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The Impact of Obesity and Intentional Weight loss on the Health-Related Quality of Life in Older Adults

by

Holly Kirkland-Kyhn

DISSERTATION

Submitted in partial satisfaction of the requirements for the degree of

DOCTOR OF PHILOSOPHY

in

Nursing

in the

GRADUATE DIVISION

of the

UNIVERSITY OF CALIFORNIA, SAN FRANCISCO

DEDICATION

This dissertation is dedicated to my loving husband, Robert Kyhn, and to my son Jackson. Their continuous love, support, and encouragement made my dissertation journey possible.

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Chapter two of this dissertation, "The Impact of Obesity on Adult Health Related Quality of Life" was submitted and is under review at the Geriatric Nursing journal. Chapter three "The Physiological Outcomes of an intentional weight loss program for Adults" will be submitted for consideration for publication in the Bariatric Surgical Practice and Patient Care Journal. Chapter four "The Impact of Intentional Weight Loss on Health-Related Quality of Life" will be submitted to Quality of Life Journal for publication. The members of my dissertation committee, Dr. Jyu-Lin Chen, Dr. Sheri Pruit, and Dr. Janine Cataldo supervised the research that forms the basis of these articles and for this dissertation.

ABSTRACT

Background

The proportion of older adults who are obese has doubled in the past 30 years. Obesity and aging are associated with an increase in the number of chronic health conditions (metabolic syndrome, diabetes, and hypertension) that negatively impact the health-related quality of life (HRQOL) which is an important health indicator of the patient's well-being over time.

Objectives

This dissertation examines the level of HRQOL among obese adults before and after an intensive a weight loss program. Further it examines whether there is difference in HRQOL between gender, age, blood pressure, and BMI, both before and after the weight loss program. The change in weight and the change in blood pressure by gender and age are also explored.

Methods

This study analyzed HRQOL data with the use of a 36 question-survey (SF–36) on obese individuals before and after an intentional weight loss program. The SF–36 physical component summary scores (PCS) and mental component summary scores (MCS) were analyzed with reference to BMI, gender, blood pressure, and age group. Furthermore, this study measured changes in systolic blood pressure (SBP), diastolic blood pressure (DBP), and weight that occurred from week 1 to week 17 and how these changes affected the PCS and MCS scores.

Results

Average weight loss from week 1-week-17 was approximately 47 pounds (18.89 kg) per person, or an average weight loss of 17% from baseline weight. BMI and the week in the program were statistically significant contributors to the PCS score. Participating in the program for 17 weeks was associated with an increase in the PCS score by 0.34% (p = .000) [$sr^2 = .0724$, p = .000]. The SBP was significantly decreased by 12.288 mmHg and the DBP was

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significantly decreased by 6.705 mmHg on average for all participants. There was no significant drop in the blood pressure between age groups or between genders.

Conclusions

This structured weight loss program improved both physiological health and HRQOL. The youngest participants had the lowest MCS score, before the weight loss program and after the program compared to the older age groups. In older obese adults (60 years of age and older), PCS scores were inversely related to BMI and age: as the BMI increased and age increased, the PCS score decreased.

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CHAPTER 1.

INTRODUCTION

CHAPTER 1. INTRODUCTION

Obesity and Aging in the United States

The worldwide prevalence of obesity has tripled in the past 20 years. In the United States, an upsurge in the prevalence of obesity has been accompanied by a rapid growth in the older adult population (i.e., adults 65 years of age and older); as of 2014, this age group has grown to approximately 44.7 million people (U.S. Bureau of the Census, 2014). According to the census data, obesity and aging have occurred worldwide (Ogden, Carroll, Kit, & Flegal, 2012) with the prevalence of obesity continuing to rise as people live longer.

The obesity epidemic has impacted all age groups and both genders. Current estimates suggest that one in three American adults are obese—that is, have a body mass index (BMI) of greater than 30 kg/m² (Ogden et al., 2012). In a comparison of age groups, obesity rates are higher among adults in the middle age (40-59 years of age, 39.5%) than among adults 60 years and older (35.4%) and younger adults (20- 39 years of age, 30.3%; Ogden et al., 2012). Moreover, the proportion of older adults who are obese has doubled in the past 30 years. Obesity rates higher for women 60 years of age and older than for men age 60 and older (Ogden et al., 2012).

Obesity, Aging, and Chronic Health Conditions

Both obesity and aging are strongly associated with chronic health conditions such as diabetes, cardiovascular disease, osteoarthritis, and some cancers (Ford & Mokdad, 2008; Jia & Lubetkin, 2005). Epidemiological studies of people with obesity report an elevated prevalence of hypertension, type 2 diabetes, and metabolic syndrome in all age groups (Gregg et al., 2000). Approximately 80% of all individuals older than 65 years of age have at least one chronic health condition, and about 50% of individuals older than 65 years of age have two or more chronic

health conditions (Ogden et al., 2012). In addition, obesity and the chronic health conditions associated with obesity may have a negative impact on older adult's health-related quality of life (HRQOL), possibly because of obesity-related limitations in physical function and mobility (Gregg et al., 2000; Houston et al., 2007).

Aging Obesity and HRQOL

Obesity in older adults may exacerbate the age-related onset of *frailty*—defined as "having less than a normal amount of strength or force: very weak; easily damaged or destroyed" (Webster's, dictionary) (Hubbard, Lang, Llewellyn, & Rockwood, 2010) and concomitant decline in physical function—including diminished ability to perform important practical and social activities of daily living. Research findings on older adults consistently indicate that as BMI increases, physical function decreases (Apovian, Frey, Rogers, McDermott, & Jensen, 1996). Physical function impairment is linked to greater declines in HRQOL (Yancy, Olsen, Westman, Bosworth, & Edelman, 2002) and, for older adults, obesity may be an important contributor to limitations in physical function and mobility and problems associated with chronic health conditions.

Weight Loss and HRQOL

Several studies of intentional weight loss programs for adults with obesity have found a relationship between weight loss and HRQOL improvement. For example, the findings reported by Fontaine et al. (2004) and Ross et al. (2009) suggest that intentional weight loss improves HRQOL for mildly-to-moderately overweight adults (Fontaine, Barofsky, Bartlett, Franckowiak, & Andersen, 2004; Ross et al., 2009). Some participants in these intentional weight loss programs reported benefits in improved HRQOL, and these benefits persisted throughout the studies' first year—regardless of whether weight loss was maintained. The persistence of these

benefits may have been due to the adoption of other healthy behaviors (e.g., increased physical activity and associated improvement in self-esteem) or to increased social interaction afforded by the interventions themselves (support groups).

Few studies have examined the impact of weight change on physical function domain of HRQOL. However, a longitudinal study by Fine et al. (1999) used the Nurse's Health Study to investigate the association between weight change and the physical function domain in the HRQOL survey, for vitality, and bodily pain domains in female nurses (N = 40,098; age range, 46–71 years; mean age, 58.5 years). The data collected at baseline in 1992 showed that more than half of the study sample had a BMI within the normal range, and less than 5% of the nurses had a BMI of 35 kg/m² or higher. Weight loss in the women considered overweight or obese was associated with improved physical function and vitality and a decreased bodily pain. Among the women in the two highest BMI categories, substantial improvements in the physical function were associated with weight loss; for example, weight loss of 20 pounds (9.09 kg) or more was associated with a 6.9-point improvement in the physical function domain (p < .05; Fine et al., 1999).

Although research suggests that both weight loss and increased physical activity may lead to increases in HRQOL, individual contributions of weight loss and increased physical activity to HRQOL improvements have not been identified. Ross et al. (2009) used the Short Form Health Survey®–36 (SF–36) in a longitudinal study that examined the impact of a 6-month lifestyle intervention (a diet and a walking program) on self-rated HRQOL in women with obesity (n = 298; baseline mean BMI = 36.7, SD = 4.9; mean age = 59.0 years, SD = 6.2). In seven out of the nine SF–36 domains that were assessed, the study's findings indicated that weight loss contributed to HRQOL improvements. Weight loss was significantly correlated with all SF–36

subscales except for the Physical Role Functioning and Emotional Role Functioning subscales. Specifically, decreases in BMI and increases in physical fitness were associated with improvements in health transition (r = .45), physical functioning (r = .21), bodily pain (r = .14), general health (r = .27), vitality (r = .27), social functioning (r = .14), and mental health scores (r = .02; all p < .05 (Ross et al., 2009). Although this study's major finding suggested that weight loss and physical fitness contributed substantially to improvements in seven of the nine key domains of HRQOL, weight loss was found to mediate the relationship between physical fitness and HRQOL. In comparison with those who lost less weight but improved more in physical fitness had substantially greater improvements in self-rated HRQOL.

To date, the major findings regarding obesity in adults suggest that weight loss may improve physical function (Villareal, Banks, Sinacore, Siener, & Klein, 2006) and that improved physical function leads to improved HRQOL (Wright et al., 2012). However, few studies have examined the HRQOL of adults with obesity and the effect of weight loss on blood pressure and HRQOL in adults; furthermore, few studies have examined the impact of intentional weight loss on HRQOL in older adults.

Purpose and Aims

The overall purpose of this dissertation is to examine how obesity and intentional weight loss impact the health related Quality of life in adults. Specifically, the research described in this dissertation had three aims:

Aim 1. to describe the relationship between obesity and HRQOL and identify gender and age difference in the correlations between obesity and HRQOL;

- Aim 2. to examine the impact of intensive weight loss program on the physiological changes in obese adults; and
- Aim 3. to describe the moderating factors (gender, age, BMI) related to HRQOL changes that occur after completing an intentional weight loss program.

Significance

Given the substantial adverse effect of obesity in adults—especially in older adults identifying relationships between obesity and HRQOL and examining the efficacy of an intensive weight loss program and moderating factors associated with successful weight loss are important research objectives. Findings from such research can potentially be valuable for clinicians and researchers who seek to develop evidence-based programs to reduce obesity and its associated health detriments. Research on the comparative effectiveness of weight loss and the impact of age and gender on self-rated physical function may provide information that will be useful for individuals who seek to improve their health behavior through weight loss and increasing physical activity. Also, such interventions may assist older individuals in both maintaining physical function and decreasing disabilities from chronic health conditions—and thereby help such individuals to increase their independence and HRQOL into an older age.

Presentation of the Dissertation

This dissertation is presented in five chapters. Chapter 1 presents the background and significance of obesity and aging and introduces the dissertation aims. Chapter 2 identifies associations of BMI, gender, age, and HRQOL among obese adults who were enrolling into an intentional weight loss program. The HRQOL and sub-scores were further compared with general population normative data by age and gender. Chapter 3 examines the changes in physiologic health (weight and blood pressure) that occur after a 17-week intensive weight loss

program. Chapter 4 explores (a) the moderating factors (i.e., gender, BMI, and age) (b) the change in blood pressure weight and BMI that occur as a result of the weight loss program, and (c) how those moderating factors impact the mental component summary scores and the physical component summary scores related to HRQOL for Week 1 and Week 17 (immediately after intensive weight loss). Chapter 5 provides a summary of the research findings, conclusions about obesity and weight loss in older adults, and implications and recommendations for future policy and research.

References

- Apovian, C. M., Frey, C. M., Rogers, J. Z., McDermott, E. A., & Jensen, G. L. (1996). Body mass index and physical function in obese older women. *Journal of the American Geriatrics Society*, 44(12), 1487–1488.
- Fine, J. T., Colditz, G. A., Coakley, E. H., Moseley, G., Manson, J. E., Willett, W. C., & Kawachi, I. (1999). A prospective study of weight change and health-related quality of life in women. *JAMA*, 282(22), 2136–2142.
- Fontaine, K. R., Barofsky, I., Bartlett, S. J., Franckowiak, S. C., & Andersen, R. E. (2004).
 Weight loss and health-related quality of life: Results at 1-year follow-up. *Eating Behavior*, 5(1), 85–88. doi:10.1016/s1471-0153(03)00059-x
- Ford, E. S., & Mokdad, A. H. (2008). Epidemiology of obesity in the Western Hemisphere. Journal of Clinical Endocrinology and Metabolism, 93(11 Suppl 1), S1–S8. doi:10.1210/jc.2008-1356
- Beckles, G. L., Williamson, D. F., Leveille, S. G., Langlois, J. A., Engelgau, M. M., & Narayan,
 K. M. (2000). Diabetes and physical disability among older U.S. adults. *Diabetes Care*, 23(9), 1272–1277.
- Gregg, E. W., Beckles, G. L., Williamson, D. F., Leveille, S. G., Langlois, J. A., Engelgau, M. M., & Narayan, K. M. (2000). Diabetes and physical disability among older U.S. adults. *Diabetes Care*, 23(9), 1272–1277. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/10977018
- Houston, D., Ding, J., Nicklas, B. J., Harris, T. B., Lee, J. S., Nevitt, M. C., . . . Kritchevsky, S.B. (2007). The association between weight history and physical performance in the

Health, Aging and Body Composition study. *International Journal of Obesity (London)*, *31*(11), 1680–1687. doi:10.1038/sj.ijo.0803652

- Houston, D. K., Ding, J., Nicklas, B. J., Harris, T. B., Lee, J. S., Nevitt, M. C., . . . Kritchevsky,
 S. B. (2007). The association between weight history and physical performance in the
 Health, Aging and Body Composition study *International Journal of Obesity (London)*,
 31, 1680–1687).
- Hubbard, R. E., Lang, I. A., Llewellyn, D. J., & Rockwood, K. (2010). Frailty, body mass index, and abdominal obesity in older people. *The Journals of Gerontology. Series A, Biological sSciences and Medical Sciences*, 65(4), 377–381. doi:10.1093/gerona/glp186
- Jia, H., & Lubetkin, E. I. (2005). The impact of obesity on health-related quality-of-life in the general adult US. *Journal of Public Health: Oxford Journals*, 27(2), 156–164. doi:10.1093/pubmed/fdi025
- Ogden, C. L., Carroll, M. D., Kit, B. K., & Flegal, K. M. (2012). Prevalence of obesity in the United States, 2009-2010. *National Centers for Health Statistics Data Brief*, (82), 1–8.
- Ross, K. M., Milsom, V. A., Rickel, K. A., Debraganza, N., Gibbons, L. M., Murawski, M. E., & Perri, M. G. (2009). The contributions of weight loss and increased physical fitness to improvements in health-related quality of life. *Eating Behaviors*, 10(2), 84–88. doi:10.1016/j.eatbeh.2008.12.002
- Villareal, D. T., Banks, M., Sinacore, D. R., Siener, C., & Klein, S. (2006). Effect of weight loss and exercise on frailty in obese older adults. *Archives of Internal Medicine*, 166(8). doi:10.1001/archinte.166.8.860

- Wright, F. E., Boyle, S., Baxter, K., Gilchrist, L., Nellaney, J., Greenlaw, N., & Forde, L. (2012).
 Understanding the relationship between weight loss, emotional well-being and health-related quality of life in patients attending a specialist obesity weight management service. *Journal of Health Psychology*. doi:10.1177/1359105312451865
- Yancy, W. S., Jr., Olsen, M. K., Westman, E. C., Bosworth, H. B., & Edelman, D. (2002).
 Relationship between obesity and health-related quality of life in men. *Obesity Research*, *10*(10), 1057–1064. doi:10.1038/oby.2002.143

CHAPTER 2.

