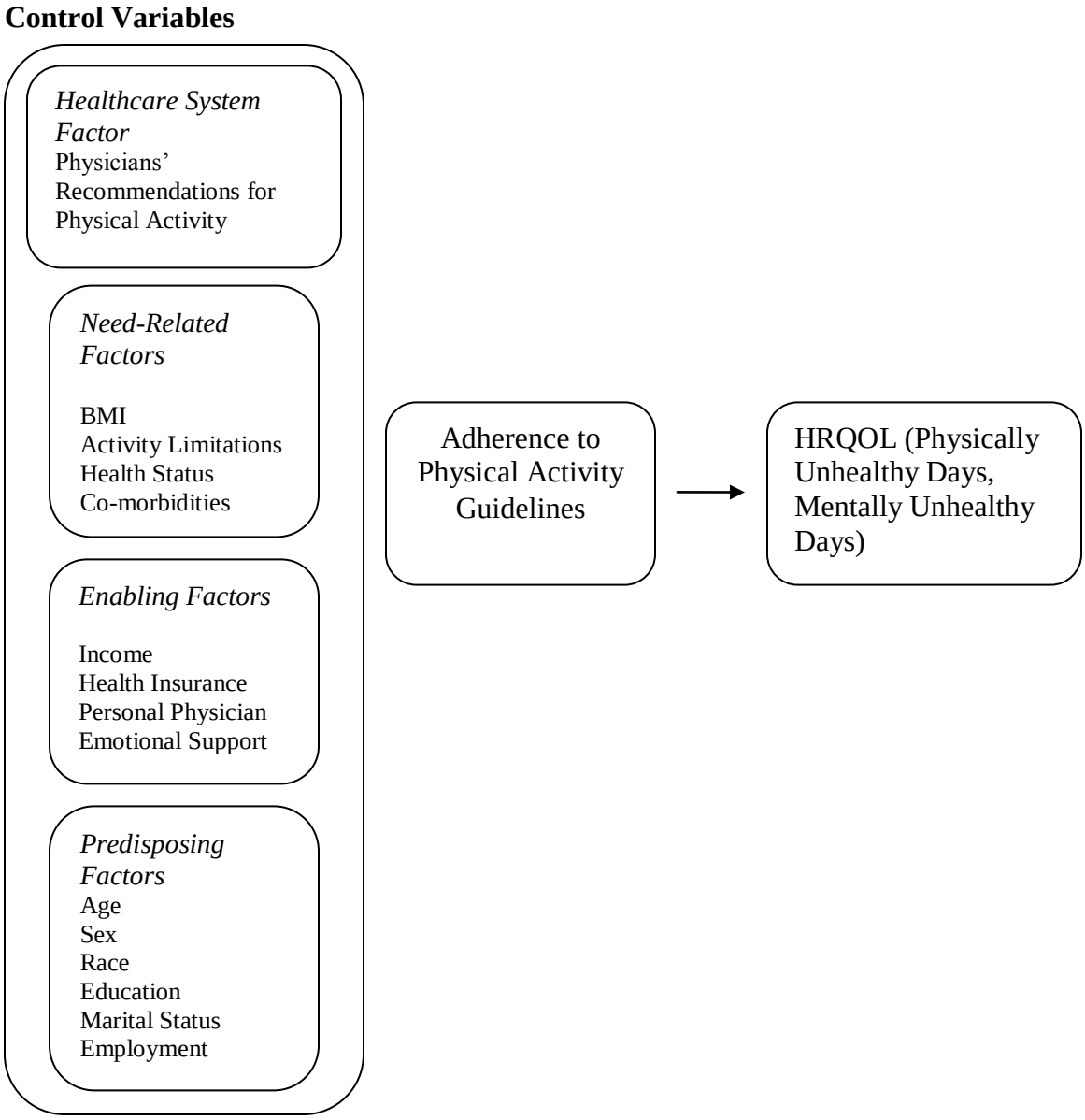

Figure 6. Association between adherence to physical activity guidelines and HRQOL (measured as physically unhealthy days and mentally unhealthy days) controlling for covariates.

Older adults are less likely to receive physicians' recommendations for physical activity compared to the age group 45-64 years. Therefore, they may be less likely to adhere to physical activity guidelines and may have lower HRQOL. Hence, a part of step three (Figure 7) was to examine whether the association between adherence to physical

activity guidelines and HRQOL was the same for older and younger age groups, controlling for physicians' recommendations and need-related, enabling, and other predisposing factors.

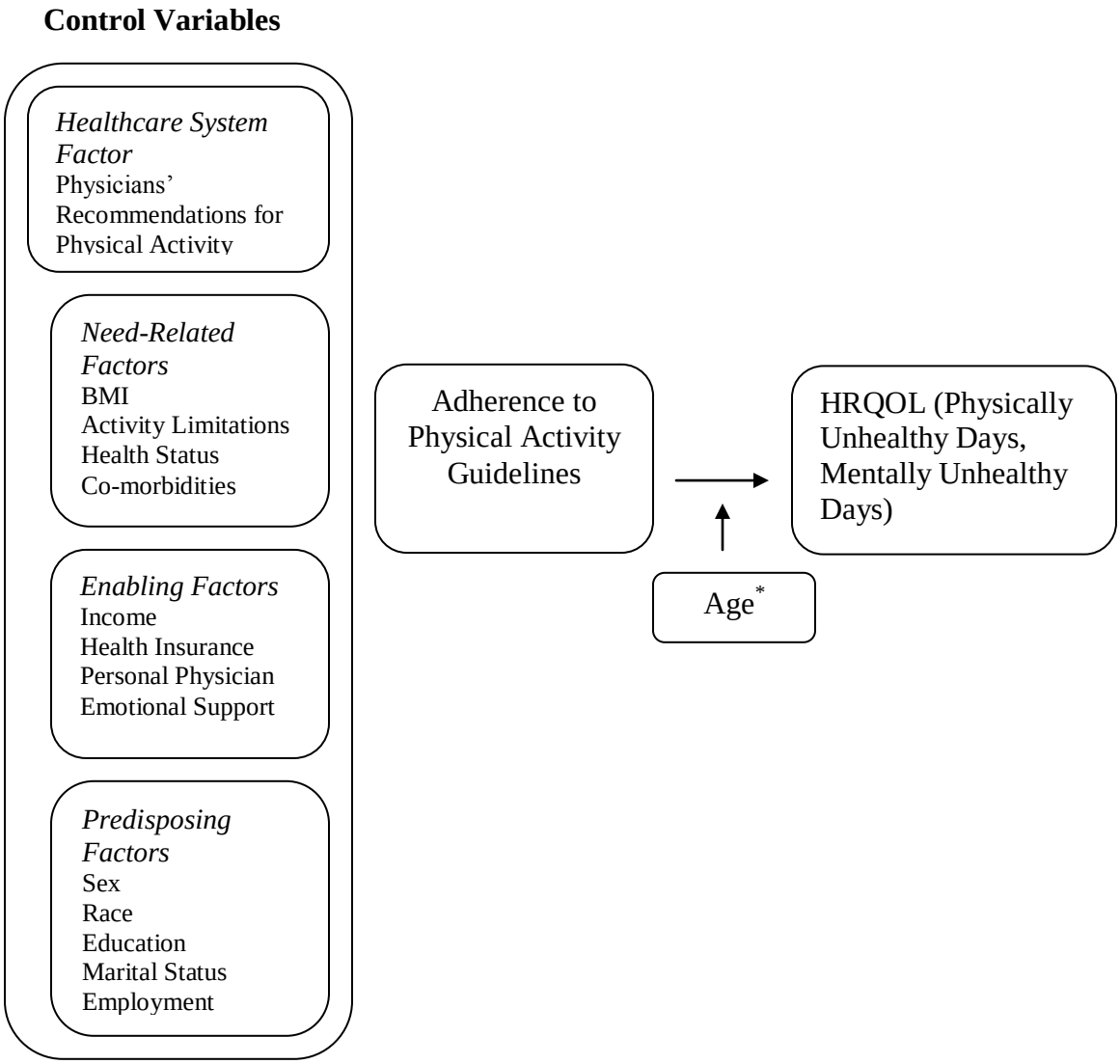

Figure 7. Influence of individuals' ages on the association between HRQOL and adherence to physical activity guidelines controlling for covariates.
*The analysis for the two age groups (45-64 years old and 65 years or older) was conducted as separate independent models and compared.

Coding Procedure

A consistent coding procedure was followed where all variables with the high-risk categories were coded as "0," and the lower risk categories were coded as "1." For example, for the variable physicians' recommendations, those who did not receive the recommendation were coded as "0," and those who received a recommendation were coded as "1"; individuals with co-morbidities were coded as "0," and those with no co-morbidities were coded as "1."

Methods of Analysis

The Institutional Review Board of the University of Alabama at Birmingham approved this study (protocol # N090121006). The Statistical Package for Social Sciences (SPSS) Version 17.0 was used for data management and analyses. Univariate and bivariate statistical tests were conducted. Variance Inflation Factor was calculated to determine multicollinearity among independent variables.

The bivariate associations between individuals' ages and physicians' recommendations for physical activity, and physicians' recommendations and adherence to physical activity guidelines, were analyzed using chi-square analysis. Since the variables in the analysis were nominal variables, the strength of associations were assessed based on phi correlation coefficient (Φ). In addition, odds ratios were calculated to identify the group that was less likely to receive physicians' recommendations for physical activity and were less likely to adhere to physical activity guidelines.

Hypotheses 1.1 and 2.1: Multiple logistic regression was used to analyze the association between individuals' ages and physicians' recommendations after controlling for need-related, enabling, and other predisposing factors, and the association between physicians' recommendations and adherence to of physical activity guidelines controlling for need-related, enabling, and predisposing factors. These models had the dependent variables measured as binary variables. The results were interpreted as odds ratios. The Hosmer-Lemeshow test was used to assess the goodness of fit of the models.