THE IMPACT OF OBESITY ON ADULT HEALTH-RELATED QUALITY OF LIFE

CHAPTER 2. THE IMPACT OF OBESITY ON ADULT HEALTH-RELATED QUALITY OF LIFE

Abstract

Background. Obesity is widely recognized as a major public health issue. In the United States, the prevalence of obesity has increased in parallel with the increased age of the nation's general population. The obesity epidemic has impacted all age groups and both genders. Current estimates suggest that one in three American adults are obese (i.e., having a body mass index of 30 kg/m² or higher) (Ogden, Carroll, Kit, & Flegal, 2012) with obesity rates highest among middle-age adults (40–59 years of age; 39.5%), followed by older adults (60 years of age or older; 35.4%) and younger adults (20–39 years of age; 30.3%). In the age group 60 years of age and older, the percentage of adults who are obese has doubled during the past 30 years, with obesity rates higher for women than for men. In addition, obesity and aging may have adverse impacts on older adults, understanding the effects of age, gender, and weight status on HRQOL in the older population can help clinicians and researchers develop effective obesity prevention interventions that are tailored to older adults.

Aims. The aims of the study discussed in this dissertation were (a) to examine the influence of BMI, gender, and age on HRQOL in obese older adults who sought to participate in an intensive weight loss program and (b) to compare the BMI, gender, age and HRQOL data of these participants with equivalent data for the general population. To achieve these aims, individual participants were categorized in three ways: by age group (i.e., 18–39 years, 40–59 years, or 60 years and older); by gender; and by BMI. Furthermore this paper will (a) explore the level of HRQOL among obese adults who enrolled in an intensive weight loss program and

compare this group's HRQOL scores with those of the U.S. population; (b) examine whether HRQOL differs according to gender or age group; and (c) examine the influences of BMI, age, and gender on HRQOL.

Methods. This cross-sectional secondary study used data from a behavior modification intensive weight-loss program. The study used a self-rated short form with 36 questions (Short Form–36 [SF–36]) to analyze HRQOL data of obese individuals entering the weight loss program. SF–36 scores are separated into physical component summary (PCS) scores and mental component summary (MCS) scores; these PCS and MCS scores are further divided into subscores that were analyzed with reference to BMI, gender, and age group.

Results. In examining participants PCS scores and sub-scores, the study participants' mean scores and those of the general population; this comparison indicated that for study participants as a group, the scores for obese participants was lower than the general population. In adults 60 years of age and older, PCS scores were inversely related to BMI: higher BMI values were associated with lower PCS scores. Study participants' MCS scores did not significantly differ from the general population; however, the MCS scores of younger participants were lower than those of older participants.

Conclusions. The prevalence of obesity is increasing along with a rapid increase in the number of older adults. In this study, adults with obesity who sought intentional weight loss had a significantly lower scores in self-rated physical health summary (PCS scores) and for older adults this was of greater significance. In light of these findings, when considering obesity counseling for older adults, the impact of their current physical condition on HRQOL should be addressed.

CHAPTER 2. THE IMPACT OF OBESITY ON ADULT HEALTH-RELATED QUALITY OF LIFE

Introduction

According to U.S. census data for 2014, approximately 44.7 million of people were 65 and older in the United States and this group accounted for 14.1% of the population. The U.S. Bureau of the Census (2014) has also projected that in 2033, for the first time in U.S. history, the population of people 65 and older will outnumber people younger than 18 years of age. One of America's most troubling public health issues is obesity; and the national increased aging population is in parallel with the increased obesity prevalence. The obesity epidemic has impacted all age groups and both genders. Current estimates suggest that one in three American adults are *obese*—that is, have a body mass index (BMI) of 30.0 kg/m² or higher; ¹ Ogden et al., 2012). The prevalence of obesity varies according to age group: the obesity rates of adults of middle age (40–59 years old; 39.5%) are higher than the obesity rates of adults 60 years or above (35.4%) and of younger adults (20–39 years old; 30.3%; Ogden et al., 2012). Moreover, in the past 30 years the proportion of older adults (60 years of age and older) who are obese has doubled, with obesity rates higher for women than for men (Ogden et al., 2012).

Both obesity and aging are associated with chronic health conditions such as diabetes, cardiovascular disease, osteoarthritis, and some cancers (Ford & Mokdad, 2008; Jia & Lubetkin, 2005). Of all individuals 65 years of age and older, approximately 80% have at least one chronic health condition, and about 50% of older individuals have at least two chronic health conditions (Ogden et al., 2012). In addition, obesity and aging may have a negative impact on older adults' HRQOL. Research suggests that as individuals grow older, obesity-related limitations in physical

¹ *Body mass index*, a measure of body fat, is calculated as the ratio of an individual's body weight (in kilograms) to the square of the individual's body height in meters,

function and mobility increase (Gregg et al., 2000; Houston et al., 2007) and physical HRQOL quality of life decreases—as measured using the Short Form Health Survey–36 (SF–36; Mishra, Hockey, & Dobson, 2014).

Individuals with obesity, even in those without chronic health conditions, report lower levels of HRQOL when compared to normal weight individuals (Jia & Lubetkin, 2005). Moreover, some investigations have found that individuals with obesity self-report a higher number of "unhealthy days" than do individuals without obesity (Ford & Li, 2008).

In addition to the impact of age and obesity on HRQOL, gender differences have been reported. In comparing between males and females with obesity, Jia and Lubetkin (2005) found that in all age groups, HRQOL scores of females with obesity were lower than those of males with obesity, in all age groups. In younger age groups (adolescents and individuals 20–30 years of age), females reported lower mental health related quality of life as compared to males. Although the SF–36 scores of these adolescents and young adults were similar, females' mean MCS score was significantly lower than that of males (Dixon, Rice, Lambert, & Lambert, 2015). Also, in the age group that was over 18 years of age, BMI and MCS were significantly correlated (r = .34, p = .002), with trends similar in males and females (Dixon et al., 2015). However, among obese individuals, little is known about the relationship between gender and HRQOL—especially in older adults.

Studies have found that, in comparison with individuals with normal weight, both individuals who are overweight or who have obesity and individuals who are underweight report lower HRQOL (Dixon et al., 2015; Jia & Lubetkin, 2005; Villareal, Apovian, Kushner, & Klein, 2005). However, most of these observations were conducted on younger adults. Given the high prevalence of obesity among older adults, understanding the effects of age, gender, and weight status on older adults' HRQOL may help clinicians and researchers develop effective interventions for obesity prevention that are tailored specifically to this older population. Thus, the aim of this study is to ascertain the effects of age, gender, and weight status on HRQOL for a group of individuals participating in an intensive weight loss program. The study's three specific research aims are

- explore the level of HRQOL among adults with obesity enrolled in an intensive weight management program and compare their HRQOL scores to U.S. population norms;
- examine whether there is a difference in HRQOL between gender and among different age groups; and
- examine the role of BMI, age and gender on HRQOL.

Method

A cross-sectional study design was used to explore factors associated with HRQOL in older adults. This paper reported baseline data collected in an intensive weight loss program in northern California. Participants were self-referred from recruitment flyers in physician offices and volunteered for this fee based self-pay program in northern California. The inclusion criteria for participating in the weight loss program were (a) 18 years of age or older, (b) ability to read and speak English, (c) a BMI of at least 30 kg/m² or a BMI over 25 kg/m², and (d) one cardiac risk factor (specifically, metabolic syndrome, diabetes, or hypertension). Patients with angina, class III kidney disease, and psychiatric conditions were excluded from participating in the program. A nurse practitioner or a physician screened all participants for eligibility.

The weight loss program included 17 weeks of a low-calorie diet (960 calories/day) in the form of meal replacements and 75-minute weekly group meetings that focused on behavioral change; the meetings were led by a health educator (facilitator). The entire program lasted 82

weeks. Participants in the weight loss program completed HRQOL surveys (i.e., SF–36) at baseline, at 17 weeks, and after completing the program (82 weeks). Participants completed the surveys at the clinic.

This paper reported only baseline data. The study was approved by the institutional review boards of the University of California, San Francisco and Kaiser Permanente of Northern California.

Measures.

Demographics. Demographic information was collected as part of the patients' medical records. In order to calculate individuals' BMI values, height and weight data were collected at baseline. Weights were also measured during weekly visits. In this study, the age groups were divided into three age cohorts—18–39 years, 40–59 years, and 60–79 years. These age-group classifications were in accordance with Erickson's (2007) theory of psychosocial development for adults. According to this theory, people in the age range 18–39 year old age group typically seek "love" (intimacy vs isolation); in contrast, people in older age groups seek "care" and "wisdom" (Erickson, 2007). Age-related psychosocial development may further impact self-rated HRQOL beyond obesity, thus the age cohorts were grouped for comparison.

Because the age groups in this study spanned 20 years while the comparison group (norm population) spanned 10 years, the norm population age groups statistics were averaged to create comparable age groups (i.e. 18–24, and 25–34, and 35–44 were averaged to form a comparable group for this study's 18–39 age group) in order to obtain the normalized comparison.

SF–*36*. The SF–36 is a self-report survey used to assess HRQOL. The questions on the SF–36 contain items that measure eight HRQOL conceptual dimensions: physical functioning (PF) role limitations due to physical problems (RP), bodily pain (BP), general health (GH),

vitality (VT), social functioning (SF), role limitations due to emotional health (RF), and mental health (MH). These concepts are combined into the physical component summary (PCS) score and the mental component summary (MCS) scores (Jia & Lubetkin, 2005). For each conceptual dimension, item scores are coded, summed, and transformed to a scale from 0 (worst health) to 100 (prefect health) (Ware & Kosinski, 2001). PCS and MCS scores are represented on a standardized scale (as a T score with a mean of 50 and standard deviation of 10). The magnitude of difference in the summary scores can be used as a measure of rate of change in health of patients over a treatment period or between populations (Ware & Kosinski, 2001). Higher scores on this questionnaire represent higher perceived HRQOL. The internal consistency was supported by the high Chronbach's alphas of 0.93 (graduate students) and 0.90 (dialysis patients; Ferrans & Powers, 1985). Available evidence suggests the SF–36 is a valid measure of HRQOL in obesity research on the basis of the good content and construct validity (de Zwaan et al., 2009). The content validity of the SF-36 is supported both in literature review and in reports of patients regarding quality of life while experiencing chronic health conditions (Ferrans & Powers, 1985).

U.S. population norms have been published and used as normative data for comparison (13). Scale norms were based on age and gender and for age by gender. The study discussed in this paper used these norms as reference.

Statistical analysis. Descriptive statistics were calculated for all demographics and SF– 36 scales. A bivariate analysis was conducted to test for statistically significant differences between the study sample and population norms for the SF–36. One-way ANOVA was used to detect differences within the study sample by gender and age group. Bonferroni correction was applied to reduce type 1 error. The association of the SF–36 (PCS, MCS) and of the patient

characteristics of BMI, gender, age, as well as interactions between BMI–Gender, BMI–Age, and Gender–Age among participants seeking intensive weight loss program was assessed by linear regression. PCS and MCS scores were entered as outcome variables with age, gender, BMI, and interaction terms between these variables were entered in the model as predictors. Age data were clustered into three level structures by age group (18–39 years of age; 40–59 years of age; and 60 years of age and older); gender was structured as a two-level variable (female and male). Stepwise regression and Mallows's Cp criterion were used to determine the best models. A *p*-value of less than .05 was considered statistically significant. The analyses were conduct in SPSS and STATA.

Results

The study sample consisted of a total of 1,020 participants who were over the age of 18 and who were enrolled in an intensive weight loss program. The mean age of study participants was 55.64 years (SD = 11.9; females, 75%; males, 25%). The age groups in this study were 18–39 years old (females, 8.8%; males, 2%); 40–59 years old (females, 37.5%; males, 11.6%); and 60 years or older (females, 28.6%; males, 11.5%; see Table 2.1).

HRQOL scores compared to HRQOL scores of U.S. population norms. For

participants in this study, average SF–36 scores ranged from 44.24 (PF) to 48.88 (MCS). The mean PCS score was 44.68 (SD = 9.66); the mean MCS score was 48.88 (SD = 10.66). The SF–36 scores from this study's participants with obesity were below the means mean scores of the general population (Table 2.2). For all study participants, all scores, except the MCS score (p <.005), were significantly lower than those of the general population (p < .005).

HRQOL gender differences. PCS subscale scores (for physical functioning, role limitations due to physical problems, bodily pain, and general health) were lower than those of

females in the general population, and this difference was statistically significant (Table 2.2). Also, the MCS subscale scores for social functioning and vitality were significantly lower for females in this study than for females in the general population.

The PCS score and PCS subscores (physical functioning, role limitations due to physical problems, bodily pain, and general health) reported by male participants in this study were significantly lower than those of the general population. Male participants reported statistically lower subscores for VT than males from the normal population (see Table 2.2).

Age group comparisons in this study. Participants 60 years of age and older had a lower PCS score and PCS subscores (physical functioning, role limitations due to physical problems, bodily pain, and mental health) than did participants in the other age groups. However, the older age group's MCS scores were higher than those of the other age groups. Participants in the 40–59 year age group also exhibited a significantly higher MCS score than the 18–39 age group (Table 2.2). In this study, the MCS scores increased as age increased.

Age-group scores compare to general population scores. For study participants 18–39 years of age, all subscale scores were significantly lower than those of the general population, except for bodily pain and mental health. For participants 40–59 years of age, all subscale scores were significantly lower than those of the normal population, except for role limitations due to emotional health. For participants 60 years of age and older, only the PCS subscale scores of physical functioning, bodily pain, and vitality were substantially lower than those of the normal population.

The role of BMI, Age, and Gender on HRQOL. A higher BMI was associated with lower SF–36 scores in PCS (r = -.381, p = .000), general health (r = -.299, p = .0000), physical functioning, (r = -0.375, p = .000), vitality (r = -0.157, p = .0000), and social functioning (r = -

.136, p = .000). No statistically significant association was found between BMI and other HRQOL subscales.

The multivariate regression model suggests that older age ($sr^2 = 0.0427$, p < .005) and BMI ($sr^2 = .0110$, p < .005) were associated with higher MCS scores in adults with obesity ($r^2 = .0581$, F = 31.39, p < .005). For PCS scores, results suggest that older age ($sr^2 = .0227$, p = .0000) and the interaction of age and BMI ($sr^2 = .1745$, p = 0.0000) were associated with a lower PCS scores in obese adults (r = .2283, F = 150.42, p = .005). Higher age and interaction between age and BMI were associated with lower PCS scores.

Discussion

This investigation of HRQOL in adults with obesity found that participants in all age groups reported lower HRQOL than the general population. Gender differences were also found in this study, with the MCS scores of females with obesity being lower MCS scores than those of their male counterparts. In comparison with males with obesity, females with obesity had lower social functioning scores; the social functioning scores of females with obesity were also lower than those of females with normal weight status. Interestingly, the mean MCS scores of older participants with obesity reported higher MCS than did younger obese study participants. The PCS score was found to be related to age and to interaction between age and BMI.

This study's findings are supported by findings of other studies that suggest that obesity is related to poorer HRQOL—independent of age and of gender (Fine et al, 1999; Wright et al, 2012). Wright et al. (2012) found that, regardless of disease status, individuals with obesity of all ages have physical and psychosocial self-identified difficulties that adversely impact HRQOL. Studies conducted by Finkelstein (2000) and by Jia and Lubetkin (2005) have also found that as higher BMI values are associated with diminished HRQOL (Finkelstein, 2000; Jia & Lubetkin,

2005). Others have also found that in comparison with people with normal weight, people , with severe obesity had significantly lower HRQOL, MCS, and PCS scores, but in particular, the greatest decrement was noted in PCS scores (Jia & Lubetkin, 2005; Kaukua, Pekkarinen, Sane, & Mustajoki, 2003). Because obesity is associated with physical health conditions (e.g., osteoarthritis and diabetes), individuals with obesity may report having diminished HRQOL due to obesity-related health issues (Ford & Li, 2008)). Moreover, common health complaints such as pain, fatigue, and impaired mobility are more prevalent in older individuals with obesity. These common health complaints also negatively affect HRQOL (Borglin et al., 2005; (Finkelstein, 2000; Jia & Lubetkin, 2005). In addition to the relationship between poor physical health and quality of life (PCS), lower mental health quality of life (MCS) also is reported by both males and females with obesity (Reynolds, Saito, & Crimmins, 2005)

The current study found that the impact of obesity on HRQOL varies by gender. The MCS scores of females with obesity were lower than those of their male counterparts. Specifically, the social functioning scores for female participants were significantly lower than scores for both males and the females in the general population. This finding suggests that females with obesity may struggle with social functioning that negatively impacts their HRQOL. The lower social functioning scores may be due to social stigmatization and a lack of self-satisfaction associated with obesity, especially for females (Puhl, Masheb, White, & Grilo, 2010). For example, some researchers have reported that females with obesity are less likely to get married (Gortmaker, Musi, Perrin, Sobol, & Dietz, 1993) than are females without obesity. Moreover, females with higher BMIs have reported lower satisfaction in their intimate partner relationships, (Boyes & Latner, 2009) and perceptions of being less attractive than other women (i.e., have lower self-esteem). In addition, females with obesity have been reported to partner with less-educated men (Lipowicz, 2003) and with men with lower socioeconomic status (Boyes & Latner, 2009). However, while examining males for issues related to obesity and social functioning, the impact was not observed (Boyes & Latner, 2009). It is possible that social stigma related to obesity may be stronger for females than for males, and therefore females with obesity report lower mental health-related quality of life than do males with obesity.

The current investigation found that older participants with obesity reported better mental health-related quality of life (MCS) than did their younger counterparts, while physical health-related quality of life (PCS) was associated with older age and the interaction between BMI and age. These findings are similar to those of other studies, which have reported that the MCS scores of older individuals with obesity were higher than those of younger individuals with obesity. Minnetti and associates (Minniti et al., 2011) compared younger women (age, 18–59 years) who were overweight or obese with older female counterparts (age, 60–80 years). The researchers found that although the older women had more chronic health conditions and similar BMIs, their psychological functioning (MCS) scores were higher than those of their younger counterparts. Other studies have also reported that older women with obesity reported better psychological status (i.e., happiness and satisfaction with life) than did younger women with obesity—despite the older women's having more chronic health conditions, greater physical impairment, and a greater rate of decline in overall HRQOL (Koster et al., 2010; Yancy, Olsen, Westman, Bosworth, & Edelman, 2002; Zizza et al., 2003)

Yet, in the current sample, physical functional status (PCS scores) decreased in older adults as BMIs increased. A self-rated decline (i.e., a drop in SF–36 PCS score) in physical ability was related to the interaction effect of age and obesity. Earlier studies suggest that for both older men and women, obesity exacerbates age-related decline in physical function.
Research also suggests that, in comparison with normal-weight older adults, older people with obesity have a significantly higher probability of physical functional decline and associated functional limitations (Reuser, Bonneux, & Willekens, 2009; Vincent, Vincent, & Lamb, 2010). Data on older adults consistently indicate that as BMI increases, physical function decreases (Apovian, Frey, Rogers, McDermott, & Jensen, 1996).

Both obesity and aging have been found to be strongly associated with chronic health conditions such as diabetes, cardiovascular disease, osteoarthritis, and some types of cancer (Ford & Mokdad, 2008); (Jia & Lubetkin, 2005). For older adults, obesity may be an important contributor to physical function limitations and chronic health problems. Approximately 80% of all individuals over age 65 have at least one chronic health condition, and about 50% of individuals in this age group have at least two chronic health conditions (Ogden et al., 2012). Obesity and the chronic health conditions may have a negative impact on older adults' HRQOL, possibly due to obesity-related limitations in physical function and mobility (Gregg et al., 2000; Houston et al., 2007).

Limitations

This study had a number of limitations. One is the sample population being studied. This particular weight loss program is expensive and by self-referral. It has drawn mostly White, middle- to high-income participants and may not be generalizable to people of other races and ethnicities, to non-English speaking individuals, or those with lower income. Further, the SF–36 is a generic HRQOL instrument and therefore does not specifically focus on the issues related to aging, chronic health conditions, or obesity.

Conclusion

Although obesity is an important modifiable contributor to chronic health conditions (e.g., diabetes, CHD), research on obesity in an aging population is scant. This study is one of the few to explore the gender and age differences in the HRQOL of individuals with obesity. The prevalence of obesity is increasing along with a rapid growth in the number of older Americans. In this study, we found that adults with obesity seeking intentional weight loss in a formal weight management program have significantly lower scores in self-rated physical health, and for older adults in the program, this finding was of greater significance. When considering obesity counseling for older adults, the impact of their current physical functioning as related to HRQOL should be better addressed to allow a more informed decision based on the understanding of the benefits and risks of intentional weight loss in older adults. Future studies on the impact of weight loss on HRQOL in older adults should be conducted.

Table 2.1 Demographic Characteristics							
Ages	Female n (%)	Male <i>n</i> (%)	Female BMI (<i>SD</i>)	Male BMI (<i>SD</i>)			
Ages 18-39	90 (8%)	20 (2%)	39.46 (7.08)	44.24 (13.44)			
Ages 40-59	383 (37.5%)	118 (11.5%)	39.89 (7.21)	40.67 (7.36)			
Ages 60+	292 (28.5%)	117 (11.5%)	38.70 (6.98)	38.87 (6.53)			
N= 1020	75%	25%	39.39 (7.12)	40.12 (7.76)			

	GH	PF	RP	BP	PCS	VT	SF	MH	RE	MCS
Norms	50	50	50	50	50	50	50	50	50	50
ALL	(10)	(10)	(10)	(10)	(9.95)	(10)	(10)	(10)	(10)	(10.03)
Study	45.20	44.24	46.84	46.73	44.68	45.39	46.92	48.78	48.34	48.88
sample ALL	(9.35)	(9.92)	(10.27)	(9.95)	(9.66)	(9.66)	(10.57)	(9.56)	(10.50)	(10.60)
Norms	50.66	51.41	50.99	50.96	50.96	51.36	50.98	51.26	51.10	51.13
male	(9.72)	(9.11)	(9.54)	(9.59)	(9.3)	(9.60)	(9.33)	(9.30)	(9.31)	(9.17)
Study	44.25	45.05	47.57	47.17	44.46	46.77	49.07	50.54	50.24	51.16
sample male	(9.30)	(9.52)	(9.78)	(9.77)	(9.31)	(9.29)	(9.49)	(8.79)	(8.82)	(9.35)
Norms	49.39	48.70	49.09	49.11	49.12	48.74	49.09	48.84	48.98	48.96
female	(10.22)	(10.59)	(10.33)	(10.29)	(10.45)	(10.19)	(10.50)	(10.48)	(10.50)	(10.67)
Study	45.46	43.97	46.59	46.59	44.75	44.94	46.20	48.19	47.70	48.12
sample female	(9.36)	(10.04)	(10.43)	(10.01)	(9.78)	(9.74)	(10.82)	(9.74)	(10.94)	(10.89)
Norms	51.13	53.03	52.39	51.41	48.91	49.69	50.52	49.10	50.98	52.84
ages	(9.29)	(7.05)	(7.94)	(8.97)	(9.96)	(9.53)	(9.34)	(9.98)	(9.05)	(7.51)
18-44										
Study	42.70	47.67	48.27	49.97	48.05	44.49	45.14	46.14	46.12	44.71
ages	(9.23)	(8.48)	(9.01)	(9.03)	(8.05)	(10.07)	(11.43)	(9.27)	(10.10)	(10.77)
18-39										
Norms	50.03	50.27	50.46	49.57	50.29	50.42	50.13	50.03	50.51	50.06
ages 35-64	(10.20)	(9.24)	(9.70)	(10.09)	(10.08)	(10.22)	(10.13)	(10.14)	(9.77)	(9.64)
Study	44.52	45.56	48.34	47.52	45.91	44.75	46.72	48.02	48.85	47.97
sample	(9.50)	(9.22)	(9.50)	(9.66)	(9.05)	(9.43)	(10.42)	(9.68)	(10.41)	(10.66)
40-59										
Norms	47.89	43.98	45.19	47.39	51.80	50.39	48.88	51.52	47.72	44.53
ages 55–75+	(10.59)	(11.38)	(11.07)	(10.68)	(10.18)	(10.45)	(11.05)	(9.88)	(11.58)	(10.89)
Study	46.59	41.71	44.61	44.89	42.27	46.42	47.65	50.41	48.31	51.11
sample ages 60+	(8.83)	(10.52)	(11.09)	(10.20)	(10.23)	(9.75)	(10.47)	(9.23)	(10.67)	(9.99)

Table 2.2. SF–36 Subscales vs. Population Norms Mean (SD)

References

- Apovian, C. M., Frey, C. M., Rogers, J. Z., McDermott, E. A., & Jensen, G. L. (1996). Body mass index and physical function in obese older women. *Journal of the American Geriatrics Society*, 44(12), 1487–1488.
- de Zwaan, M., Petersen, I., Kaerber, M., Burgmer, R., Nolting, B., Legenbauer, T., . . . Herpertz, S. (2009). Obesity and quality of life: A controlled study of normal-weight and obese individuals. *Psychosomatics*, 50(5), 474–482. doi:10.1016/S0033-3182(09)70840-0
- Dixon, J. B., Rice, T. L., Lambert, E. A., & Lambert, G. W. (2015). Obese adolescents report better health-related quality of life than obese young adults. *Obesity Surgery*. doi:10.1007/s11695-015-1677-8
- Erickson, H. L. (2007). Philosophy and theory of holism. *Nursing Clinics of North America*, 42(2), 139–163. doi:DOI: 10.1016/j.cnur.2007.03.001
- Ferrans, C. E., & Powers, M. J. (1985). Quality of life index: Development and psychometric properties. ANS. Advances in Nursing Science, 8(1), 15–24.
- Finkelstein, M. M. (2000). Body mass index and quality of life in a survey of primary care patients. *Journal of Family Practice*, 49(8), 734v737. Retrieved from http://search.ebscohost.com/login.aspx?direct=true&db=a9h&AN=3459057&site=ehostlive
- Ford, E. S., & Li, C. (2008). Metabolic syndrome and health-related quality of life among U.S. adults. *Annals Epidemiololgy*, 18(3), 165–171. doi:10.1016/j.annepidem.2007.10.009
- Ford, E. S., & Mokdad, A. H. (2008). Epidemiology of obesity in the Western Hemisphere. Journal of Clinical Endocrinology and Metabolism, 93(11 Suppl 1), S1–S8. doi:10.1210/jc.2008-1356

Gregg, E. W., Beckles, G. L., Williamson, D. F., Leveille, S. G., Langlois, J. A., Engelgau, M. M., & Narayan, K. M. (2000). Diabetes and physical disability among older U.S. adults. *Diabetes Care*, 23(9), 1272–1277. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/10977018

- Houston, D., Ding, J., Nicklas, B. J., Harris, T. B., Lee, J. S., Nevitt, M. C., . . . Kritchevsky, S.
 B. (2007). The association between weight history and physical performance in the Health, Aging and Body Composition study. *International Journal of Obesity (London)*, *31*(11), 1680–687. doi:10.1038/sj.ijo.0803652
- Jia, H., & Lubetkin, E. I. (2005). The impact of obesity on health-related quality-of-life in the general adult U.S. *Journal of Public Health: Oxford Journals*, 27(2), 156–164. doi:10.1093/pubmed/fdi025
- Kaukua, J., Pekkarinen, T., Sane, T., & Mustajoki, P. (2003). Health-related quality of life in obese outpatients losing weight with very-low-energy diet and behaviour modification--a
 2-y follow-up study. *International Journal of Obesity and Related Metabolic Disorders*, 27(10), 1233–1241. doi:10.1038/sj.ijo.0802379
- Koster, A., Stenholm, S., Alley, D. E., Kim, L. J., Simonsick, E. M., Kanaya, A. M., . . . Harris, T. B. (2010). Body fat distribution and inflammation among obese older adults with and without metabolic syndrome *Obesity (Silver Spring)* (Vol. 18, pp. 2354–2361). United States.
- Minniti, A., Bissoli, L., Di Francesco, V., Olivieri, M., Mandragona, R., Mazzali, G., . . .
 Zamboni, M. (2011). Comparison of physical and psychological status in younger and older overweight-obese women. *Nutrition, Metabolism and Cardiovascular Diseases,* 21(12), 909-914. doi:10.1016/j.numecd.2010.02.025