Hypothesis 2.1: Multiple logistic regression was used to analyze the associations between physicians' recommendations and need-related, enabling, and other predisposing factors and adherence to physical activity guidelines for the two age groups (45-64 years and 65 years or older). The models for the two age groups were run separately, and the results were compared. Results were presented as odds ratios. The Hosmer-Lemeshow test was used to assess the goodness of fit of the model.

The bivariate associations between adherence to physical activity guidelines and physically unhealthy days and adherence to physical activity guidelines and mentally unhealthy days were analyzed using the Wilcoxon test, which is a non-parametric test to measure the bivariate association between a count variable and a nominal variable.

Hypotheses 3.1(a) and 3.1(b): The negative binomial regression model was used to examine the associations since the dependent variables in both models were overdispersed count variables; i.e., the variance was larger than the mean (Hoffman, 2004). To examine the overdispersion a standard procedure, i.e., contrasting the deviance resulting from Poisson regression and negative binomial regression, was used. Comparisons indicated a lower deviance value for negative binomial. Hence, the negative

binomial approach was the most appropriate method of analysis for producing unbiased standard errors.

Results from negative binomial regression were expressed as percentages estimated from the following equation:

$\Delta\ \% = (e^{\beta} - 1)\ X\ 100$ (Pampel, 2000)

$\Delta\ \%.$ = increase or decrease in the dependent variable due to one unit change in the independent variable

e^{β} = exponentiated coefficient of estimate

For example, if the exponentiated coefficient of estimate for individuals who did not adhere to recommended levels of physical activity was 1.14, then the dependent variable for the number of physically unhealthy days is interpreted as (1.14-1) X 100. This means the number of physically unhealthy days was 14% higher for those who did not adhere to the recommended levels of physical activity compared to those who adhered to recommended levels of physical activity.

Hypotheses 3.2(a) and 3.2(b): The negative binomial was considered appropriate to analyze the associations for both age groups (45-64 years and 65 years or older). The models for the two age groups were run separately, and the results were compared. The results were presented as percentages, and the deviance goodness of fit test was used to assess the model fit.

CHAPTER 4

RESULTS AND FINDINGS

This chapter discusses the results of the research questions and the hypotheses proposed in chapter 3. Results from univariate analysis, bivariate tests, multiple logistic regression, and negative binomial regressions are presented in tabular format.

Respondents' Characteristics

The sample had 33,071 individuals with physician-diagnosed arthritis. Table 1 represents the characteristics of the respondents. To answer the research questions, three data sets were created: a) the whole sample containing both the age groups (n=33,071); b) those aged 45-64 years (n=17,607); and c) 65 years or older (n=15,464). Of these 33,071, 44% did not receive any physicians' recommendations for physical activity, 60% did not adhere to the physical activity guidelines, mean physically unhealthy days were 7.7, mean mentally unhealthy days were 4.4. In addition, 47% were 65 years or older, 65% were females, 15% were non-Whites, 67.4% had an annual income less than $50,000, 83% had personal physician, 36% were obese, 44% had activity limitations, and 81% had co-morbidities.

Table 1

Variables, Measurements, Frequencies and P value

Variable and Measurement	Sample with missing/ refused/do not know (n=49706) (%)	Sample minus missing/refused /do not know (n=33071) (%)	≥ 65 yrs (n=15464) (%)	45-64 yrs (n=17607) (%)	*p* value
Physicians' Recommendations					
No	43.1	43.9	46.6	41.4	
Yes	53.3	56.1	53.4	58.6	0.16
Adherence to physical activity guidelines					
Not adhered	57.8	60.0	62.4	58.0	
Adhered	35.8	40.0	37.6	42.0	0.75
HRQOL (Physically unhealthy days)					
Mean (SD)	1.5 (2.5)	7.7 (11.2)	7.3 (11)	8.1 (11)	0.62
HRQOL (Mentally unhealthy days)					
Mean (SD)	1.0 (2.2)	4.4 (8.9)	2.3 (7)	6.0 (10)	0.36
Independent Variables					
Predisposing factors					
Age					
≥ 65 years	50.0	46.8	-	-	-
45-64 years	50.0	53.2	-	-	
Sex					-
Female	67.9	65.0	65.5	64.6	
Male	32.1	35.0	34.5	35.4	0.63
Race					
Non-White	15.6	15.2	11.7	18.3	
White	83.3	84.8	88.3	81.7	0.21
Education					
≤ HS	49.6	47.1	51.9	42.8	
> HS	50.2	52.9	48.1	57.2	0.05
Marital Status					
Unmarried	49.2	48.0	54.6	42.3	
Married	50.6	52.0	45.4	57.7	0.20
Employment					
Unemployed	68.8	66.1	88.4	46.5	
Employed	31.0	33.9	11.6	53.5	0.17

Table 1 (continued)

Variables, Measurements, Frequencies and P Value

Variable and Measurement	Sample with missing/ refused/do not know (n=49706)	Sample minus missing/refused/ do not know (n=33071)	≥ 65 years (n=15464)	45-64 years (n=17607)	*p* value
Independent Variables					
Enabling Factors					
Income					
< $50,000	57.5	67.4	77.4	58.7	0.53
≥ $50,000	26.5	32.6	22.6	41.3	
Health Insurance					
No	7.2	7.1	1.4	12.1	
Yes	92.6	92.9	98.6	87.9	0.16
Personal Physician					
No	17.4	16.7	15.6	17.6	
Yes	82.3	83.3	84.4	82.4	0.20
Emotional Support					
No	24.3	24.6	22.4	26.5	
Yes	72.0	75.4	77.6	73.5	0.47
Need-Related factors					
BMI					
Obese	33.3	35.5	29.0	41.2	
Non-obese	63.0	64.5	71.0	58.8	0.95
Activity limitation					
Yes	43.8	44.2	42.0	46.3	
No	55.6	55.8	58.0	53.7	0.15
Health Status					
Poor	34.6	33.6	33.8	33.5	
Good	64.9	66.4	66.2	66.5	0.56
Co-morbidities					
Yes	81.5	81.2	86.3	76.6	
No	18.5	18.8	13.7	23.4	0.42

Table 2

Correlation Matrix[a] for the Independent Variables (n=33071)

	Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Age	1													
2	Sex	0.01	1												
3	Race	-0.09[b]	0.03[b]	1											
4	Education	0.09[b]	0.05[b]	0.07[b]	1										
5	Marital Status	0.12[b]	0.20[b]	0.09[b]	0.07[b]	1									
6	Employment	0.44[b]	0.03[b]	0	0.15[b]	0.10[b]	1								
7	Income	0.20[b]	0.13[b]	0.12[b]	0.34[b]	0.35[b]	0.31[b]	1							
8	Health Insurance	-0.20[b]	0	0.08[b]	0.07[b]	0.04[b]	-0.05[b]	0.12[b]	1						
9	Personal Physician	-0.02[b]	-0.04[b]	0.02[b]	0.02[b]	0.02[b]	0.02[b]	0.05[b]	0.11[b]	1					
10	Emotional Support	-0.04[b]	0	0.13[b]	0.12[b]	0.15[b]	0.06[b]	0.18[b]	0.09[b]	0.05[b]	1				
11	BMI	-0.12[b]	0.01[b]	0.08[b]	0.06[b]	0	-0.02[b]	0.05[b]	0.03[b]	0.00	0.04[b]	1			
12	Activity Limitation	-0.04[b]	0.01[b]	0	0.04[b]	0.09[b]	0.20[b]	0.16[b]	0.03[b]	0.06[b]	0.12[b]	0.13[b]	1		
13	Health Status	0.00	0.01[b]	0.11[b]	0.20[b]	0.11[b]	0.23[b]	0.26[b]	0.08[b]	0.09[b]	0.19[b]	0.13[b]	0.39[b]	1	
14	Co-morbidities	0.12[b]	-0.01[b]	0.03[b]	0.06[b]	0.04[b]	0.16[b]	0.10[b]	-0.03[b]	-0.05[b]	0.04[b]	0.15[b]	0.12[b]	0.18[b]	1

Note. [a] Phi correlation coefficient; [b] Correlations were significant at 0.05 level

Variance Inflation Factor was calculated to determine multicollinearity. The values for variance inflation factor were less than 10. Hence, multicollinearity was not a concern in the model.

Physicians' Recommendations for Physical Activity and Individuals' Age

This analysis looked at the association between individuals' ages and physicians' recommendations for physical activity. The observed frequencies are shown in Table 3. There is an association between physicians' recommendations for physical activity and age ($\Phi = 0.05$, $p < 0.001$).

Table 3

Observed Frequencies (Physicians' Recommendation for Physical Activity, Age)

			Age Groups		
			≥ 65 years	45-64 years	Total
Physicians' Recommendations for Physical Activity	No	(N)	7207	7296	14503
		(%)	(46.6)	(41.4)	(43.9)
	Yes	(N)	8257	10311	18568
		(%)	(53.4)	(58.6)	(56.1)
	Total	(N)	15464	17607	33071
		(%)	(100)	(100)	(100)

The sample odds ratio (OR) was 1.2 $\left[(7207 \times 10311) \div (7296 \times 8257)\right]$ i.e., older adults were likely to not receive physicians' recommendations for physical activity compared to individuals in the younger age group.

The analysis tested whether those who were 65 years or older were less likely to receive physicians' recommendations for physical activity compared to the group 45-64 years old, controlling for need-related, enabling, and other predisposing factors (H1). As shown in Table 4, those in the age group 65 years or older were less likely (OR=0.86) to

receive physicians' recommendations for physical activity compared to the group 45-64 years, controlling for need-related, enabling, and other predisposing factors.

Among the predisposing factors, all variables (sex, race, education, and marital status) except employment status were significant predictors of physicians' recommendations. The strongest predictors were sex and race. Females were more likely (OR=1.43) to receive physicians' recommendations compared to males. Non-Whites were more likely (OR=1.32) to receive physicians' recommendations for physical activity compared to Whites.

All of the enabling factors (income, health insurance, personal physician, and emotional support) were significant predictors of physicians' recommendations. The strongest predictors were income and having a personal physician. Those with an annual household income of less than $50,000 were less likely (OR=0.90) to receive physicians' recommendations for physical activity compared to those with annual incomes greater than or equal to $50,000. Compared to those who had a personal physician, those who did not have one were less likely (OR=0.89) to receive physicians' recommendations for physical activity.

Except for health status, all the other need-related factors (BMI, activity limitations, and co-morbidities) were significant predictors of physicians' recommendations. BMI was the strongest predictor among the need-related factors. Those who were obese were more likely (OR=1.71) to receive physicians' recommendations for physical activity compared to those who were non-obese. The Hosmer-Lemeshow goodness of fit test (χ^2=4.02, p =0.85) indicated the model to be a good fit.

Table 4

Association between Individuals' Ages and Physicians' Recommendations for Physical Activity Controlling for Need-Related, Enabling, and other Predisposing Factors among Individuals with Arthritis (n=33,071)

Variable (Reference Category)		β	SE	Wald Stat.	OR (95% CI)
Age (45-64 yrs)	≥ 65 yrs	-0.14	0.02	29.71	0.86 (0.81,0.91)**
Control Variables					
Other Predisposing factors					
Sex (Male)	Female	0.35	0.02	216.99	1.43 (1.36,1.50)**
Race (Whites)	Non-Whites	0.28	0.02	72.14	1.32 (1.24,1.41)**
Education (> HS)	≤HS	-0.17	0.02	51.74	0.83 (0.79,0.87)**
Marital Status (Married)	Unmarried	-0.07	0.02	9.23	0.92 (0.88,0.97)**
Employment(Employed)	Unemployed	0.03	0.02	1.23	1.03 (0.97,1.09)
Enabling factors					
Income (≥$50,000)	<$50,000	-0.10	0.02	12.60	0.90 (0.85,0.95)**
Health insurance (Yes)	No	-0.17	0.04	15.00	0.84 (0.76,0.91)**
Personal Physician (Yes)	No	-0.11	0.03	15.04	0.89 (0.83,0.94)**
Emotional support (Yes)	No	-0.12	0.02	20.22	0.88 (0.83,0.93)**
Need- related factors					
BMI (Non-obese)	Obese	0.54	0.02	478.15	1.71(1.63,1.80)**
Activity limitation (No)	Yes	0.25	0.02	97.78	1.28 (1.22,1.35)**
Health status (Good)	Poor	0.00	0.02	0.00	1.00 (0.94,1.05)
Co-morbidities (No)	Yes	0.25	0.02	73.52	1.29 (1.21,1.37)**

Note. OR=Odds Ratio; CI = Confidence Interval; ** p <0.001

Adherence to Physical Activity Guidelines and Physicians' Recommendations

The analysis looked at the association between adherence to physical activity guidelines and physicians' recommendations. The observed frequencies are shown in Table 5. There is an association between adherence to physical activity guidelines and physicians' recommendations for physical activity (Φ = - 0.01, p <0.05).

Table 5

Observed Frequencies (Adherence to Physical Activity Guidelines, Physicians' Recommendations for Physical Activity)

			Physicians' Recommendations for Physical Activity		
			No	Yes	Total
Adherence to Recommended Levels of Physical Activity	Not Adhered	(N)	8598	11261	19859
		(%)	(59.3)	(60.6)	(60.0)
	Adhered	(N)	5905	7307	13212
		(%)	(40.7)	(39.4)	(40.0)
	Total	(N)	14503	18568	33071
		(%)	(100)	(100)	(100)

The sample OR was 0.94 $[(8598 \times 7307) \div (11261 \times 5905)]$ i.e., those who did not receive physicians' recommendations for physical activity were less likely to adhere to physical activity guidelines compared to individuals who received physicians' recommendations.

Hypothesis (H2.1) tested whether those who did not receive physicians' recommendations for physical activity were less likely to adhere to physical activity guidelines compared to individuals who received physicians' recommendations, controlling for the need-related, enabling, and predisposing factors. As shown in Table 6, those who did not receive physicians' recommendations were less likely (OR=0.94) to

adhere to physical activity guidelines compared to those who received physicians' recommendation for physical activity, controlling for the covariates. Among the predisposing factors, age, sex, race, marital status, and employment status were significant predictors of adherence to physical activity guidelines. Employment status was the strongest predictor among the predisposing factors. Those who were unemployed were more likely (OR=1.12) to adhere to guidelines compared to individuals who were employed. Among the enabling factors, all variables (income, health insurance, and emotional support) except having a personal physician were significant predictors of adherence to physical activity guidelines. Health insurance was the strongest predictor. Those who had no health insurance were more likely (OR=1.12) to adhere to physical activity guidelines compared to individuals who had a health insurance.

Among need-related factors, BMI, activity limitations, health status, and co-morbidities were significant predictors of adherence to physical activity guidelines. Co-morbidity was the strongest predictor among the need-related factors. Those who had co-morbidities were less likely (OR=0.85) to adhere to physical activity guidelines compared to individuals who had no co-morbidities. The Hosmer-Lemeshow goodness of fit test (χ^2 =4.20, p =0.83) indicated the model to be a good fit.

Table 6

Association between Adherence to Physical Activity Guidelines and Physicians' Recommendations for Physical Activity Controlling for Need-Related, Enabling, and Predisposing Factors (n=33,071)

Variable (Reference Category)		β	SE	Wald Stat.	OR (95% CI)
Physicians' Recommendations (Yes)	No	-0.06	0.02	6.43	0.94 (0.89,0.98)**
Control Variables					
Predisposing factors					
Age (45-64 yrs)	≥ 65 yrs	-0.23	0.02	70.43	0.79 (0.74,0.83)**
Sex (Male)	Female	-0.26	0.02	112.59	0.77 (0.73,0.80)**
Race (Whites)	Non-Whites	-0.09	0.03	8.29	0.91 (0.84,0.96)**
Education (> HS)	≤HS	-0.21	0.02	74.96	0.80 (0.76,0.84)**
Marital Status (married)	Unmarried	-0.10	0.02	17.52	0.89 (0.85,0.94)**
Employment (Employed)	Unemployed	0.11	0.02	15.85	1.12 (1.06,1.19)**
Enabling factors					
Income (≥$50,000)	<$50,000	-0.15	0.02	27.23	0.85 (0.80,0.90)**
Health insurance (Yes)	No	0.11	0.04	6.24	1.12 (1.02,1.23)*
Personal Physician (Yes)	No	-0.00	0.03	0.00	0.99 (0.93,1.06)
Emotional support (Yes)	No	-0.17	0.02	38.13	0.83 (0.78,0.88)**
Need-Related factors					
BMI (Non-obese)	Obese	-0.47	0.02	334.27	0.62 (0.59,0.68)**
Activity limitation (No)	Yes	-0.44	0.02	287.99	0.64 (0.60,0.67)**
Health status (Good)	Poor	-0.50	0.02	301.55	0.60 (0.56,0.63)**
Co-morbidities (No)	Yes	-0.15	0.03	25.04	0.85 (0.80,0.91)**

Note. OR=Odds Ratios; CI=Confidence Interval; ** $p < 0.001$; * $p < 0.05$

The next hypothesis tested whether the association between physicians' recommendations for physical activity on adherence will be the same for older and younger age groups, controlling for need-related, enabling, and other predisposing factors (H2.2). Before testing the hypothesis, a $2 \times 2 \times 2$ contingency table examined the association between physicians' recommendations for physical activity and adherence conditional on age (Table 7).

Table 7

Observed Frequencies (Adherence to Physical Activity Guidelines, Physicians' Recommendations for Physical Activity, Age)

Age Group	Adherence		Physicians' Recommendation for Physical Activity		
			No	Yes	Total
≥ 65 years	Not Adhered	(N)	4445	5201	9646
		(%)	(61.7)	(63.0)	(62.4)
	Adhered	(N)	2762	3056	5818
		(%)	(38.3)	(37.0)	(37.6)
	Subtotal	(N)	7207	8257	15464
		(%)	(100)	(100)	(100)
45-64 years	Not Adhered	(N)	4153	6060	10213
		(%)	(56.9)	(58.8)	(58.0)
	Adhered	(N)	3143	4251	7394
		(%)	(43.1)	(41.2)	(42.0)
	Subtotal	(N)	7296	10311	17607
		(%)	(100)	(100)	(100)

The conditional odds ratio for the association between physicians' recommendations for physical activity and adherence to guidelines is illustrated. The estimated OR for the group 65 years or older equals

$$[(4445 \times 3056) \div (5201 \times 2762)] = 0.94$$

Among the group 65 years or older, those who did not receive physicians' recommendations for physical activity were less likely (OR=0.94) to adhere to guidelines. The estimated OR for the age group 45-64 years equals

$$[(44153 \times 4251) \div (6060 \times 3143)] = 0.92$$

Among the age group 45-64 years, those who did not receive physicians' recommendations for physical activity were less likely (OR= 0.92) to adhere to guidelines.