- Mishra, G. D., Hockey, R., & Dobson, A. J. (2014). A comparison of SF–36 summary measures of physical and mental health for women across the life course. *Quality of Life Research*, 23(5), 1515–1521. doi:10.1007/s11136-013-0586-3
- Ogden, C. L., Carroll, M. D., Kit, B. K., & Flegal, K. M. (2012). Prevalence of obesity in the United States, 2009-2010. *National Centers for Health Statistics Data Brief*, (82), 1-8.
- Reuser, M., Bonneux, L. G., & Willekens, F. J. (2009). Smoking kills, obesity disables: A multistate approach of the US Health and Retirement Survey *Obesity (Silver Spring)* (Vol. 17, pp. 783–789). United States.
- Reynolds, S. L., Saito, Y., & Crimmins, E. M. (2005). The impact of obesity on active life expectancy in older American men and women. *The Gerontologist*, 45(4), 438–444. doi:10.1093/geront/45.4.438
- Villareal, D. T., Apovian, C. M., Kushner, R. F., & Klein, S. (2005). Obesity in older adults: Technical review and position statement of the American Society for Nutrition and NAASO, The Obesity Society. *Obesity Research*, *13*(11). doi:10.1038/oby.2005.228
- Vincent, H. K., Vincent, K. R., & Lamb, K. M. (2010). Obesity and mobility disability in the older adult. *Obesity Review*, *11*(8), 568–579. doi:10.1111/j.1467-789X.2009.00703.x
- Ware, J. E., & Kosinski, M. (2001). Interpreting SF–36 summary health measures: A response. *Quality of Life Research*, *10*(5), 405–413; discussion 415-420.
- Yancy, W. S., Jr., Olsen, M. K., Westman, E. C., Bosworth, H. B., & Edelman, D. (2002).
 Relationship between obesity and health-related quality of life in men. *Obesity Research*, *10*(10), 1057–1064. doi:10.1038/oby.2002.143
- Zizza, C., Herring, A., Domino, M., Haines, P., Stevens, J., & Popkin, B. M. (2003). The effect of weight change on nursing care facility admission in the NHANES I Epidemiologic

Followup Survey. *Journal of Clinical Epidemiology*, *56*(9), 906–913. doi:10.1016/S0895-4356(03)00142-2

CHAPTER 3.

THE PHYSIOLOGICAL OUTCOMES OF AN INTENTIONAL WEIGHT LOSS PROGRAM

CHAPTER 3. THE PHYSIOLOGICAL OUTCOMES OF AN INTENTIONAL WEIGHT LOSS PROGRAM

Abstract

Introduction. The prevalence of obesity in industrialized countries has increased during the last two decades and is highest in the United States, where almost a third of American adults are classified as obese. Because individuals with obesity have increased fatty tissue—and, as a result, elevated vascular resistance—many individuals with obesity also have hypertension. Obesity-related hypertension may account for 65% to 75% of the risk for primary (essential) hypertension.

Hypertension is associated with increased risk for chronic health conditions (e.g., cardiovascular disease, stroke, renal disease) and metabolic syndrome (whose risk factors include hypertension, increased waist circumference, impaired glucose tolerance, and increased serum lipids). Given the high prevalence of obesity and associated hypertension, it is important to study how obesity and intentional weight loss in obese individuals impacts physiologic health measured by blood pressure.

Aim. The primary aim of this 17-week study was to examine how weight loss in adults with obesity affects blood pressure—both systolic (SBP) and diastolic (DBP)—from baseline to Week 17 (immediately after the intervention) An additional - aim of this study was to examine the role of BMI, age, and gender on SBP and DBP before and after an intensive weight loss program.

Methods. A secondary dataset of adult patients (n = 645; age: 18 years and older) was accessed over the age of 18, who were enrolled in the weight loss program over the course of at least 17 weeks. Descriptive statistics were calculated for all demographics, and participants were separated by age cohorts and gender. For outcome comparison, we used the variables of BMI, weight loss, the blood pressure from baseline to immediately after the intervention (immediately

following Week 17). The data were further examined to identify differences between age groups and between genders.

Results. The mean ages of female and male participants were 55.47 and 57.27 years, respectively. The weight change for all of the participants decreased on average by 41.57 pounds or an average weight loss of 16.6%; the BMI decreased by 6.514 points on average from Week 1 to Week 17. On average for all participants, SBP significantly decreased by 12.288 mmHg; DBP significantly decreased by 6.705 mmHg. Blood pressure reduction did not significantly differ between age groups or between genders.

Conclusion. In this study, we found that adults with obesity who engaged in an intentional weight loss program can improve their blood pressure and thereby reduce their risk for chronic health conditions. In obesity counseling for adults, the impact of their current blood pressure and risk for chronic health conditions should be discussed to enable them to make better-informed decisions based on the understanding of the benefits and risks of intentional weight loss.

CHAPTER 3. THE PHYSIOLOGICAL OUTCOMES OF AN INTENTIONAL WEIGHT LOSS PROGRAM

Introduction

In the last two decades, the prevalence of obesity has increased in industrial countries and is reported to be the highest in the United States. Currently, estimates suggest that 30% of adults in the US are obese. Obesity is determined by body mass index (BMI), a measure of body fat (i.e., the ratio of body weight in kilograms to the square of body height in meters [kg/m2]). Obesity is defined as a weight status in which BMI exceeds 30 kg/m2 (Ogden, Carroll, Kit, & Flegal, 2012).

Obesity, cardiovascular disease, and hypertension. People who are overweight or obese have a higher incidence of cardiovascular disease and a greater mortality risk (Harsha & Bray, 2008). In addition, for both overweight men and women, increasing weights have been correlated with increasing blood pressures and, hypertension (Alpert, Omran, Mehra, & Ardhanari, 2014). Moreover, *hypertension,* a systolic blood pressure exceeding 140 mmHg or a diastolic blood pressure exceeding 90 mmHg, is itself a major public health concern. Obesity-related hypertension is associated with hemodynamic alterations that lead to disturbances in the heart morphology and left ventricular function (Alpert et al., 2014). These disturbances are related to the total amount of body fat and the degree of abdominal fat stored in the body (Kardassis, Bech-Hanssen, Schonander, Sjostrom, & Karason, 2012). Researchers estimate that 65% to 75% of the risk for primary (i.e., essential) hypertension is due to obesity (Hall, do Carmo, da Silva, Wang, & Hall, 2015).

Obesity as a modifiable risk factor. Fortunately, as a contributor to chronic health conditions, obesity is a modifiable risk factor. For example, lifestyle changes with weight

reduction (and maintaining BMI in the range $18.5-24.9 \text{ kg/m}^2$), along with adequate physical activity (i.e., 30 minutes per day), have been shown effective for both prevention and treatment of hypertension (Ross et al., 2009). Weight loss in obese individuals has been found to improve ventricular systolic and diastolic function (Kardassis et al., 2012). Given these benefits, healthy weight management is critical to prevent hypertension and other cardiovascular diseases.

Benefits of weight loss for hypertension. Observational epidemiologic studies have reported that throughout adulthood, a majority of people have an age-associated increase in systolic blood pressure (Wills et al., 2011). However, in a study of adult participants with obesity (age 50 years and older) who engaged in an intensive weight-loss program, those who lost 10% of body weight underwent a significant decrease in systolic blood pressure (SBP; Christensen et al. (2013). Stevens et al. (2010) found clinically significant reductions in blood pressure and a 65% lower relative risk for hypertension for individuals with obesity 30–54 years of age who lost at least 4.5 kg and maintained this weight reduction for the next 30 months (Stevens et al., 2001). Other studies found that for individuals with obesity, weight loss can have a beneficial effect on measures of blood pressure and blood lipids (Foraker et al., 2014). These studies also suggest that the optimal treatment for hypertension and cardiovascular disease in individuals with obesity includes weight loss and healthy weight maintenance (Foraker et al., 2014); (Kardassis et al., 2012).

Deficits in research evidence. Although research has provided evidence related to the impact of weight loss on the improvement of blood pressure and other cardiovascular function, few studies have examined the role of gender and age on weight loss and change of blood pressure among obese individuals. For example, whether the impact of weight loss on blood pressure differs by age group remains unclear. Similarly, research has not examined whether the

effect of engagement in a weight loss program varies by gender. Foraker et al. (2014) found that weight loss was effective for lowering SBP in overweight and obese pre-menopausal women (Foraker et al., 2014). Most of the research on obesity and weight loss has been conducted on women; few studies have included adults over the age of 65 years (Waters, Ward, & Villareal). Few studies of weight loss among obese individuals have measured the degree of change in blood pressure in relation to gender and age group. Given the high prevalence of obesity and its associated adverse health consequences, it is important to examine: (a) the efficacy of clinicbased weight-loss programs on physiologic health outcomes (e.g., BMI and blood pressure) in obese individual; and (b) whether changes in physiological outcomes differ by age and gender.

Study aims. Given these deficits in research evidence, the specific aims of the study described in this dissertation were to investigate the efficacy of a clinic-based intensive obesity management program on BMI, systolic (SBP), and diastolic (DBP) from baseline to immediately after the intervention (Week 17);

- examine whether there is a difference between gender and among different age groups with the physiological changes that occur immediately after the intensive weight loss program; and
- examine the role of BMI, age, and gender on changes of systolic and diastolic blood pressure after the intervention.

Methods

A pre/post-study design was used to examine the efficacy of a clinic-based intensive weight loss program for overweight or obese individuals. The research study inclusion criteria were that participants must: (a) have a BMI of 30 kg/m^2 or a BMI over 25 kg/m^2 with one cardiac risk factor (i.e. metabolic syndrome, diabetes, hypertension); (b) pay a program fee; (c)

agree to terms and conditions of the medical weight loss program; and (d) be over the age of 18. Exclusion criteria were that participants must: (a) have a diagnosis of angina, class III kidney disease, developmental delay, or psychiatric conditions; or (b) be pregnant or planning a pregnancy. Individuals with previous bariatric surgery and with obesity-related or non-obesityrelated health conditions were not excluded from this study. Ethics approval for this study was obtained from the University of California, San Francisco and Kaiser Permanente of Northern California independent review boards.

Study Procedure

Participants in northern California were self-referred from recruitment flyers in physicians' offices and volunteered for this fee-based self-pay program. All participants first attended a group information session to understand the program's philosophy, goals, and expectations. Group information session attendance was required before entering the program.

The sample of participants included all obese individuals seeking weight loss in a medical weight loss program at a group health plan of North California. A pre-intervention medical screening was completed by the nurse practitioner or physician. Participants were required to agree to follow the plan for the program and to (a) have monthly blood tests (not analyzed in this paper), (b) have a weekly weight check, (c) have meal replacements of 960 calories a day for 7 days a week for 16 weeks, (d) begin a physical activity program and monitor minutes, (e) complete and submit daily eating and activity records, (f) problem-solve challenges to achieve healthy lifestyle goals, and (g) sign a commitment letter.

Intervention

The intensive weight loss program consisted of two parts—meal replacement and group meetings. The program intervention provided meal replacements (shake, bar, and soup choices)

and weekly group meetings to promote increased physical activity and eating within a specified calorie range. . In the group meetings, participants learned a set of self-management, behavior-change skills known as "SMART skills." This set of skills, developed by Klapow and Pruitt (Klapow & Pruitt, 2008), are stated in the order of their originators' SMART mnemonic: **S**—<u>s</u>et a goal, **M**—<u>m</u>onitor your progress, **A**—<u>a</u>rrange your world for success, **R**—<u>r</u>ecruit a support team, and **T**—<u>t</u>reat yourself. The program's intensive weight loss component consisted of (a) food supplements that provided 960 calories a day and (b) weekly, 1-hour group meetings conducted over the course of 82 weeks. At Week 17, food was re-introduced and the participants had one calorie-restricted meal a day; the rest of the meals consisted of the meal replacements. Week 18 had two calorie-restricted meals a day and the remaining meals were the meal replacements. By Week 20, all patients were eating calorie-restricted meals and encouraged, but not required to continue using 2 meal replacements per day.

Each class had approximately 20 participants and one assigned trained facilitator. The weekly group class meetings lasted 1.25 hours for the first 30 weeks. Participants are encouraged to stay within their class cohort for 30 weeks and during the maintenance phase. Each meeting has a specific topic, for example, the importance of monitoring eating and activity. Each class is designed to teach participants necessary skills for independent self-management of weight.

All participants who were taking diuretics (hydrochlorothiazide or Maxide® [i.e., hydrochlorothiazide and triamterene] for the treatment of blood pressure discontinued their diuretics upon beginning the meal replacements (i.e., in Week 2 of the weight loss program). This study reports data collected immediately following the intensive (i.e., 17 weeks after enrollment) part of the 82 week weight loss program.

Measures

Demographics. Demographic information, including age and gender, was collected as part of the patients' medical record. In this study, the participants were divided into three age cohorts (18–39, 40–59, and 60–79 years) whose age range was determined according to physiological and psychosocial developmental stages (Erickson, 2007).

Blood pressure, weight, and height. During the weekly visits, participants' physiological data (i.e., BP, weight) were collected by two medical assistants and entered into the medical record. After entering the clinic, each participant had a 5-minute resting period before the automated blood pressure device was used for blood pressure measurement. Unless contraindicated, blood pressure was first measured while the patient was sitting on the right arm while the patient was sitting; then measured on the left arm. To calculate participants' BMI, height and weight were measured at baseline. Height was collected on the first visit using a hospital-grade Stadiometer with the participant's shoes off. Weight was collected at the weekly visits.