Further, the effect of physicians' recommendations for physical activity on adherence was examined for older and younger age groups controlling for need-related, enabling, and other predisposing factors. As shown in Table 8, the effect of physicians' recommendations for physical activity on adherence to physical activity guidelines is different for the two age groups controlling for need-related, enabling, and other predisposing factors.

For the group 45-64 years, the association between adherence to physical activity guidelines and physicians' recommendations was not statistically significant (p=0.14) controlling for the covariates. For the group 65 years or older, the association between adherence to guidelines and physicians' recommendations was statistically significant (p=0.03) controlling for the covariates. For this age group, those who did not receive

physicians' recommendation were less likely (OR=0.92) to adhere to physical activity guideline compared to those who received physicians' recommendations.

The Hosmer-Lemeshow goodness of fit test for the age group 45-64 years (χ^2 =14.76, p =0.06), indicated the model to be a good fit. For the age group 65 years or older (χ^2 =15.68, p =0.04), the model was not a good fit. However, the model (χ^2 =6.97, p =0.53) was a good fit when the analysis was rerun after removing the non-significant variables (employment status, health insurance, and personal physician).

Table 8

Association between Physicians' Recommendations for Physical Activity and Adherence in the Two Age Groups, Controlling for Need-Related, Enabling, and Other Predisposing Factors

Variable (Reference Category)		45-64 years (n=17607) β	SE	Wald Stat	OR (95% CI)	≥65 years (n= 15464) β	SE	Wald Stat	OR (95% CI)
Physicians' Recommendations(Yes)	No	-0.04	0.03	2.14	0.95 (0.89,1.01)	-0.07	0.03	4.31	0.92 (0.86,0.99)*
Control Variables									
Predisposing factors									
Sex (Male)	Female	-0.18	0.03	28.93	0.83 (0.78,0.89)**	-0.35	0.03	88.27	0.69 (0.64,0.75)**
Race (Whites)	Non-Whites	-0.08	0.04	4.23	0.91(0.84,0.99)*	-0.11	0.05	4.28	0.89 (0.79,0.99)*
Education (> HS)	≤HS	-0.16	0.03	23.10	0.84 (0.79,0.90)**	-0.26	0.03	50.67	0.76 (71,0.82)**
Marital Status (Married)	Unmarried	-0.04	0.03	1.34	0.95 (0.89,1.02)	-0.16	0.03	18.16	0.85 (0.79,0.91)**
Employment (Employed)	Un employed	0.12	0.03	12.06	1.13 (1.05,1.21)**	0.03	0.05	0.50	1.03 (0.93,1.15)
Enabling factors									
Income (≥$50,000)	<$50,000	-0.19	0.03	25.22	0.82 (0.76,0.88)**	-0.12	0.04	7.18	0.88 (0.81,0.96)**
Health insurance (Yes)	No	0.14	0.05	8.31	1.15 (1.04,1.27)**	-0.30	0.15	3.76	0.73 (0.53,1.00)
Personal Physician(Yes)	No	0.03	0.04	0.56	1.03 (0.94,1.12)	-0.40	0.04	1.04	0.95 (0.86,1.04)
Emotional support (Yes)	No	-0.19	0.03	25.73	0.82 (0.76,0.88)**	-0.17	0.04	16.25	0.83 (0.76,0.91)**

Table 8 (Continued)

Need-Related factors									
BMI (Non-obese)	Obese	-0.47	0.03	202.84	0.62 (0.58,0.66)**	-0.46	0.04	130.97	0.62 (0.58,0.68)**
Activity limitation(No)	Yes	-0.36	0.03	100.84	0.69 (0.64,0.74)**	-0.54	0.03	202.43	0.58 (0.53,0.62)**
Health status (Good)	Poor	-0.51	0.04	155.43	0.59 (0.55,0.64)**	-0.50	0.04	146.15	0.60 (0.55,0.65)**
Co-morbidities (No)	Yes	-0.14	0.03	15.07	0.86 (0.79,0.92)**	-0.15	0.04	10.13	0.85 (0.77,0.99)**

Note. OR=Odds ratios; CI=Confidence Interval; ** $p < 0.001$;* $p < 0.05$

Health Related Quality of Life (HRQOL) and Adherence to Physical Activity Guidelines

The analysis tested the association between HRQOL and adherence to physical activity guidelines. HRQOL was measured as physically unhealthy days and mentally unhealthy days. The Wilcoxon test indicated that the mean number of physically unhealthy days ($z = -32.36$, $p < 0.001$) and mentally unhealthy days ($z = -17.07$, $p < 0.001$) was not the same for those who adhered and those who did not adhere to guidelines.

Physically Unhealthy Days and Adherence to Physical Activity Guidelines

Hypothesis (H3.1a) tested whether those who did not adhere to physical activity guidelines had higher physically unhealthy days compared to the individuals who adhered to guidelines controlling for physicians' recommendations and need-related, enabling, and predisposing factors. As shown in Table 9, the physically unhealthy days were 14% higher for those who did not adhere to guidelines compared to individuals who adhered to guidelines, controlling for physicians' recommendations for physical activity and need-related, enabling, and predisposing factors.

Those who did not receive physicians' recommendations had 8% fewer physically unhealthy days compared to individuals who received the recommendations. Among predisposing factors, all variables (age, sex, race, education, and employment status), except marital status were significant predictors of physically unhealthy days. The strongest predictor was employment status. The physically unhealthy days were 28% higher for those who were unemployed compared to individuals who were employed.

Among enabling factors, all variables (personal physician and emotional support) except income and health insurance were significant predictors of physically unhealthy days. The strongest predictor was emotional support. Those who received no emotional support had 14% higher physically unhealthy days compared to individuals who received emotional support. Among need-related factors, all variables (activity limitations, health status, and co-morbidities) except BMI were significant predictors of physically unhealthy days. The strongest predictor was health status. Those who reported poor health status had 237% higher physically unhealthy days, compared to individuals who reported good health status. The deviance test of goodness of fit (χ^2 =30796.50, p =0.93) indicated the model to be a good fit.

Table 9

Association between Adherence to Physical Activity Guidelines and Physically Unhealthy Days Controlling for Physicians' Recommendations, Need-Related, Enabling, and Predisposing Factors (n=33,071)

Variable (Reference Category)		β	SE	Wald Stat.	e^{β} (95% CI)
Adherence (adhered)	Not Adhered	0.13	0.02	33.84	1.14 (1.09,1.20)**
Control Variables					
Physicians' Recommendations (Yes)	No	-0.08	0.02	14.97	0.92 (0.87,0.95)**
Predisposing Factors					
Age (45-64 yrs)	≥ 65 yrs	-0.12	0.02	24.97	0.88 (0.84,0.92)**
Sex (Male)	Female	0.09	0.02	15.05	1.09 (1.04,1.14)**
Race (Whites)	Non-Whites	0.04	0.02	2.65	1.05 (0.99,1.10)
Education (> HS)	≤HS	0.07	0.02	9.41	1.07 (1.02,1.12)*
Marital Status (Married)	Unmarried	0.00	0.02	0.05	1.00 (0.96,1.05)
Employment (Employed)	Unemployed	0.25	0.02	76.00	1.28 (1.21,1.35)**
Enabling factors					
Income (≥$50,000)	<$50,000	0.19	0.03	42.31	1.21(0.14,1.29)
Health insurance (Yes)	No	-0.04	0.03	1.20	0.95(0.89,1.03)
Personal Physician (Yes)	No	0.08	0.02	9.40	1.08 (1.03,1.14)*
Emotional support (Yes)	No	0.13	0.02	31.65	1.14 (1.08,1.19)**
Need-Related factors					
BMI (Non-obese)	Obese	0.03	0.02	3.00	1.03(0.99,1.08)
Activity limitation (No)	Yes	0.85	0.02	1502.27	2.34(2.24,2.44)**
Health status (Good)	Poor	1.21	0.01	3877.79	3.37(3.24,3.50)**
Co-morbidities (No)	Yes	0.11	0.03	11.82	1.12(1.05,1.19)*

Note. e^{β} =Exponentiated Coefficient of Estimate; CI=Confidence Interval; ** $p < 0.001$; * $p < 0.05$

Mentally Unhealthy Days and Adherence to Physical Activity Guidelines

The next hypothesis (H3.1b) tested whether those who did not adhere to physical activity guidelines had higher mentally unhealthy days compared to individuals who adhered to guidelines, controlling for physicians' recommendations and need-related, enabling, and predisposing factors. As shown in Table 10, the mentally unhealthy days were 12% higher for those who did not adhere to physical activity guidelines compared to individuals who adhered to guidelines controlling for covariates.

Those who did not receive physicians' recommendations had 7% fewer mentally unhealthy days compared to those individuals who received the recommendations. Among predisposing factors, all variables (age, sex, marital status, and employment status), except race and education were significant predictors of the number of mentally unhealthy days. The strongest predictor was age. The mentally unhealthy days were 56% fewer for older adults compared to the group 45-64 years old.

All enabling factors were significant predictors of mentally unhealthy days. The strongest predictor was emotional support. Those who received no emotional support had 111% higher number of mentally unhealthy days compared to individuals who received emotional support. Among need-related factors, all variables (activity limitations, health status, and co-morbidities) except BMI were significant predictors of mentally unhealthy days. The strongest predictor was health status. Those who reported poor health status had 109% higher number of mentally unhealthy days compared to individuals who reported a good health status. The deviance test of goodness of fit (χ^2 =22216.40, p=0.67) indicated the model to be a good fit.