Statistical Analysis

Descriptive statistics were calculated for all demographics. Age data were clustered into a three-level structure by age group (18–39 years of age; 40–59 years of age; 60 years of age and older) while gender was structured as a two-level structure (female and male). Paired *t*-tests were conducted to assess differences in weight, BMI, diastolic blood pressure (DBP), and systolic blood pressure (SBP) from Week 1 to Week 17 in program. Bonferroni correction was applied to reduce Type 1 error. *T*-tests were used to compare the change in BMI, weight, DBP, and SBP between gender groups (assuming unequal variances). Bonferroni correction was applied to reduce Type 1 error. One-way ANOVA and Tukey post-hoc tests were used to compare the

change in BMI, weight, DBP and SBP in the three age groups. To find relationships between changes in weight and BP (both diastolic and systolic), linear regression was applied. A *p*-value of less than .05 was considered statistical significance. The analyses were conducted in SPSS 23 and Stata 12.

Results

Sample characteristics. Over the course of 17 weeks, 645 patients over the age of 18 enrolled in the weight loss program. The mean ages of female and male participants were 55.47 years and 57.27 years, respectively. About 73% of the participants were female, and 42% of participants were over age of 60 years old (see Table 3.1).

Table 3.1. Demographic Characteristics								
		Age Groups (in	years)	All				
N = 645	18–39	40–59	60+					
Male (<i>n</i>)	16	82	78	176				
%	2.5	12.7	12.1	27.2				
Female (<i>n</i>)	54	224	191	469				
%	8.4	34.7	29.6	72.7				
	10.9	47.4	41.7					

Significant changes in body weight, BMI, and systolic and diastolic blood pressure were observed immediately after the 16-week intensive weight loss intervention (Table 3.2).

Weight. For the entire group, weight decreased by 41.57 pounds on average (16.56% of the body weight; *SD*: 15.12, p = .0000).

Gender differences in weight loss. Among females, weight decreased by 37.94 pounds on average (15.87%; SD = 11.69, p = .0000); among males, weight decreased by 51.25 pounds on average (18.12%, SD = 18.60, p = .0000) for males. During the program, females lost less weight on average than did males (t = -8.86, p = .0000).

Age group differences in weight loss. In the 18–39 year age group, weight decreased by 45.81 pounds on average (SD = 16.13; p = .0000); in the 40–59 year age group, by 42.84 pounds on average (SD = 16.22, p = .0000); and in the 60 years and older age group and 39.03 pounds (SD = 13.04, p = .0000). The 60+ age group lost significantly less weight than did the 18–39 year-old age group (p = .002) and the 40–59 year-old age group (p = .007). No statistically significant difference was found in the average amount of weight lost by the 18–39 group and 40–59 year old group (p = .293).

BMI. For all participants, there was a mean BMI decrease of 6.514 points on average immediately after the 16-week intervention (SD = 2.072, p = .000,). BMI decreased by 6.24 points on average for females (*SD* = 1.82, p = .000) and by 7.24 points on average for males (*SD* = 2.50, p = .000,). Immediately after the intervention, females' BMI reduction was substantially less than that of males (p <.001). Significant BMI reductions were observed for all age groups. The 60+ year-old age group's BMI reduction was substantially less than that of the 18–39 year old age group (p = .002) and 40–59 year old age group (p = .013). No statistically significant difference was found in the average BMI decreases between age groups 18–39 and 40–59.

Blood pressure changes.

SBP. For the entire study group, there was a substantial SBP decrease immediately after the 16-week intervention (see Table 3.2). The SBP in females decreased by 11.95 mmHg on average (SD = 14.26, p = .0000) and in males by 13.19 mmHg on average (SD = 15.27, p = .0000) and in males by 13.19 mmHg on average (SD = 15.27, p = .0000) and in males by 13.19 mmHg on average (SD = 15.27, p = .0000) and in males by 13.19 mmHg on average (SD = 15.27, p = .0000) and in males by 13.19 mmHg on average (SD = 15.27, p = .0000) and in males by 13.19 mmHg on average (SD = 15.27, p = .0000) and in males by 13.19 mmHg on average (SD = 15.27, p = .0000) and in males by 13.19 mmHg on average (SD = 15.27, p = .0000) and in males by 13.19 mmHg on average (SD = 15.27, p = .0000) and in males by 13.19 mmHg on average (SD = 15.27, p = .0000) and in males by 13.19 mmHg on average (SD = 15.27, p = .0000) and in males by 13.19 mmHg on average (SD = 15.27, p = .0000) and in males by 13.19 mmHg on average (SD = 15.27, p = .0000) and in males by 13.19 mmHg on average (SD = 15.27, p = .0000) and in males by 13.19 mmHg on average (SD = 15.27, p = .0000) and in males by 13.19 mmHg on average (SD = 15.27, p = .0000) and SD = .0000 and SD = .0000 average (SD = 15.27, p = .0000) and SD = .0000 average (SD = 15.27, p = .0000) and SD = .0000 average (SD = 15.27, p = .0000) average (SD = 15.27,

.0000). The SBP decreased in the 18–39 year-old age group by 10.09 mmHg on average (SD = 12.06, p = .0000); in the 40–59 year age group, by13.49 mmHg on average (SD = 13.78, p = .0000); and in the 60 years of age and older age group, by 11.50 mmHg (SD = 15.84, p = .0000). Age group and gender differences were not statistically significant.

DBP and SBP. The DBP decreased by 6.705 mmHg (SD = 9.91, p = .000) on average for all participants immediately after the intervention. DBP decreased in females by 6.33 mmHg on average (SD = 9.75, p = .000) and in males by 7.72 mmHg on average (SD = 10.29, p = .000). However, between-gender differences in DBP changes were not statistically significant. DBP decreased significantly in all age groups. The 40–59 year-old age group exhibited significantly more change in diastolic BP (by 2.384 mmHg, p = .011) than did the 60 years and older age group (Table 3.2). For every 5% decrease in weight, SBP decreased by 2.1%, and DBP decreased by 2.2%. For every 10% reduction in weight, SBP decreased by 4.2%, and DBP decreased by 4.32%.

Discussion

Weight loss and BMI. This study revealed that an intensive weight loss program can decrease weight, BMI, and blood pressure. Furthermore, the degree of changes in weight and BMI varies by age and gender. During the initial 16-week weight-loss program, the weight reduction was clinically and statistically significant both in gender and in all age groups. Average weight loss was approximately 47 pounds per person, or an average weight loss of 17% from their baseline weight. In addition, participants in this study also had a significant blood pressure reduction and the reduction of weight was significantly associated with decreased blood pressure.

Consistent with the literature, the males and the younger-age cohorts in our study lost more weight when attending intensive weight loss program than did the females and the 60+ age group. Previous studies have found that males of all ages lose weight faster than do females and that younger adults lose weight faster than do older adults (Villareal, Banks, Siener, Sinacore, & Klein, 2004). The weight loss difference may be due to the differences for older adults in lean body mass (Janssen, Heymsfield, & Ross, 2002) and the decrease of energy expenditure secondary to decrease in functional mobility (Jenkins, 2004) in older adults. In addition, older adults tend to lose less weight in a weight loss program due to lower levels of metabolism (decrease in energy expenditure), and less lean body mass available to burn calories (Aronne, 2001).

Obesity is associated with an increased mortality rate with a hazard ratio of 1.18 (95% CI [1.12, 1.25]) for all obesity and 1.34 (95% CI [1.21, 1.47]) for severe obesity (BMI > 40 kg/m2;.(Coleman et al., 2015). In the older adult population, reported effects of obesity on morbidity and mortality have been inconsistent. Although the negative impact of high BMI on mortality risk is well established, a decline in the added relative risk from obesity with aging was also reported (Adams et al., 2006). Some studies have suggested that obesity should not be viewed as a disease in individuals over 55 years of age (Adams et al., 2006; Chapman, 2010) and have suggested that in older adults, the relationship between obesity and mortality follows a J-shaped curve—or what is described as the "obesity paradox," which refers to obese individuals' faring better or at least equal to their low-weight counterparts in terms of mortality from chronic health conditions (Uretsky et al., 2007). Given the limited research on obesity and weight loss study outcomes other than mortality, intentional weight loss in older adults has not been encouraged. However, studies have shown significant improvements in physical function and

mobility (Jensen & Hsiao, 2010), improvements in chronic health conditions, and overall improvement in health-related quality of life (Bouchonville et al., 2013; Villareal et al., 2004). Physical Function and health related quality of life are significantly improved with weight loss in obese individuals of any age and both genders (Villareal et al., 2011). Therefore, obesity-induced complications have a negative impact on self-rated quality of life and may limit older adult active lifespan.

Gender differences exist for obese individuals, especially for women with obesity, partly because women live longer and aging itself can contribute to a greater number of chronic health conditions (Anton et al., 2011). Most of the weight loss studies have been conducted in women and women have less weight loss during weight loss programs than men. This may be due to women having a lower lean muscle mass (males, 7.23–7.26 kg/m² and women, 5.5–5.67 kg/m²) than men and with age, body composition changes (Schautz, Later, Heller, Muller, & Bosy-Westphal, 2012). The incidences of chronic health conditions increase with age. In individuals with obesity, worsening chronic health conditions, and decreasing physical function and mobility (Zizza et al., 2003) occur with older obese individuals. Older obese individuals report impairment in activities of daily living (Barzilay et al., 2007) and have a higher rate of nursing home admissions (Zizza et al., 2003).

Our study found a significant reduction of blood pressure with weight loss independent of gender and age group. More importantly, this study revealed reduction of BMI and weight is correlated with a decrease in blood pressure. We found that with a 5% decrease in weight, SBP decreased by 2.1%, and DBP decreased by 2.2%. These findings are consistent with other studies that showed that weight loss often results in improvement in physiologic, functional, and metabolic health (Beavers et al., 2012; Wing et al., 2011). Despres, Golay, and Sjostrom (2005)

found that for people with obesity who modified their lifestyle, as little as a 7% weight loss reduced the risk of metabolic syndrome and cardiovascular disease (Despres, Golay, & Sjostrom, 2005). Kukkonen-Harjula, Borg, Nenonen, and Fogelholm (2005) found that a 4.8 kg (10.56 lbs) weight loss reduced the odds of metabolic syndrome by 71%. Early studies conducted by Hovell (Hovell, 1982) showed that a decrease in weight of 3 kg may be associated with a 5–7 mmHg decrease in SBP and a 3–4 mmHg decrease in DBP. Review of the blood pressure data over years reveals that all major guidelines recommend weight loss for treating hypertension (Semlitsch et al., 2016; Siebenhofer et al., 2011). These findings are more impressive when viewed in conjunction with U.S. Preventative Task Force reports and recommendations that indicate that screening for obesity and the successful treatment of hypertension result in significant reductions in cardiovascular disease and chronic health conditions over time (Pi-Sunyer, 1998, 2007; Williamson et al., 2009).

Limitations

Significant limitations exist in any study using a secondary dataset. The age range of this study's sample was broad, but the participants were all well insured and had a higher socioeconomic status. Also, the particular weight loss program used in the study is expensive, and participation is by self-referral. The weight loss program drew mostly White, middle- to high-income participants and may not be generalizable to racial–ethnic, non-English-speaking individuals or to those with lower income.

Our study population was enrolled in a health care system in which patients receive care for hypertension and other chronic health conditions. We also had a higher percentage of women enrolled in the weight-loss program. Finally, other potential factors related to change of outcomes (such as use of medication and adherence to the treatment) were not collected. Future

research may need to collect other important information in order to obtain a more comprehensive understanding of the mechanism of the change in blood pressure outcomes.

Conclusion

Although obesity is an important modifiable contributor to chronic health conditions, research on how obesity and weight loss affect blood pressure by age and gender is scant. This study is one of the few to explore gender and age differences among individuals with obesity and the ways in which an intensive weight loss program impact physiological outcomes. In this study, we found that adults with obesity who engaged in an intentional weight loss program have improvements in blood pressure and thereby reduce the risk for chronic health conditions. To support adult patients in making well-informed health behavior decisions, obesity counseling should include discussion of the benefits of intentional weight loss. In addition, researchers should conduct studies on the effects of weight loss immediately after weight loss and on long-term weight maintenance.

Table 3.2. Weight, BMI, SBP, DBP, and Changes

645 patients	Age Groups (in years)			Gender		All	
	18–39	40–59	60+	Female	Male		
	<i>n</i> = 70	<i>n</i> = 306	<i>n</i> = 269	<i>n</i> = 469	<i>n</i> = 176		
Weight (in pounds)							
Week 1	262.151	253.978	244.605	238.987	282.851	250.956	
SD	70.540	55.056	48.889	46.288	62.421	54.756	
Week 17	216.349	211.141	205.578	201.049	231.603	209.386	
SD	61.100	46.054	42.541	41.010	52.791	46.587	
Change:	-45.803	-42.837	-39.027	-37.938	-51.248	-41.570	
Week 17–Week 1							
approx. 95% CI	[41.956,	[41.012,	[37.462,	[36.877,	[48.481,	[40.401,	
	49.650]	44.661]	40.592]	38.400]	54.016]	42.739]	
average	17.47%	16.87%	15.96%	15.87%	18.12%	16.56%	
Body mass index							
Week 1	40.880	39.779	38.989	39.392	40.039	39.569	
SD	9.539	7.130	6.813	7.021	8.045	7.314	
Week 17	33.767	33.109	32.807	33.150	32.780	33.055	
	8.460	6.276	6.229	6.361	6.947	6.523	
Change:	-7.113	-6.670	-6.182	-6.242	-7.240	-6.514	
Week 17–Week 1							
approx. 95% CI	[6.568,	[6.423,	[5.966,	[6.077,	[6.869,	[6.354,	
<i>p</i> = .0000	/.658]	6.917]	6.398]	6.407]	/.611]	6.6/5]	
Blood pressure – systolic (mmHg)							
Week 1	131	135.474	138.8625	135.241	139.494	136.40	
	11.617	13.275	14.697	13.881	13.605	13.926	
Week 17	120.914	121.987	127.364	123.293	126.301	124.11	

SD	12.780	12.793	13.456	13.618	12.355	13.343
Change:	-10.086	-13.487	-11.498	-11.949	-13.193	-12.288
Week 17–Week 1						
95% CI	[7.210,	[11.937,	[9.597,	[10.655,	[10.922,	[11.164,
	12.961]	15.037]	13.340]	13.243]	15.465]	13.413]
Blood pressure – dias	tolic (mmHg)					
Week 1	79.1	81.314	77.405	78.812	81.125	79.44
SD	9.691	9.439	10.585	10.034	10.162	10.114
Week 17	71.343	73.621	72.097	72.486	73.409	72.74
SD	8.365	8.934	8.676	8.890	8.530	8.797
Change:	-7.757	-7.693	-5.309	-6.326	-7.716	-6.705
Week 17–Week 1						
95% CI	[5.436,	[6.615,	[4.085,	[5.441,	[6.185,	[5.939,
	10.078]	8.770]	6.532]	7.211]	9.247]	7.472]