Table 10

Association between Adherence to Physical Activity Guidelines and Mentally Unhealthy Days Controlling for Physicians' Recommendations and Need-Related, Enabling, and Predisposing Factors (n=33,071)

Variable (Reference Category)		β	SE	Wald Stat.	e^{β} (95% CI)
Adherence (adhered)	Not Adhered	0.11	0.03	13.04	1.12 (1.05,1.19)**
Control Variables					
Physicians' Recommendations (Yes)	No	-0.67	0.03	4.98	0.93 (0.88,0.99)*
Predisposing factors					
Age (45-64 yrs)	≥ 65 yrs	-0.81	0.03	578.32	0.44 (0.41,0.47)**
Sex (Male)	Female	0.40	0.03	152.69	1.50 (1.40,1.60)**
Race (Whites)	Non-Whites	0.01	0.03	0.04	1.00 (0.93,1.08)
Education (> HS)	≤HS	0.05	0.03	3.64	1.06 (0.99,1.12)
Marital Status (Married)	Unmarried	0.15	0.03	22.87	1.16 (1.09,1.23)**
Employment (Employed)	Unemployed	0.08	0.03	5.83	1.09 (1.01,1.17)*
Enabling factors					
Income (≥$50,000)	<$50,000	0.16	0.03	17.03	1.17 (1.09,1.27)*
Health insurance (Yes)	No	0.13	0.04	8.84	1.14 (1.04,1.24)*
Personal Physician (Yes)	No	0.09	0.03	6.73	1.10 (1.02,1.18)*
Emotional support (Yes)	No	0.74	0.02	759.34	2.11(2.00,2.22)**
Need- related factors					
BMI (Non-obese)	Obese	-0.02	0.03	0.40	0.98 (0.92,1.04)
Activity limitation (No)	Yes	0.51	0.03	261.54	1.67 (1.57,1.78)**
Health status (Good)	Poor	0.73	0.03	560.93	2.09 (1.96,2.22)**
Co-morbidities (No)	Yes	0.24	0.03	39.15	1.28 (1.18,1.38)**

Note. e^{β} =Exponentiated Coefficient of Estimate; CI=Confidence Interval; ** $p < 0.001$; * $p < 0.05$

This section tests the hypothesis whether the association between adherence to physical activity guidelines and physically unhealthy days is the same for older and younger age groups, controlling for physicians' recommendations and need-related, enabling, and other predisposing factors. As shown in Table 11, for both age groups, the association between physically unhealthy days and adherence to physical activity guidelines was statistically significant controlling for the covariates.

Among the group 45-64 years, physically unhealthy days were 12% higher for those who did not adhere to physical activity guidelines compared to those who adhered to physical activity guidelines controlling for covariates. Similarly, among the group 65 years or older, physically unhealthy days were 18% higher for those who did not adhere to guidelines compared to those who adhered to physical activity guidelines controlling for covariates.

The deviance test of goodness of fit for the age group 45-64 years (χ^2 =17088.15, p =0.97) and 65 years and older (χ^2 =13711.63, p =0.88) indicated the models to be good fit.

Table 11

Association between Adherence to Physical Activity Guidelines and Physically Unhealthy Days in the Two Age Groups, Controlling for Physicians' Recommendations for Physical Activity, Need-Related, Enabling, and Other Predisposing Factors

		45-64 years (n=17607)				≥65 years (n= 15464)			
Variable (Reference Category)		β	SE	Wald Stat.	e^{β} (95% CI)	β	SE	Wald Stat.	e^{β} (95% CI)
Adherence (Adhered)	Not Adhered	0.11	0.03	13.75	1.12 (1.05,1.19)**	0.16	0.03	21.29	1.18 (1.10,1.27)**
Control Variables									
Physicians' Recommendations(Yes)	No	-0.06	0.03	4.27	0.93 (0.88,0.99)*	-0.11	0.03	11.49	0.89 (0.83,0.95)**
Predisposing factors									
Sex (Male)	Female	0.07	0.03	5.78	1.07 (1.01,1.14)*	0.10	0.03	8.69	1.11(1.03,1.19)**
Race (Whites)	Non-Whites	0.01	0.03	0.17	1.05 (0.94,1.09)	0.09	0.04	4.42	1.10 (1.00,1.20)*
Education (> HS)	≤HS	0.08	0.03	7.89	1.09 (1.02,1.15)**	0.04	0.03	1.80	1.04 (0.97,1.12)
Marital Status (Married)	Unmarried	-0.01	0.03	0.25	0.98(0.92,1.04)	0.01	0.03	0.13	1.01 (0.94,1.08)
Employment(Employed)	Un employed	0.20	0.03	38.84	1.22 (1.15,1.30)**	0.30	0.06	23.85	1.35 (1.19,1.53)**
Enabling factors									
Income (≥$50,000)	<$50,000	0.20	0.03	27.83	1.22 (1.13,1.32)**	0.18	0.04	13.87	1.20 (1.09,1.32)**
Health insurance (Yes)	No	-0.05	0.04	1.56	0.95 (0.87,1.03)	0.03	0.10	0.13	1.04 (0.84,1.28)
Personal Physician(Yes)	No	0.10	0.03	9.01	1.11(1.03,1.19)**	0.04	0.03	1.20	1.04(0.96,1.12)
Emotional support(Yes)	No	0.18	0.03	36.89	1.20 (1.13,1.27)**	0.04	0.03	1.83	1.05 (0.97,1.12)

Table 11 (Continued)

Need-related factors									
BMI (Non-obese)	Obese	0.07	0.02	6.45	1.07(1.01,1.14)*	-0.00	0.03	0.01	0.99 (0.93,1.06)
Activity limitation(No)	Yes	0.97	0.03	1000.06	2.65 (2.49,2.80)**	0.72	0.03	529.95	2.06 (1.94,2.19)**
Health status (Good)	Poor	1.14	0.02	1838.47	3.13 (2.97,3.30)**	1.30	0.02	2051.32	3.67 (3.47,3.88)**
Co-morbidities (No)	Yes	0.11	0.04	7.71	1.12 (1.03,1.21)**	0.11	0.05	4.27	1.12 (1.00,1.25)*

Note. e^{β} =Exponentiated Coefficient of Estimate; CI=Confidence Interval; ** $p < 0.001$;* $p < 0.05$

This study compared the regression coefficients across subsamples to draw conclusions about their differences. Hence, a *p* value was calculated based on the following formula:

$$Z = \frac{b1 - b2}{\sqrt{SEb1^2 + SEb2^2}} \qquad \text{(Cohen, 1983)}$$

The Z test assumes the regressions are from two separate groups, and the variables in the regression model in each group are the same (Cohen, 1983). The null hypothesis tested here is that the regression coefficients are the same in both groups. A z-value of 1.18 and *p* value 0.23 was obtained based on Table 11. The *p* value indicates that the differences between the regression coefficients of physicians' recommendations in both age groups were not statistically significant.

Next, the study tests the hypothesis whether the association between adherence to physical activity guidelines and mentally unhealthy days is the same for older and younger age groups, controlling for physicians' recommendations and need-related, enabling, and other predisposing factors (H3.2b). As shown in Table 12, the association between mentally unhealthy days and adherence to physical activity guidelines was different for the age groups.

Among the group 45-64 years, mentally unhealthy days were 12% higher for those who did not adhere to physical activity guidelines compared to those who adhered to physical activity guidelines controlling for covariates. However, this association was not significant for the older age group. The deviance test of goodness of fit for the group 45-64 years of age (χ^2=14449.03, p =0.82) and 65 years of age or older (χ^2 =7348.36, p =0.48) indicated the models to be good fit.

Table 12

Association between Adherence to Physical Activity Guidelines and Mentally Unhealthy Days in the Two Age Groups, Controlling for Physicians' Recommendations for Physical Activity, Need-Related, Enabling, and Other Predisposing Factors

		45-64 years (n=17607)				≥65 years (n= 15464)			
Variable (Reference Category)		β	SE	Wald Stat.	e^{β} (95% CI)	β	SE	Wald Stat.	e^{β} (95% CI)
Adherence (Adhered)	Not Adhered	0.11	0.03	11.96	1.12 (1.05,1.20)*	0.11	0.05	3.75	1.11 (0.99,1.24)
Control Variables									
Physicians' Recommendations(Yes)	No	-0.79	0.03	5.51	0.92 (0.86,0.98)*	-0.05	0.05	1.28	0.94 (0.85,1.04)
Predisposing factors									
Sex (Male)	Female	0.41	0.03	130.17	1.50 (1.40,1.61)**	0.40	0.05	46.54	1.49 (1.33,1.67)**
Race (Whites)	Non-Whites	-0.04	0.04	1.42	0.95 (0.87,1.03)	0.10	0.07	2.06	1.11(0.96,1.29)
Education (> HS)	≤HS	0.06	0.03	3.72	1.06 (0.99,1.14)	0.05	0.05	0.82	1.05(0.94,1.17)
Marital Status (Married)	Unmarried	0.16	0.03	23.12	1.18 (1.10,1.26)**	0.13	0.05	5.60	1.14 (1.02,1.23)*
Employment (Employed)	Un employed	0.11	0.03	10.22	1.12 (1.04,1.21)*	0.01	0.08	0.02	1.01(0.85,1.21)
Enabling factors									
Income (≥$50,000)	<$50,000	0.16	0.04	14.56	1.17 (1.08,1.27)**	0.17	0.07	5.31	1.18 (1.02,1.37)*
Health insurance (Yes)	No	0.14	0.04	9.84	1.15 (1.05,1.25)*	0.04	0.19	0.05	1.04 (0.71,1.54)
Personal Physician(Yes)	No	0.13	0.04	10.20	1.13 (1.05,1.23)*	0.03	0.06	0.27	1.03 (0.90,1.18)
Emotional support(Yes)	No	0.74	0.02	653.51	2.11 (1.99,2.23)**	0.74	0.04	223.47	2.10 (1.90,2.31)**

Table 12 (Continued)

Need- related factors									
BMI (Non-obese)	Obese	-0.02	0.03	0.54	0.97 (0.91,1.04)	-0.01	0.05	0.04	0.98 (0.88,1.10)
Activity limitation (No)	Yes	0.55	0.03	237.24	1.73 (1.61,1.86)**	0.46	0.05	73.87	1.59 (1.43,1.77)**
Health status (Good)	Poor	0.68	0.03	419.53	1.98 (1.85,2.11)**	0.79	0.05	227.60	2.21(2.00,2.45)**
Co-morbidities (No)	Yes	0.17	0.04	16.53	1.18 (1.09,1.29)**	0.41	0.08	23.53	1.50 (1.27,1.78)**

Note. e^{β} =Exponentiated Coefficient of Estimate; CI=Confidence Interval; ** $p < 0.001$; * $p < 0.05$

Table 13

Summary of Hypotheses Tests

	Hypotheses	Supported Yes/No
1.1	Older adults (65 years and older) with arthritis are less likely to receive physicians' recommendation for physical activity compared to adults in the group 45-64 years after controlling for need-related, enabling, and other predisposing factors.	Yes
2.1	Those who do not receive physicians' recommendations are less likely to adhere to physical activity guidelines compared to individuals who receive physicians' recommendations after controlling for need-related, enabling, and predisposing factors.	Yes
2.2	The association between physicians' recommendations for physical activity and adherence to guidelines will be the same for older and younger adults after controlling for need-related, enabling, and predisposing factors.	No
3.1(a)	Those who do not adhere to physical activity guidelines have higher physically unhealthy days compared to individuals who adhere to guidelines after controlling for physicians' recommendations and need-related, enabling, and predisposing factors.	Yes
3.1(b)	Those who do not adhere to physical activity guidelines have higher mentally unhealthy days compared to individuals who adhere to guidelines after controlling for physicians' recommendations and need-related, enabling, and predisposing factors.	Yes

Table 13 (Continued)

3.2(a)	The association between adherence to physical activity guidelines and physically unhealthy days will be the same for older and younger adults after controlling for physicians' recommendations and need-related, enabling, and predisposing factors.	Yes
3.2(b)	The association between adherence to physical activity guidelines and mentally unhealthy days will be the same for older and younger adults after controlling for physicians' recommendations and need-related, enabling, and predisposing factors.	No

CHAPTER 5

DISCUSSION

The purpose of this research was to assess the association among individuals' ages, physicians' recommendations for physical activity, adherence, and HRQOL in a sample of adults with arthritis who were 45 years or older. The conceptual framework of the study was based on the Behavioral Model of Health Services Utilization. The framework tested allows physicians, researchers, and health policy makers to better understand the association between old age, physicians' recommendations for physical activity, adherence, and HRQOL. We have not come across any other study in the arthritis literature that subsequently sheds light on individuals' ages, physicians' recommendations for physical activity, individuals' adherence to physical activity guidelines, and HRQOL based on a theoretical framework.

Conclusions

This study subsequently analyzed three associations. The first step analyzed the association between age and physicians' recommendations for physical activity, the second step examined the association between physicians' recommendations for physical activity and adherence, and the third step investigated the association between adherence

to physical activity guidelines and HRQOL in a sample of adults with self-reported physician-diagnosed arthritis.

The first step indicated an association between individuals' ages and physicians' recommendations for physical activity. Older adults were less likely to receive physicians' recommendations for physical activity compared to those in the group 45-64 years old after controlling for need-related, enabling, and other predisposing factors.

The second step showed an association between physicians' recommendations and adherence to physical activity guidelines. Those who did not receive physicians' recommendations were less likely to adhere to physical activity guidelines controlling for need-related, enabling, and predisposing factors.

However, the association between physicians' recommendations for physical activity and adherence was not the same for older and younger adults controlling for need, enabling, and other predisposing factors. For the group 45-64 years old, this association was not significant controlling for the covariates, but the association was significant for those 65 years or older. Among the group 65 years or older, those who did not receive physicians' recommendations were less likely to adhere to physical activity guidelines controlling for the covariates.

The third step found an association between adherence to physical activity guidelines and physically unhealthy days and mentally unhealthy days. Those who did not adhere to guidelines were associated with higher physically unhealthy days and mentally unhealthy days. The association between adherence and physically unhealthy days was the same for older and younger age groups controlling for physicians' recommendations, need-related, enabling, and other predisposing factors. In both the age

groups, those who did not adhere to physical activity guidelines had higher physically unhealthy days controlling for covariates.

Moreover, the association between adherence to guidelines and mentally unhealthy days for older adults was not the same as that for adults in the younger age group controlling for physicians' recommendations, need-related, enabling, and other predisposing factors. For those in the group 45-64 years old, the association was significant. Among this group, those who did not adhere to physical activity guidelines had higher mentally unhealthy days controlling for the covariates. However, for the group 65 years or older this association was not significant.

According to physical activity guidelines, it is not harmful for individuals with arthritis to participate in low-to-moderate levels of physical activity (Callahan et al., 2008; Physical Activity Guidelines Advisory Committee, 2008). Further, there is evidence that individuals with arthritis had relief from pain, improved physical function, and delayed onset of disability by engaging in low-to-moderate impact physical activity of approximately 150 minutes per week, which is five times per week for 30 minutes per session (Physical Activity Guidelines Advisory Committee, 2008). Individuals who engage in any amount of physical activity gain some health benefits (Abell, Hootman, Zack, Moriarity, & Helmick, 2005; U.S. Department of Health and Human Services, 2008). Older adults with co-morbidities who could not meet the 150 minutes of physical activity a week are advised to be physically active as their conditions and abilities allow (U.S. Department of Health and Human Services, 2008). In addition, according to ACR, the non-pharmacological therapy section of the clinical practice guideline (CPG) recommends physical activity for individuals with osteoarthritis and maintains that

pharmacological therapy is most effective when combined with the non-pharmacological therapy (American College of Rheumatology Subcommittee on Osteoarthritis Guidelines, 2000). Despite the guidelines and evidence in literature, the study found that older adults with arthritis were less likely to receive physicians' recommendations for physical activity compared to the group 45-64 years. This finding was similar to studies that examined the factors associated with physicians' recommendations (Fontaine, Bartlett, & Heo, 2005; Glasgow, Eakin, Fisher, Bacak, & Brownson, 2001). A review of Cabana's (1999) work helps us to understand the reasons why physicians do not adhere to CPG and why they hesitate to recommend physical activity to older adults. Cabana and colleagues grouped the barriers to physicians' adherence to CPG into knowledge, attitude, and behavior. Knowledge-related barriers among physicians were the lack of awareness and familiarity due to a large volume of information in the guidelines, lack of time to go through them, and inaccessibility of guidelines. Attitude-related barriers among physicians were the lack of agreement with guidelines, outcome expectancy, self-efficacy, and inertia of previous practice. Physicians' lack of agreement may be in the interpretation of evidence, applicability to the patient, cost benefits, lack of confidence in the guideline developer, rigidity in application, or not practical. Lack of outcome expectancy occurs when a physician believes that performance of the guideline recommendation will not provide expected outcomes. Lack of self-efficacy occurs when a physician feels that he cannot perform the guidelines or it is simply due to lack of motivation or inertia from previous practice. Besides the above, the external barriers to physicians' adherence to the guideline were patient preferences with guideline recommendations or guideline characteristics, such as the presence of contradictory

statements, or it may be environmental factors, such as lack of time, resources, reimbursements, organizational constraints, and perceived increase in malpractice liability (Cabana et al., 1999). These barriers may play a role in physicians not recommending physical activity to older adults. In addition, Fontaine and colleagues (2005) indicated that physicians were more likely to recommend physical activity to those who were more likely to follow their recommendations.

Furthermore, this study found that those who did not receive physicians' recommendations were less likely to adhere to physical activity guidelines compared to those who received physicians' recommendations. These results were similar to a study by Kreuter and colleagues (2000), who studied 915 individuals from four community-based family medicine clinics in southeastern Missouri on physicians' recommendations on patients' behavior changes (diet, exercise, smoking). They found that individuals who did not receive recommendations for behavior changes from their physicians were less likely to adopt the changes compared to those who received the recommendations. Loureiro and Nayga, (2006) found similar results in a panel data analysis of the 2001-2003 BRFSS data. Their study indicated that physicians' recommendations had a positive effect on an individual's behavior change on diet and exercise. Another study by Loureiro and Nayga (2007), based on the 2003 BRFSS, found a positive association between physicians' recommendations and an individual's likelihood of diet and exercise behavior changes. All of these studies were conducted in the general population and not in arthritis population.

Further, the study findings indicated that the association between physicians' recommendation and adherence was not the same for older and younger age groups,

controlling for need, enabling, and other predisposing factors. The research did not come across any other study that analyzed the influence of age on physicians' recommendations for physical activity and adherence. Among those 45-64 years, physicians' recommendations were not a significant predictor of adherence to physical activity guidelines. While among older adults, those who did not receive physicians' recommendations were less likely to adhere to physical activity guidelines compared to those who did. The modern consumerist perspective and traditional sick-role perspective in the patient-physician relationship explains this difference in the association by age (Huag & Lavin, 1981). Older adults adopt the traditional sick-role perspective. According to this perspective, the physician is in-charge, and the patient will adhere to the physician's recommendation. In this perspective, the physician's assumption of authority and the patient's trust, confidence, and norm of obedience are justified by the difference in knowledge between the two (Huag & Lavin, 1981). Based on this perspective, older adults those who do not receive physicians' recommendations are less likely to adhere to recommended levels of physical activity. Those in the age group of 45-65 years old adopt the consumerist perspective. According to the consumerist perspective, the physician does not have the right to direct the patient, and the patient has no obligation to follow physician's directions. Both patient and physician negotiate on the terms of treatment (Huag & Lavin, 1981).