References

- Adams, K. F., Schatzkin, A., Harris, T. B., Kipnis, V., Mouw, T., Ballard-Barbash, R., . . .
 Leitzmann, M. F. (2006). Overweight, obesity, and mortality in a large prospective cohort of persons 50 to 71 years old. *New England Journal of Medicine*, *355*(8), 763–778. doi:10.1056/NEJMoa055643
- Alpert, M. A., Omran, J., Mehra, A., & Ardhanari, S. (2014). Impact of obesity and weight loss on cardiac performance and morphology in adults. *Progress in Cardiovascular Diseases*, 56(4), 391–400. doi:10.1016/j.pcad.2013.09.003
- Anton, S. D., Manini, T. M., Milsom, V. A., Dubyak, P., Cesari, M., Cheng, J., . . . Perri, M. G. (2011). Effects of a weight loss plus exercise program on physical function in overweight, older women: A randomized controlled trial *Journal of Clinical Interventions in Aging* (Vol. 6, pp. 141–149). New Zealand.
- Aronne, L. J. (2001). Epidemiology, morbidity, and treatment of overweight and obesity. *Journal of Clinical Psychiatry*, 62. Retrieved from <Go to ISI>://WOS:000171605000003
- Barzilay, J. I., Blaum, C., Moore, T., Xue, Q. L., Hirsch, C. H., Walston, J. D., & Fried, L. P. (2007). Insulin resistance and inflammation as precursors of frailty: The Cardiovascular Health Study. *Archives of Internal Medicine*, *167*(7), 635–641. doi:10.1001/archinte.167.7.635
- Beavers, K. M., Hsu, F.-C., Houston, D. K., Beavers, D. P., Harris, T. B., Hue, T. F., . . . Nicklas,
 B. J. (2012). The role of metabolic syndrome, adiposity, and inflammation in physical performance in the Health ABC Study. *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences*. doi:10.1093/gerona/gls213

- Bouchonville, M., Armamento-Villareal, R., Shah, K., Napoli, N., Sinacore, D. R., Qualls, C., & Villareal, D. T. (2013). Weight loss, exercise or both and cardiometabolic risk factors in obese older adults: Results of a randomized controlled trial. *International Journal of Obesity (London)*. doi:10.1038/ijo.2013.122
- Chapman, I. M. (2010). Obesity paradox during aging. *Interdisciplinary Topics in Gerontology and Geriatrics* (Vol. 37, pp. 20–36). Switzerland: Basel.
- Coleman, C. D., Kiel, J. R., Mitola, A. H., Langford, J. S., Davis, K. N., & Arterburn, L. M. (2015). Effectiveness of a Medifast meal replacement program on weight, body composition and cardiometabolic risk factors in overweight and obese adults: A multicenter systematic retrospective chart review study. *Nutrition Journal*, *14*, 77. doi:10.1186/s12937-015-0062-8
- Despres, J. P., Golay, A., & Sjostrom, L. (2005). Effects of rimonabant on metabolic risk factors in overweight patients with dyslipidemia. *New England Journal of Medicine*, 353(20), 2121-2134. doi:10.1056/NEJMoa044537
- Erickson, H. L. (2007). Philosophy and theory of holism. *Nursing Clinics of North America*, 42(2), 139–163. doi:DOI: 10.1016/j.cnur.2007.03.001
- Foraker, R. E., Pennell, M., Sprangers, P., Vitolins, M. Z., DeGraffinreid, C., & Paskett, E. D. (2014). Effect of a low-fat or low-carbohydrate weight-loss diet on markers of cardiovascular risk among premenopausal women: A randomized trial. *Journal of Womens Health (Larchmont)*, 23(8), 675–680. doi:10.1089/jwh.2013.4638
- Hall, J. E., do Carmo, J. M., da Silva, A. A., Wang, Z., & Hall, M. E. (2015). Obesity-induced hypertension: Interaction of neurohumoral and renal mechanisms. *Circulation Research*, *116*(6), 991–1006. doi:10.1161/circresaha.116.305697

- Harsha, D. W., & Bray, G. A. (2008). Weight Loss and Blood Pressure Control (Pro). *Hypertension*, *51*(6), 1420-1425. doi:10.1161/hypertensionaha.107.094011
- Hovell, M. F. (1982). The experimental evidence for weight-loss treatment of essential hypertension: A critical review. *American Journal of Public Health*, 72(4), 359–368.
- Janssen, I., Heymsfield, S. B., & Ross, R. (2002). Low relative skeletal muscle mass (sarcopenia) in older persons is associated with functional impairment and physical disability. *Journal of the American Geriatrics Society*, *50*(5), 889–896.
- Jenkins, K. R. (2004). Obesity's effects on the onset of functional impairment among older adults. *Gerontologist*, 44(2), 206–216.
- Jensen, G. L., & Hsiao, P. Y. (2010). Obesity in older adults: Relationship to functional limitation. *Current Opinion in Clinical Nutrition and Metabolic Care*, 13(1), 46–51. doi:10.1097/MCO.0b013e32833309cf
- Kardassis, D., Bech-Hanssen, O., Schonander, M., Sjostrom, L., & Karason, K. (2012). The influence of body composition, fat distribution, and sustained weight loss on left ventricular mass and geometry in obesity. *Obesity (Silver Spring), 20*(3), 605–611. doi:10.1038/oby.2011.101
- Klapow, J., & Pruitt, S. (2008). *Living SMART: Five Essential Skills To Change Your Health Habits Forever*. Canada: DiaMedia Publishing.
- Ogden, C. L., Carroll, M. D., Kit, B. K., & Flegal, K. M. (2012). Prevalence of obesity in the United States, 2009-2010. *National Centers for Health Statistics Data Brief*, (82), 1–8.
- Pi-Sunyer, F. X. (1998). NHLBI Obesity Education Initiative Expert Panel on the identification, evaluation, and treatment of overweight and obesity in adults—The evidence report. *Obesity Research, 6.* Retrieved from <Go to ISI>://WOS:000075818400001

- Pi-Sunyer, F. X. (2007). How effective are lifestyle changes in the prevention of type 2 diabetes mellitus? *Nutr Rev*, 65(3), 101–110.
- Ross, K. M., Milsom, V. A., Rickel, K. A., Debraganza, N., Gibbons, L. M., Murawski, M. E., & Perri, M. G. (2009). The contributions of weight loss and increased physical fitness to improvements in health-related quality of life. *Eating Behaviors*, 10(2), 84–88. doi:10.1016/j.eatbeh.2008.12.002
- Schautz, B., Later, W., Heller, M., Muller, M. J., & Bosy-Westphal, A. (2012). Total and regional relationship between lean and fat mass with increasing adiposity--impact for the diagnosis of sarcopenic obesity. *European Journal of Clinical Nutrition*, 66(12), 1356– 1361. doi:10.1038/ejcn.2012.138
- Semlitsch, T., Jeitler, K., Berghold, A., Horvath, K., Posch, N., Poggenburg, S., & Siebenhofer,
 A. (2016). Long-term effects of weight-reducing diets in people with hypertension.
 Cochrane Database of Systematic Reviews, 3, Cd008274.
 doi:10.1002/14651858.CD008274.pub3
- Siebenhofer, A., Jeitler, K., Berghold, A., Waltering, A., Hemkens, L. G., Semlitsch, T., . . .
 Horvath, K. (2011). Long-term effects of weight-reducing diets in hypertensive patients. *Cochrane Database of Systematic Reviews*, (9), Cd008274.
 doi:10.1002/14651858.CD008274.pub2
- Stevens, V. J., Obarzanek, E., Cook, N. R., Lee, I. M., Appel, L. J., Smith West, D., . . . Cohen, J. (2001). Long-Term Weight Loss and Changes in Blood Pressure: Results of the Trials of Hypertension Prevention, Phase II. *Annals of Internal Medicine*, *134*(1), 1–11. doi:10.7326/0003-4819-134-1-200101020-00007

- Uretsky, S., Messerli, F. H., Bangalore, S., Champion, A., Cooper-Dehoff, R. M., Zhou, Q., & Pepine, C. J. (2007). Obesity paradox in patients with hypertension and coronary artery disease. *The American Journal of Medicine*, *120*(10), 863–870.
 doi:10.1016/j.amjmed.2007.05.011
- Villareal, D. T., Banks, M., Siener, C., Sinacore, D. R., & Klein, S. (2004). Physical frailty and body composition in obese elderly men and women. *Obesity Research*, 12(6). doi:10.1038/oby.2004.111
- Villareal, D. T., Chode, S., Parimi, N., Sinacore, D. R., Hilton, T., Armamento-Villareal, R., . . . Shah, K. (2011). Weight loss, exercise, or both and physical function in obese older adults. *New England Journal of Medicine*, *364*(13), 1218–1229. doi:10.1056/NEJMoa1008234
- Waters, D. L., Ward, A. L., & Villareal, D. T. Weight loss in obese adults 65 years and older: A review of the controversy. *Experimental Gerontology*(0). doi:http://dx.doi.org/10.1016/j.exger.2013.02.005
- Williamson, D. A., Rejeski, J., Lang, W., Van Dorsten, B., Fabricatore, A. N., & Toledo, K. (2009). Impact of a weight management program on health-related quality of life in overweight adults with type 2 diabetes. *Archives of Internal Medicine*, *169*, 163–171. United States.
- Wills, A. K., Lawlor, D. A., Matthews, F. E., Sayer, A. A., Bakra, E., Ben-Shlomo, Y., . . .
 Hardy, R. (2011). Life course trajectories of systolic blood pressure using longitudinal data from eight UK cohorts. *PLoS Medicine*, 8(6), e1000440.
 doi:10.1371/journal.pmed.1000440

- Wing, R. R., Lang, W., Wadden, T. A., Safford, M., Knowler, W. C., Bertoni, A. G., ...
 Wagenknecht, L. (2011). Benefits of modest weight loss in improving cardiovascular risk factors in overweight and obese individuals with type 2 diabetes. *Diabetes Care, 34*(7), 1481–1486. doi:10.2337/dc10-2415
- Zizza, C., Herring, A., Domino, M., Haines, P., Stevens, J., & Popkin, B. M. (2003). The effect of weight change on nursing care facility admission in the NHANES I Epidemiologic
 Followup Survey. *Journal of Clinical Epidemiology*, *56*(9), 906–913. doi:10.1016/S0895-4356(03)00142-2

CHAPTER 4. THE IMPACT OF INTENTIONAL WEIGHT LOSS ON HEALTH-RELATED QUALITY OF LIFE

CHAPTER 4. THE IMPACT OF INTENTIONAL WEIGHT LOSS ON HEALTH-RELATED QUALITY OF LIFE

Abstract

Background. Over the past 30 years, the percentage of older adults who are obese has doubled; the most recent CDC data indicates that adults age 60 and over were more likely to be obese than were younger adults. The number of chronic health conditions associated with obesity increases with increasing body mass index (BMI) and in association with aging. Obesity-related chronic health conditions and their associated physical function–mobility limitations are the leading cause of diminished personal independence and diminished health related quality of life (HRQOL) for older adults.

Aims. The aim of this study was to identify associations of BMI, gender, age and HRQOL with mental component summary (MCS) scores and physical component summary (PCS) scores, among adults with obesity who are enrolled in an intensive weight loss program, and at Week 17, after the intensive weight loss.

Methods. Six hundred and forty five participants (age: 18–79 years) completed the demographic data and HRQOL surveys at their first visit (baseline) and at Week 17 of an intensive weight loss program. The short form (SF–36) was used to measure the HRQOL for physical component summary (PCS), mental component summary (MCS), BMI, weight loss, systolic blood pressure (SBP), and diastolic blood pressure (DBP) were measured for between-group and between-gender comparisons. Further analysis was performed to evaluate Week 1–Week 17 outcomes and differences.

Results. From Week 1 to Week 17, all of the study participants lost weight. Average weight loss was approximately 47 pounds (21.36 kg) per person, or an average weight loss of

17% from baseline weight. BMI and the week in the program were statistically significant contributors to the PCS score. Participation in the program for 17 weeks was associated with an increase in the PCS score by 0.34% (p = .000) [$sr^2 = .0724$, p = .000], and lowering the SBP increases the PCS score by 0.087% (p = .000) [$sr^2 = .0166$, p = .000], and as SBP increases, the PCS score decreases. In other words, the SBP and the PCS score during linear regression or were inversely related.

Regression of age, gender, week in program, SBP, DBP, and BMI onto the PCS score, revealed that age, the week in program, and BMI significantly influenced the PCS score. When only age and week in program were re-analyzed by regression, age was found to contribute 0.139% ($sr^2 = 0.0292$, p = .000) to the MCS score. Staying in the program until 17 weeks led to an increase in MCS score of 0.265%, $sr^2 = .0475$, p = .000.

When only age, week in program, and BMI were re-analyzed by regression, age was found to decrease PCS score by 0.217% ($sr^2 = .0784$, p = .000), and BMI decreased the PCS score by 0.474% ($sr^2 = .1260$, p = .000), while staying in the program for 17 weeks led to an increase in PCS score of 0.214%, $sr^2 = .0282$, p = .000.

Conclusion. Obesity and in turn weight loss are associated with HRQOL. This study is one of the few to explore the gender and age differences (to include patients with multiple chronic health conditions) in the HRQOL of individuals with obesity. The SF–36 is a self-rated measure of health; the instrument's scores are influenced by the respondent's perceptions, expectations, and interpretations regarding their health. This study provides comprehensive data that elucidate how obesity and intentional weight loss affect self-rated physical and mental health in younger and older adults; this information is pertinent to people who may or may not have chronic health conditions. The study found that, as an individual became older, their MCS scores tended to improve. In this study, females with obesity tended to have a lower MCS score than did males with obesity, and that PCS scores increase as weight and BMI decrease.

CHAPTER 4. THE IMPACT OF INTENTIONAL WEIGHT LOSS ON HEALTH-RELATED QUALITY OF LIFE

Introduction

The worldwide prevalence of obesity has tripled in the past 20 years. In the United States, it is estimate that today approximately 50% of adults are classified as overweight or obese (Ogden, Carroll, Kit, & Flegal, 2012). In addition to this increase in obesity, the nation has undergone a rapid growth in its aging population. About 14.1% of the population is older than 65 years of age, and the aging population is expected to grow to 21.7% by 2040 (HHS.gov/aging). The prevalence of obesity continues to rise along with the proportion of the subpopulation of older adults who are obese has doubled in the past 30 years. The most recent CDC data indicate that adults 60 years of age and over are more likely to be obese than are younger adults. Researchers estimate that among adults 60 years of age and older, 42.3% of women and 36.6% of men are obese (Ogden et al., 2012).