The next finding indicated that those who did not adhere to physical activity guidelines had higher physically and mentally unhealthy days compared to individuals who adhered to the guidelines. Previous studies in the arthritis literature had similar results (Abell et al., 2005; Brown et al., 2003; Dominick, Ahern, Gold, & Heller, 2004;

Mili, Helmick, Zack, & Moriarty, 2003). Adhering to physical activity guidelines not only improved the general health of an individual but decreased physically and mentally unhealthy days (Abell et al., 2005).

The association between adherence to physical activity guidelines and physically unhealthy days for older adults was the same as for the younger age group, controlling for physicians' recommendation for physical activity and need-related, enabling, and other predisposing factors. This supports the view that all individuals, irrespective of age, benefit from adhering to physical activity.

However, the study did not find the association between adherence and mentally unhealthy days for older adults the same as the younger age group controlling for physicians' recommendations for physical activity, need, enabling, and other predisposing factors. For the older adults, the association between adherence and mentally unhealthy days was not significant. For this group, health status and emotional support were the strongest predictors of mentally unhealthy days. However, for the group 45-64 years old those who did not adhere to guidelines had higher mentally unhealthy days.

The study findings are important for individuals with arthritis especially older adults, physicians, researchers, and health policy makers. This study indicates that there is an age bias in physicians' recommendations for physical activity. Physicians do not recommend physical activity to every individual with arthritis despite the guideline recommendations. Those who did not receive physicians' recommendations were less likely to adhere to physical activity guidelines, and those who did not adhere to guidelines had higher physically and mentally unhealthy days.

The results on the association between control variables and physicians' recommendations for physical activity were similar to previous findings in the literature (Fontaine et al., 2005; Glasgow et al., 2001; Loureiro & Nayga, 2007) Fontaine et al., 2005; Glasgow et al., 2001; (Wee, McCarthy, Davis, & Phillips, 1999). After controlling for the covariates, those who were more likely to receive physicians' recommendations were females, non-Whites, had an education less than high school, were married, had an annual income greater than or equal to $50,000, had health insurance, had a personal physician, received emotional support, were overweight and obese, had activity limitations, and co-morbidities. The findings indicated that physicians recommended physical activity to some individuals, but not others. The reasons why physicians may not recommend physical activity to all individuals with arthritis has been discussed in a previous section of this chapter.

The association between control variables and adherence to physical activity guidelines showed that after controlling for the covariates, those who were less likely to adhere to physical activity guidelines were older adults, females, non-Whites, had an education less than or equal to high school, were unmarried, unemployed, had income less than $50,000, had health insurance, no emotional support, had activity limitations, poor health status, were overweight and obese, and had co-morbidities. The results were similar to previously conducted studies (Abell et al., 2005; Fontaine, Heo, & Bathon, 2004). Some of the reasons for individuals not adhering to physical activity guidelines may be lack of physicians' recommendations, lack of recreational facilities in the neighborhood, lack of time, and motivation. In addition, individuals may fear that

physical activity would make their arthritis condition worse (Fontaine et al., 2004; Iversen, Fossel, & Daltroy, 1999).

The association between control variables and HRQOL measures showed that after controlling for covariates, those who had higher physically unhealthy days were younger adults (45-64 years old), females, had an education less than or equal to high school, were unemployed, had no personal physician, no emotional support, had activity limitations, poor health status, co-morbidities, and received physicians' recommendations for physical activity. Those who reported higher mentally unhealthy days were younger adults, females, those who were unmarried, unemployed, had an annual income < $ 50,000, had no health insurance, no emotional support, had activity limitations, poor health status, co-morbidities and received physicians' recommendations for physical activity after controlling for covariates. Previously conducted studies have shown that individuals who adhered to physical activity guidelines had fewer physically and mentally unhealthy days (Abell et al., 2005; Brown et al., 2003; Mili et al., 2003). Perhaps, the sample of individuals in our study did not adhere to physical activity guidelines. However, further research is required to examine the barriers to physical activity engagement among these individuals.

The negative coefficient obtained in the association between HRQOL measures and physicians' recommendations paradoxically indicated individuals who did not receive physicians' recommendations had fewer physically and mentally unhealthy days, controlling for the covariates. The findings could provide alternate explanations. For example, there may be reverse causality; perhaps physicians recommended physical activity to only those who had lower HRQOL or on the other hand, only those who had

lower HRQOL in the first place approached a physician. Failure to recognize reverse causality may underestimate the effect of physicians' recommendations on HRQOL measures (Flanders & Augestad, 2008). Hence, the association should be further examined in additional analysis (Kenkel & Terza, 2001). The effect of physicians' recommendations on outcomes such as adherence and HRQOL are perhaps more complex than suggested by the pattern of associations observed by simple bivariate associations. Hence, physicians' recommendations not controlling for the background variables when made may not have intended effects.

Consequently, physicians' advice alone is not sufficient for individuals to adhere to physical activity guidelines. Interventions such as the Five A's—Ask, Advise, Assess, Assist and Arrange —used in the smoking cessation programs (Agency for Healthcare Research and Quality, 2008; Caplan, Stout, & Blumenthal, 2010; Succar, Hardigan, Fleisher, & Godel, 2010) may improve individuals' adherence to physical activity. On their visits to the clinic, physicians may ask patients about their engagement in physical activity and be advised about the benefits of physical activity. Physicians can assess patients' readiness to engage in physical activity and develop strategies to improve patients' physical activity engagement. Further, physicians may assist patients in planning and including physical activity in their daily schedule and finally, in every subsequent visit, they may follow up on patients' adherence to physical activity.

Some policy-level interventions at the organizational level to increase physicians' recommendations for physical activity are training the physicians to comply with CPGs, emphasis on written physician order for physical activity rather than verbal instructions, provision of incentives to physicians who recommend physical activity to their patients,

and identify physicians' barriers in adherence to CPGs. At the population level, interventions may include availability of low-cost, centrally located facilities for exercise and providing physical activity/exercise classes and programs focused towards older adults.

Limitations of the Study

The study results should be considered in the light of some limitations. The cross-sectional nature of the study does not allow for determining cause and effect. The survey does not include households without telephones and those in institutions and the military. In addition, the responses were self-reports; hence, there is a possibility of social desirability and recall bias. Respondents may underreport or overreport physical activity and physical and mental unhealthy days (Abell et al., 2005; Freelove-Charton, Bowles, & Hooker, 2007), and the study could not confirm physician-diagnosed arthritis through a health professional or medical records (Freelove-Charton et al., 2007). The BRFSS survey does not distinguish different types of arthritis. There would be differences in activity limitations among the respondents based on the type of arthritis they have. Also, those who reported joint pain/ symptoms but were not diagnosed by a physician for arthritis were excluded, thus the study may have underestimated the burden of arthritis (Fontaine, Haaz, & Heo, 2007). The BRFSS item measured whether the physician recommended physical activity or not, but it did not measure whether the physician recommended 30 minutes of physical activity five times a week. Some of the possible confounders for the study were individuals' past exercise behavior, number of visits to

the clinic, patient-physician relationship, and contextual variables, such as recreational facilities available and crime in the neighborhood.

Structural equation modeling (SEM) was originally proposed to examine the patterns of associations among individuals' ages, physicians' recommendations, adherence to physical activity guidelines, and HRQOL, given the individual characteristics. The indicators of the Behavioral Model of Health Services Utilization did not measure the predisposing, enabling, and need-related factors. Hence, the factor structure was not supported, which is one of the prerequisites of SEM (Muthen, 1983; Muthen & Satorra, 1995). Had the factor structure held as originally expected, SEM could have provided more direct and explicit means of examining the associations among the variables.

In order to examine potential bias due to the exclusion of the cases, the study examined whether there were any differences between the included (n=33,071) and excluded (n=16,635) groups on the variables age, sex, and co-morbidities. The two groups differed in the proportion of females. The proportion of females to males were 65:35 and 74:26 in the included and excluded groups, respectively. Further, the missing income was included as a third category (< $50,000, ≥$ 50,000, and missing cases) and multivariable models —logistic regression and negative binomial regression —were examined. The models were not different in their direction of associations from the original models that did not include the missing income.

Despite the limitations, this was the first time associations among age, physicians' recommendations, adherence to physical activity guidelines, and HRQOL were subsequently studied among individuals with arthritis. Studies on race and gender bias

are extensively researched, but age bias has received less attention. This study addresses age bias in physicians' recommendations for physical activity in a population of individuals with arthritis. In addition, the study adds to the literature the association between physicians' recommendations for physical activity and adherence to physical activity guidelines, and the influence of individuals' ages on this association. Further, the study examined the influence of individuals' ages on the association between adherence to physical activity guidelines and HRQOL, which is, again, the first time in the arthritis literature. The study results are generalizable, since it was based on a large nationally representative sample (Abell et al., 2005; Centers for Disease Control and Prevention, 2000).

Recommendations for Future Research

Future studies should focus on the barriers encountered by physicians in recommending physical activity to older adults with arthritis, identify the motivators of physical activity in older adults with arthritis, and identify the factors associated with long-term involvement in physical activity in this population. In addition, studies should examine the association between physicians' recommendations, adherence, and HRQOL based on different types of arthritis; analyze the association between physicians' recommendations, adherence, and HRQOL among young-old (65-74 years), middle-old (75-84 years), and old-old adults (85 years or older); examine ageism in physicians' recommendations for health-promoting behavior; and analyze the mediating effect of adherence in the association between physicians' recommendations and HRQOL.