Both obesity and aging are independently and in combination associated with an increase in the number of physical health conditions (i.e., metabolic syndrome, diabetes, and hypertension (Ford & Mokdad, 2008; Jia & Lubetkin, 2005)). The number of physical health conditions associated with obesity--- increases with increasing body mass index (BMI) and in association with aging (Villareal, Apovian, Kushner, & Klein, 2005). In the subpopulation of people older than 65 years of age, approximately 80% have at least one chronic health condition and approximately 50% have at least two chronic health conditions (Ogden et al., 2012). In addition, obesity may exacerbate age-related physical function decline due to decreasing physical mobility and function which negatively affects health-related quality of life (Villareal, Banks, Sinacore, Siener, & Klein, 2006).
Furthermore, a mounting body of evidence indicates that obesity and health-related quality of life (Jensen & Hsiao, 2010; Villareal et al., 2006). Although HRQOL has no standard definition, researchers generally accept that HRQOL is subjective and multifaceted. According to (Jia & Lubetkin, 2005), these facets comprise physical, psychological, and social domains. HRQOL is an important health outcome in assessing treatments and health over time; with measurements of HRQOL, health care providers have access to useful information about patients' well-being and experience during treatment (Apovian et al., 2002; Jenkins, 2004).

Research has found that even a 5% reduction in body-weight improves self-rated HRQOL in obese individuals (Fontaine, 2003). Studies of older adults have shown that intentional weight loss is associated with improved HRQOL, as measured by improvements in physical component summary scores (Villareal, Banks, Siener, Sinacore, & Klein, 2004). Despite widespread awareness of the negative impact of obesity on physical, functional, and psychosocial health, few researchers have examined the impact of intentional weight loss on HRQOL in older adults. Also, few researchers have investigated obesity and factors associated with change of HRQOL in older adults with obesity (Reuser, Bonneux, & Willekens, 2008). Given that obesity is an important modifiable risk factor for hypertension and other cardiovascular diseases, the aim of this study was to compare factors (e.g., age, gender, change of BMI, and change of blood pressure) that that may effect change of HRQOL in adults specifically after the initial weight loss that occurred after the adults had participated in an intensive weight loss program.

Methods

A pre-/post-study design was used to identify factors associated with change of HRQOL in obese adults who attended an intensive weight loss program. This paper used data from a study of adults with obesity enrolled in a weight loss program. The study's overall aim was to examine the efficacy of weight loss in obese adults on blood pressure—both systolic (SBP) and diastolic (DBP)—and HRQOL from baseline to immediately after the intervention (Week 17). The variables of interest included age, gender, change in BMI, weight, blood pressure, and change of HRQOL from baseline to immediately after the intervention. Ethics approval for this study was obtained from the University of California, San Francisco and Kaiser Permanente of Northern California independent review boards.

Study Procedure. The study's setting was a group health management organization (HMO) evening clinic in northern California. This clinic, which was held in a medical office education center, used medical-grade equipment. Participants who were self-referred from recruitment flyers in physician offices volunteered to participate in this fee-based self-pay program. All participants attended a mandatory group information session to understand the philosophy, goals, and expectations of the program. Group information session attendance was required before entering the program, and participants volunteered after being fully informed of cost, risk, and benefit of the 82-week weight loss program.

Intervention. The program intervention provided meal replacements (shake, bar, and soup choices) and weekly-facilitated (by a health educator or a dietician) group meetings to promote increase in physical activity and healthy behavior. The intensive weight loss program provided 960 calories a day in supplements and weekly, 1-hour facilitated group meetings led by a health educator (facilitator) over the course of 82 weeks. Blood pressure was measured weekly,

while participants were seated in a quiet room. In Week 2 of the weight loss program, all participants who were taking diuretics (hydrochlorathiazide or Maxide® for the treatment of blood pressure) had their diuretics discontinued upon commencing the meal replacements. Detailed description of this study procedure has been reported in a previous publication (Kirkland-Kyhn et al., 2016).

Inclusion and exclusion criteria. The research study inclusion criteria were (a) participants had a BMI of 30 kg/m² or a BMI over 25 kg/m² with one cardiac risk factor (i.e., metabolic syndrome, diabetes, hypertension), (b) agreed to pay the fee for the program, (c) agreed to terms and conditions of the medical weight loss program, and (d) be over the age of 18. Participants with angina, class III kidney disease, pregnant or planning a pregnancy, and those individuals with developmental delay or psychiatric conditions were excluded from this study because these patients were excluded from participating in the weight loss program. Individuals with previous bariatric surgery and obesity-related or non-obesity-related health conditions were not excluded from this study.

Measures

Demographics. The demographic information such as age and gender was collected as part of the patients' medical record. In this study, participants were divided into three age groups: 18–39 years, 40–59 years, and 60–79 years). These age ranges were determined in accordance with Erickson's (2007) theory of psychosocial development for adults. According to Erickson's concept, people who are 18–39 years of age typically seek "love" (intimacy vs. isolation); in contrast, older adults seek "care" and "wisdom" (Erickson, 2007). Age-related psychosocial development may impact self-rated HRQOL beyond obesity; thus the age groups were grouped for comparison according to proposed psychosocial development for adults.

Blood pressure, weight, and height. During the weekly visits, the physiological data (BP, weight) were collected by two medical assistants and entered into the medical record. Each participant had a 5-minute rest period (after entering the clinic) before the blood pressure was measured. Unless contraindicated, blood pressure was measured using the right arm while the patient was sitting, then blood pressure was measured using the left arm. In order to calculate BMI, height and weight data were collected at baseline. Height was measured on the first visit using a hospital-grade Stadiometer with shoes off; weight was collected at the weekly visits.

HRQOL SF–36. Participants in the weight loss program completed HRQOL surveys (SF–36) at baseline and after completing the initial 17 weeks of the weight loss program. The SF–36 is a self-report survey used to assess HRQOL. The questions on the SF–36 (QOL) contain items which measure two major constructs of HRQOL into *physical component summary* (PCS) scales and *mental component summary* scales (MCS(Jia & Lubetkin, 2005). PCS and MCS scores are represented on a standardized scale (as a T-score with a mean of 50 and a standard deviation of 10). The magnitude of difference in the summary scores can be used as a measure of rate of change in health of patients over a treatment period or between populations (Ware & Kosinski, 2001). Higher scores on this questionnaire indicate higher perceived HRQOL (Ferrans & Powers, 1985). Available evidence suggests the SF–36 is a valid measure of HRQOL in obesity research on the basis of the good content and construct validity (de Zwaan et al., 2009). The content validity of the SF–36 is supported by both literature review and reports of patients regarding the quality of life while experiencing chronic health conditions (Ferrans & Powers, 1985).

Statistical analysis. Descriptive statistics were calculated for all demographics. Paired *t*-tests were conducted to assess differences in weight, BMI, diastolic BP, systolic BP, MCS

scores, PCS scores between baseline and post-intervention, age group, and gender. Bonferroni correction was applied to reduce Type 1 error. ANOVA and Tukey post-hoc tests were used to compare the change in BMI, weight, diastolic BP, systolic BP, MCS score, and PCS score between age groups (18–39 years, 40–59 years, 60+ years). Linear regressions were used to identify relationships between changes in weight and BP (both diastolic and systolic), impacts of BMI and BP on HRQOL, as well as all factors (length of time in program, age, gender, diastolic and systolic BP) associated with HRQOL. Stepwise regression was also further used to refine statistically significant relationships. Age data were clustered into three level structures by age group (i.e., 18–39 years, 40–59 years, and 60 years and older), while gender was structured as a two-level (male and female). A *p*-value of less than .05 was considered statistical significance. The analyses were conducted in SPSS 23 and STATA 12.

Results

Sample characteristics. A total of 645 patients over the age of 18 were included in this study. The mean ages of male and female participants were 57.27 years and 55.47 years, respectively. Table 4.1 presents the sample's characteristics.

Table 4.1. Demographic Characteristics							
		All					
<i>N</i> = 645	18–39	40–59	60+				
Male (<i>n</i>)	16	82	78	176			
%	2.5	12.7	12.1	27.2			
Female (<i>n</i>)	54	224	191	469			
%	8.4	34.7	29.6	72.7			
Group %	10.9	47.4	41.7				

BMI and length of time in the program to MCS and PCS. BMI is not a statistically significant contributor to the MCS score. However, remaining in the program until 17 weeks contributed to an increased MCS score by 0.27% ($sr^2 = .0396$, p = .000). BMI and length of time in the program are statistically significant contributors to the PCS score. Remaining in the program until Week 17 increased the PCS score by 0.226% (p = .000; $sr^2 = .0317$, p = .000). With a higher the BMI, the PCS score was decreased by 0.444% (p = .000; $sr^2 = .1116$, p = .000).

SBP and length of time in program in relation to MCS and PCS scores. SBP and the number of weeks of participation in the program were found to be statistically significant contributors to the MCS score and PCS score. For the MCS score, remaining in the program until Week 17 increased the MCS score by 0.313% (p = .000; $sr^2 = 0.0548$, p = .000] and with lowering SBP, the MCS score increased by 0.062% (p = .000)[$sr^2 = .0076$, p = .001]. For the PCS score, Staying until 17 weeks in the program increases the PCS score by 0.340% (p = .000; $sr^2 = .0724$, p = .000] and lowering the SBP increases the PCS score by 0.087% (p = .000; $sr^2 = .0166$; p = .000). The SBP and the PCS score during linear regression had an inverse relationship

DBP and Length of Time in Program to MCS and PCS. DBP is not a statistically significant contributor to MCS or PCS scores. However, remaining in the program until 17 weeks increases the MCS score by 0.27% ($sr^2 = .0437$, p = .000) and increases the PCS score by 0.42% ($sr^2 = .1183$, p = .000).

Regression Analysis for Factors Related to Change of HRQOL. When age, gender, length of time in the program, SBP, DBP, and BMI were regressed onto the MCS score, we found that age and the number of weeks in the program showed statistical significance in influencing the MCS score. When only age and the number of weeks in the program were reanalyzed by regression, we found that age contributed 0.139% (sr2 = .0292, p = .000) to the MCS score while staying in the program until 17 weeks led to an increase of 0.265% (sr2 = .0475, p = .000) in MCS score.

When age, gender, length of time in program, SBP, DBP, and BMI were regressed onto the PCS score, it was revealed that age, length of time in the program, and BMI significantly influenced the PCS score. When just age, length of time in program and BMI were re-analyzed by regression it was found that higher the age and BMI were associated with lower PCS score by 0.217% ($sr^2 = .0784$, p = .000), BMI decreased the PCS score by 0.474% ($sr^2 = .1260$, p = .000) while staying in the program until 17 weeks lead to an increase of 0.214% ($sr^2 = .0282$, p = .000) in PCS score.

Discussion

We found that the participants in all age groups reported improvement in HRQOL after the weight loss intervention. We also found that older participants with obesity reported higher MCS HRQOL scores at baseline and post intervention than did younger obese participants. In general, the female participants' MCS scores were lower than those of males; however, no significant differences were found between males and females for the PCS scores. Change of physical HRQOL (PCS) was associated with older age and the interaction between BMI and age (older age and higher BMI—both had lower PCS scores). SBP and the number of weeks of participation in the program were found to be statistically significant contributors to the MCS score and PCS score.

MCS scores. Results of our study found that MCS scores of the older adults with obesity were higher than those of younger adults with obesity. Specifically, the 18–39 year-old age group had the lowest MCS scores at baseline. These findings are similar to those of other

studies, which reported that the MCS scores of older individuals with obesity were higher than those of younger individuals with obesity (Minniti et al., 2011). These previous studies found that although older overweight–obese women had more chronic health conditions and similar BMIs to younger women, older women reported better psychological functioning (MCS score) than did younger women (Koster et al., 2010; Yancy, Olsen, Westman, Bosworth, & Edelman, 2002; Zizza et al., 2003). The younger women's MCS scores may be lower than those of older women because of the differences between the psychosocial stages that occur in the different age groups (Erickson, 2007). Erickson would suggest that younger individuals are in the *isolation vs. intimacy* stage—in which they are looking for a love relationship. Finding a love relationship when one is obese may be more difficult, and this difficulty may adversely impact MCS scores.

In this study, females had lower MCS scores than did males for pre- post-intervention. Jia and Lubetkin (2005) found differences in HRQOL between males and females with obesity, with females having lower HRQOL scores than males among all age groups. In younger age groups (adolescents and individuals 20–30 years of age), females' reported lower mental HRQOL than that of males. Although SF–36 scores were found comparable for males and females in adolescents and those aged 20 to 30 years, the mean for the MCS score in females was significantly lower than the mean for males (Dixon, Rice, Lambert, & Lambert, 2015). In comparison with women who did not have obesity, women with obesity were found to be less likely to marry compared with women who had a lower BMI (Gortmaker, Must, Perrin, Sobol, & Dietz, 1993). This could due to women with higher BMIs reported less satisfaction in love relationships. Women with obesity have been found to have decrements in overall quality of life physically, socially, and psychologically (Kolotkin, Crosby, Williams, Hartley, & Nicol, 2001).

In our study, a key factor associated with improvement in HRQOL was the length of time that participants engaged in the weight loss program. As with other studies, a higher level of engagement in health-promoting lifestyle behavior was positively associated with higher overall HRQOL (Savoy & Penckofer, 2014). Our study's particular program engaged adults in weekly group sessions and in monthly health care provider visits. These visits focused on giving participants personalized attention, coaching participants in the use of positive health behaviors and choices and keeping the participants engaged in the weight loss program.

PCS scores. Older adults in our study reported lower PCS scores than those of the middle-age group and the younger adult group at baseline and follow up, albeit PCS score improved at the end of intervention in all age groups. The association of physical functional decline with obesity and with aging is well established (Rejeski et al., 2012). The marginal increases in PCS scores in the older group can be explained when examining how common health complaints such as pain, fatigue, and mobility impairment negatively affect HRQOL (Borglin, Jakobsson, Edberg, & Hallberg, 2005) in individuals with obesity. Once weight loss occurs the obesity-related health complaints are not as functionally limiting and may result in improved HRQOL. Although the PCS scores by gender improved by week 17, there was no significant difference between the genders for Week 1 or Week 17.