Summary

Physicians should not underestimate the implication of their recommendations for physical activity in individuals' with arthritis. Following the CPG, physicians should recommend physical activity to individuals with arthritis irrespective of individuals' ages, as this may result in adherence to physical activity guidelines and better HRQOL in adults with arthritis. In general, the study found that those who did not receive physicians' recommendations were less likely to adhere to physical activity guidelines. Further, those who did not adhere to guidelines had more physically unhealthy days and mentally unhealthy days. However, the study also found that older adults were less likely to receive physicians' recommendations for physical activity compared to the group 45-64 years old. Further, the study investigated the influence of individuals' ages on physicians' recommendations and adherence, and adherence and HRQOL. The association between physicians' recommendations and adherence was different for the two age groups. Older adults, those who did not receive physicians' recommendation, were less likely to adhere to physical activity guidelines, and those who did not adhere had higher physically unhealthy days. Adherence was not a predictor of mentally unhealthy days for older adults. The group 45-64 years old was more likely to receive physicians' recommendations for physical activity compared to older adults. However, for this group, physicians' recommendations were not a predictor for adherence to physical activity guidelines. Furthermore, in this age group, those who did not adhere to guidelines had more physically unhealthy days and mentally unhealthy days.

The study adds to the literature by studying the age bias in physicians' recommendations for physical activity, association between physicians'

recommendations and adherence to physical activity guidelines, association between adherence to physical activity guidelines and HRQOL, influence of age on the association between physicians' recommendations for physical activity and adherence to guidelines, and adherence to guidelines and HRQOL. These preliminary findings will help health services researchers to develop future studies to understand the associations and may help in developing policies to improve HRQOL among individuals with arthritis.

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APPENDIX A

Approval from the UAB Institutional Review Board

THE UNIVERSITY OF ALABAMA AT BIRMINGHAM

Institutional Review Board for Human Use

DATE: 9/23/05

MEMORANDUM

TO: **Shamly Austin**
Principal Investigator

FROM: Sheila Moore, CIP
Sheila Moore, CIP
Director, UAB OIRB

RE: Request for Determination—Human Subjects Research
IRB Protocol #N090121006– Age bias in physicians' recommendation for physical activity, adherence, and health related quality of life among individuals with arthritis

An IRB Member has reviewed your application for Designation of Not Human Subjects Research for above referenced proposal.

The reviewer has determined that this proposal is **not** subject to FDA regulations and is **not** Human Subjects Research. Note that any changes to the project should be resubmitted to the Office of the IRB for determination.

SM/hw

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APPENDIX B

Study Items from the 2007 Behavioral Risk Factor Surveillance System

1. Physicians' recommendation for Physical Activity

   Description: Has a doctor or other health professional EVER suggested physical activity or exercise to help your arthritis or joint symptoms?

Value	Value Label
1	Yes
2	No
7	Don´t know/Not Sure
9	Refused

2. Adherence to Recommended levels of Physical Activity
   Description: Adults self reported physical activity level status

Value	Value Label
1	Meet physical activity recommendations Notes: PACAT_ = 1 or 2 or 3
2	Insufficient physical activity Notes: PACAT_ = 4
3	No physical activity Notes: PACAT_ = 5
9	Notes: PACAT_ = 9

3. Number of Days Physical Health Not Good
   Description: Now thinking about your physical health, which includes physical illness and injury, for how many days during the past 30 days was your physical health not good?

Value	Value Label
1 – 30	Number of days
	Notes: _ _ Number of days
88	None
77	Don't know/Not sure
99	Refused
BLANK	Not asked or Missing

4. Number of Days Mental Health Not Good
   Description: Now thinking about your mental health, which includes stress, depression and problems with emotions, for how many days during the past 30 days was your mental health not good?

Value	Value Label
1 – 30	Number of days
	Notes: _ _ Number of days
88	None
77	Don't know/Not sure
99	Refused
BLANK	Not asked or Missing

Predisposing Factors

1. Age
   Description: What is your age?

Value	Value Label
7	Don't know/Not sure
9	Refused
18 - 24	Age 18 - 24
	Notes: _ _ Code age in years
25 - 34	Age 25 - 34
35 - 44	Age 35 - 44
45 - 54	Age 45 - 54
55 - 64	Age 55 - 64
65 - 99	Age 65 or older

2. Sex

Description: Indicate sex of respondent

Value	Value Label
1	Male
2	Female

3. Race

Description: Which one of these groups would you say best represents your race?

Value	Value Label
1	White
2	Black or African American
3	Asian
4	Native Hawaiian or Other Pacific Islander
5	American Indian, Alaska Native
6	Other
	Notes: Specify_____
7	Don't know/Not sure
9	Refused
BLANK	Not asked or Missing

4. Education

Description: What is the highest grade or year of school you completed?

Value	Value Label
1	Never attended school or only kindergarten
2	Grades 1 through 8 (Elementary)
3	Grades 9 through 11 (Some high school)
4	Grade 12 or GED (High school graduate)
5	College 1 year to 3 years (Some college or technical school)
6	College 4 years or more (College graduate)
9	Refused
BLANK	Not asked or Missing

5. Marital Status
   Description: Are you: (marital status)

Value	Value Label
1	Married
2	Divorced
3	Widowed
4	Separated
5	Never married
6	A member of an unmarried couple
9	Refused
BLANK	Not asked or Missing

6. Employment
   Description: Are you currently: (employment status)

Value	Value Label
1	Employed for wages
2	Self-employed
3	Out of work for more than 1 year
4	Out of work for less that 1 year
5	A homemaker
6	A student
7	Retired
8	Unable to work
9	Refused
BLANK	Not asked or Missing

Enabling Factors

7. Income
   Description: Is your annual household income from all sources:

Value	Value Label
1	Less than $10,000 Notes: If "no," code 02
2	Less than $15,000 ($10,000 to less than $15,000) Notes: If "no," code 03; if "yes," ask 01
3	Less than $20,000 ($15,000 to less than $20,000) Notes: If "no," code 04; if "yes," ask 02
4	Less than $25,000 ($20,000 to less than $25,000) Notes: If "no," ask 05; if "yes," ask 03
5	Less than $35,000 ($25,000 to less than $35,000) Notes: If "no," ask 06
6	Less than $50,000 ($35,000 to less than $50,000) Notes: If "no," ask 07
7	Less than $75,000 ($50,000 to less than $75,000) Notes: If "no," code 08
8	$75,000 or more
77	Don’t know/Not sure
99	Refused
BLANK	Not asked or Missing

8. Health Insurance
   Description: Do you have any kind of health care coverage, including health insurance, prepaid plans such as HMOs, or government plans such as Medicare?

Value	Value Label
1	Yes
2	No
7	Don’t know/Not Sure
9	Refused

9. Personal Physician
   Description: Do you have one person you think of as your personal doctor or health care provider?

Value	Value Label
1	Yes, only one
2	More than one
3	No
7	Don’t know/Not Sure
9	Refused
BLANK	Not asked or Missing

10. Emotional Support
    Description: How often do you get the social and emotional support you need?

Value	Value Label
1	Always
2	Usually
3	Sometimes
4	Rarely
5	Never
7	Don’t know/Not sure
9	Refused
BLANK	Not asked or Missing

Need-Related Factors

11. Computed body mass index categories (BMI)
Description: Three-categories of Body Mass Index (BMI)

Value	Value Label
1	Neither overweight nor obese
	Notes: _BMI4 < 2500
2	Overweight
	Notes: 2500 <= _BMI4 < 3000
3	Obese
	Notes: 3000 <= _BMI4 < 9999
9	Don't know/Refused/Missing
	Notes: _BMI4 = 9999

12. Activity Limitation Due to Health Problems
Description: Are you limited in any way in any activities because of physical, mental, or emotional problems?

Value	Value Label
1	Yes
2	No
7	Don't know/Not Sure
9	Refused
Blank	Not asked or Missing

13. Health Status
Description: Would you say that in general your health is:

Value	Value Label
1	Excellent
2	Very good
3	Good
4	Fair
5	Poor
7	Don't know/Not Sure
9	Refused
BLANK	Not asked or Missing

14. Co-morbidities
    1. Ever Told by Doctor You Have Diabetes
       Description: Have you ever been told by a doctor that you have diabetes

Value	Value Label
1	Yes
2	Yes, but female told only during pregnancy
3	No
4	No, pre-diabetes or boarderline diabetes
7	Don't know/Not Sure
9	Refused

    2. Ever Told Blood Pressure High
       Description: Have you EVER been told by a doctor, nurse or other health professional that you have high blood pressure?

Value	Value Label
1	Yes
2	Yes, but female told only during pregnancy
3	No
4	Told borderline high or pre-hypertensive
7	Don´t know/Not Sure
9	Refused
BLANK	Not asked or Missing

    3. Ever Told Blood Cholesterol High
       Description: Have you EVER been told by a doctor, nurse or other health professional that your blood cholesterol is high?

Value	Value Label
1	Yes
2	No
7	Don't know/Not Sure
9	Refused
BLANK	Not asked or Missing

4. Ever Diagnosed with Heart Attack
Description: (Ever told) you had a heart attack, also called a myocardial infarction

Value	Value Label
1	Yes
2	No
7	Don't know/Not sure
9	Refused

5. Ever Diagnosed with Angina or Coronary Heart Disease
Description: (Ever told) you had angina or coronary heart disease

Value	Value Label
1	Yes
2	No
7	Don't know/Not sure
9	Refused

6. Ever Diagnosed with a Stroke
Description: (Ever told) you had a stroke

Value	Value Label
1	Yes
2	No
7	Don't know/Not sure
9	Refused

7. Ever Told Had Asthma
Description: Have you ever been told by a doctor, nurse, or other health professional that you had asthma?

Value	Value Label
1	Yes
2	No
7	Don't know/Not sure
9	Refused