The SBP and the number of weeks of participation in the program were found to be statistically significant contributors to the MCS score and PCS score. The SBP went down significantly during the weight loss program as weight went down and as SBP went down the MCS and PCS scores improved. The improvement in MCS and PCS scores for Week 17 may be confounded by the weight loss and the group support meetings that occurred during the program.

Limitations

Our study had a number of limitations. One limitation was with regard to the sample population studied. This particular weight loss program is expensive, and participants' approach to the program was initiated by self-referral. This program drew mostly White, middle- to high-income participants, and as a result, the program and the study's findings and conclusions may not be generalizable to other racial–ethnic groups, to non-English-speaking individuals, or to those with lower income. Furthermore, the SF–36 is a generic HRQOL instrument and does not specifically focus on the issues related to aging, chronic health conditions, or obesity.

Conclusion

This study found that obese individuals reported improvement of HRQOL after attending an intensive weight loss program and factors associated with improvement of HRQOL vary by physical and psychosocial domains. Significant weight loss, which occurred during the intensive weight loss program, was found to contribute to the improvements in the PCS and MCS scores from Week 1– Week 17. In addition, the participants had a significant drop in both SBP and DBP from Week 1–Week 17. Therefore, we conclude that with this structured weight loss program, adults significantly improved their self-rated HRQOL both physically and psychosocially.

Current trends show obesity and aging increasing in developed and developing countries with social, financial, and HRQOL ramifications that are yet to be determined. This trend has led to society-wide desire for improved weight control, improved physical function, and improved HRQOL.

Although maintenance of a healthy weight and a healthy physical activity level is a health care priority for all Americans, these objectives are even more important for older adults. Once a

person has established a healthy weight, the person can then strive to maintain and improve physical function, improve chronic conditions, and improve HRQOL.

Given the rapid increases in the prevalence of obesity and in the mean age of the general population over the past two decades, future research should be directed at prevention of obesity at younger ages. To find the best methods for improving population health, researchers should investigate age-specific goals for weight loss while using theory-guided interventions. In the future, researchers should ascertain and investigate factors that influence decisions to engage in weight loss programs and factors that will keep people engaged in health behaviors conducive to maintaining activity and a healthy weight. In addition, government policies and funding should support healthy aging programs, which focus on a healthy weight and maintaining physical activity. These health promotion programs should be available and affordable for all age groups and race/ethnic groups.

Table 4.2. Week 1, Week 17, and Changes

645 patients	Age Groups (in years)		Gender		All	
-	18–39	40–59	60+	Female	Male	
	<i>n</i> = 70	<i>n</i> = 306	<i>n</i> = 269	<i>n</i> = 469	<i>n</i> = 176	
Weight (in pounds)						
Week 1	262.151	253.978	244.605	238.987	282.851	250.956
SD	70.540	55.056	48.889	46.288	62.421	54.756
Week 17	216.349	211.141	205.578	201.049	231.603	209.386
SD	61.100	46.054	42.541	41.010	52.791	46.587
Change:	-45.803	-42.837	-39.027	-37.938	-51.248	-41.570
Week 1-Week 17						
approx. 95% CI	[41.956,	[41.012,	[37.462,	[36.877,	[48.481,	[40.401,
	49.650]	44.661]	40.592]	38.400]	54.016]	42.739]
average	17.47%	16.87%	15.96%	15.87%	18.12%	16.56%
Body mass index						
Week 1	40.880	39.779	38.989	39.392	40.039	39.569
SD	9.539	7.130	6.813	7.021	8.045	7.314
Week 17	33.767	33.109	32.807	33.150	32.780	33.055
	8.460	6.276	6.229	6.361	6.947	6.523
Change:	-7.113	-6.670	-6.182	-6.242	-7.240	-6.514
Week 1–Week 17						
approx. 95% CI	[6.568,	[6.423,	[5.966,	[6.077,	[6.869,	[6.354,
p = .0000	7.658]	6.917]	6.398]	6.407]	7.611]	6.675]
Blood pressure – syst	olic (mmHg)					
Week 1	131	135 474	138 8625	135 241	139 494	136.40
WOOR I	11 617	13 275	14 697	13.881	13 605	13 926
Week 17	120.914	121 987	127 364	123 293	126 301	124.11
SD	12.780	12.793	13 456	13 618	12.355	13 343
Change:	-10.086	-13 487	-11 498	-11 949	-13 193	-12 288
Week 1–Week 17	10.000	10.107	11.190	11.515	10.170	12.200
95% CI	[7.210.	[11.937.	[9.597.	[10.655.	[10.922.	[11.164.
<i>70</i> /0 CI	12.961]	15.037]	13.340]	13.243]	15.465]	13.413]
Blood pressure – diastolic (mmHg)						
Week 1	79.1	81 314	77 405	78 812	81.125	79 44
SD	9 691	9 4 3 9	10 585	10.034	10.162	10 114
Week 17	71.343	73.621	72.097	72,486	73.409	72.74
SD	8.365	8.934	8.676	8.890	8.530	8.797
Change:	-7.757	-7.693	-5,309	-6.326	-7.716	-6.705
Week 1–Week 17	1.151	1.075	5.507	0.520	/./10	0.705
95% CI	[5.436	[6.615	[4.085	[5.441	[6,185	[5,939
	10.078]	8.770]	6.532]	7.211]	9.247]	7.472]
95% CI	[9.430, 10.078]	[0.013, 8.770]	[4.085, 6.532]	7.211]	[0.183, 9.247]	[3.939, 7.472]

Table 4.3. SF-36 MCS and PCS Scores

645 patients	Age Groups (in years)		Gender		All	
	18–39	40–59	60+	Female	Male	
	<i>n</i> = 70	<i>n</i> = 306	<i>n</i> = 269	<i>n</i> = 469	<i>n</i> = 176	
Mental component summary score (average increase in point score)						
Week 1	45.166	48.596	50.978	48.602	50.857	49.217
SD	10.718	10.559	10.050	10.926	9.127	10.507
Week 17	50.502	52.955	54.799	53.310	53.851	53.458
SD	9.059	8.427	7.900	8.475	8.130	8.380
Change: Week 1–Week 17 approx. 95% CI <i>p</i> = .0000	5.34 [2.717, 7.955]	4.36 [3.360, 5.357]	3.821 [2.722, 4.920]	4.708 [3.839, 5.577]	2.994 [1.779, 4.210]	4.24 [3.526, 4.955]
Physical component summary score (average increase in point score)						
Week 1 SD	49.022 7.414	46.640 8.722	42.540 10.082	45.243 9.641	45.044 9.038	45.189 9.473
Week 17 SD	54.949 6.579	53.047 6.480	49.327 8.472	51.948 7.749	51.045 7.421	51.702 7.665
Change: Week 1–Week 17 approx. 95% CI p = .0000	5.927 [4.226, 7.628]	6.406 [5.570, 7.242]	6.788 [5.892, 7.683]	6.705 [6.025, 7.386]	6.001 [4.941, 7.062]	6.513 [5.941, 7.086]

References

Apovian, C. M., Frey, C. M., Wood, G. C., Rogers, J. Z., Still, C. D., & Jensen, G. L. (2002).
Body mass index and physical function in older women. *Obesity Research*, *10*(8), 740–747. doi:10.1038/oby.2002.101

Borglin, G., Jakobsson, U., Edberg, A. K., & Hallberg, I. R. (2005). Self-reported health complaints and their prediction of overall and health-related quality of life among elderly people. *International Journal of Nursing Studies*, 42(2), 147–158. doi:10.1016/j.ijnurstu.2004.06.003

- de Zwaan, M., Petersen, I., Kaerber, M., Burgmer, R., Nolting, B., Legenbauer, T., . . . Herpertz, S. (2009). Obesity and quality of life: A controlled study of normal-weight and obese individuals. *Psychosomatics*, 50(5), 474–482. doi:10.1016/S0033-3182(09)70840-0
- Dixon, J. B., Rice, T. L., Lambert, E. A., & Lambert, G. W. (2015). Obese adolescents report better health-related quality of life than obese young adults. *Obesity Surgery*. doi:10.1007/s11695-015-1677-8
- Erickson, H. L. (2007). Philosophy and theory of holism. *Nursing Clinics of North America*, 42(2), 139-163. doi:DOI: 10.1016/j.cnur.2007.03.001
- Ferrans, C. E., & Powers, M. J. (1985). Quality of life index: Development and psychometric properties. ANS. Advances in Nursing Science, 8(1), 15–24.

Ford, E. S., & Mokdad, A. H. (2008). Epidemiology of obesity in the Western Hemisphere. Journal of Clinical Endocrinology and Metabolism, 93(11 Suppl 1), S1–S8. doi:10.1210/jc.2008-1356

- Gortmaker, S. L., Must, A., Perrin, J. M., Sobol, A. M., & Dietz, W. H. (1993). Social and economic consequences of overweight in adolescence and young adulthood. *New England Journal of Medicine*, 329(14), 1008–1012. doi:10.1056/nejm199309303291406
- Jenkins, K. R. (2004). Obesity's effects on the onset of functional impairment among older adults. *Gerontologist*, 44(2), 206–216.
- Jensen, G. L., & Hsiao, P. Y. (2010). Obesity in older adults: relationship to functional limitation. *Current Opinion in Clinical Nutrition and Metabolic Care*, 13(1), 46–51. doi:10.1097/MCO.0b013e32833309cf
- Jia, H., & Lubetkin, E. I. (2005). The impact of obesity on health-related quality-of-life in the general adult US. *Journal of Public Health: Oxford Journals*, 27(2), 156–164. doi:10.1093/pubmed/fdi025
- Kolotkin, R. L., Crosby, R. D., Williams, G. R., Hartley, G. G., & Nicol, S. (2001). The relationship between health-related quality of life and weight loss. *Obesity Research*, 9(9), 564–571. doi:10.1038/oby.2001.73
- Koster, A., Stenholm, S., Alley, D. E., Kim, L. J., Simonsick, E. M., Kanaya, A. M., . . . Harris, T. B. (2010). Body fat distribution and inflammation among obese older adults with and without metabolic syndrome. *Obesity (Silver Spring)*, *18*, 354–2361. United States.
- Minniti, A., Bissoli, L., Di Francesco, V., Olivieri, M., Mandragona, R., Mazzali, G., ...
 Zamboni, M. (2011). Comparison of physical and psychological status in younger and older overweight-obese women. *Nutrition, Metabolism and Cardiovascular Diseases,* 21(12), 909–914. doi:10.1016/j.numecd.2010.02.025
- Ogden, C. L., Carroll, M. D., Kit, B. K., & Flegal, K. M. (2012). Prevalence of obesity in the United States, 2009-2010. *National Centers for Health Statistics Data Brief*, (82), 1–8.

- Rejeski, W. J., Ip, E. H., Bertoni, A. G., Bray, G. A., Evans, G., Gregg, E. W., & Zhang, Q.
 (2012). Lifestyle change and mobility in obese adults with type 2 diabetes. *New England Journal of Medicine*, *366*(13), 1209–1217. doi:10.1056/NEJMoa1110294
- Reuser, M., Bonneux, L., & Willekens, F. (2008). The burden of mortality of obesity at middle and old age is small. A life table analysis of the US Health and Retirement Survey. *European Journal of Epidemiology*, 23(9), 601–607. doi:10.1007/s10654-008-9269-8
- Savoy, S. M., & Penckofer, S. (2014). Depressive symptoms impact health-promoting lifestyle behaviors and quality of life in healthy women. *Journal of Cardiovascular Nursing*. doi:10.1097/jcn.000000000000158
- Villareal, D. T., Apovian, C. M., Kushner, R. F., & Klein, S. (2005). Obesity in older adults: Technical review and position statement of the American Society for Nutrition and NAASO, The Obesity Society. *Obesity Research*, 13(11). doi:10.1038/oby.2005.228
- Villareal, D. T., Banks, M., Siener, C., Sinacore, D. R., & Klein, S. (2004). Physical frailty and body composition in obese elderly men and women. *Obesity Research*, 12(6). doi:10.1038/oby.2004.111
- Villareal, D. T., Banks, M., Sinacore, D. R., Siener, C., & Klein, S. (2006). Effect of weight loss and exercise on frailty in obese older adults. *Archives of Internal Medicine*, 166(8). doi:10.1001/archinte.166.8.860
- Ware, J. E., & Kosinski, M. (2001). Interpreting SF–36 summary health measures: a response. *Quality of Life Research*, *10*(5), 405-413; discussion 415–420.
- Yancy, W. S., Jr., Olsen, M. K., Westman, E. C., Bosworth, H. B., & Edelman, D. (2002).
 Relationship between obesity and health-related quality of life in men. *Obesity Research*, *10*(10), 1057–1064. doi:10.1038/oby.2002.143

Zizza, C., Herring, A., Domino, M., Haines, P., Stevens, J., & Popkin, B. M. (2003). The effect of weight change on nursing care facility admission in the NHANES I Epidemiologic Followup Survey. *Journal of Clinical Epidemiology*, *56*(9), 906–913. doi:10.1016/S0895-4356(03)00142-2

CHAPTER 5.

SUMMARY AND CONCLUSIONS

CHAPTER 5. SUMMARY AND CONCLUSIONS

The overall purpose of this dissertation research was to examine efficacy of an intentional weight loss program on the health-related quality of life (HRQOL) and physiological health for older adults with obesity. Obesity has been considered an epidemic in recent years and that this epidemic impacts all age groups (Ogden et al., 2006). Obesity and aging both are correlated with increased risk for chronic health conditions (e.g., diabetes, cardiovascular disease, osteoarthritis) which can in turn affect HRQOL. This dissertation has described factors that can affect the HRQOL of adults with obesity and for those engaged in an intentional weight loss program. In particular, this study has examined associations of BMI, gender, age and HRQOL with mental component summary (MCS) scores and physical component summary (PCS) scores, among adults with obesity who are enrolled in an intensive weight loss program, and at Week 17, after the intensive weight loss. This dissertation also examined the efficacy of weight loss program on physiological health and moderating factors associated with improvement of physiological outcomes and HRQOL in adults attending an intensive weight loss program.

Findings of Previous Research

Previous research had suggested that the PCS scores and the MCS scores of HRQOL may be affected more by age and gender, than by BMI (Jia & Lubetkin, 2005). In addition, obesity and aging may have a negative impact on an older adult's HRQOL. Research suggests that obesity-related limitations in physical function and mobility (Gregg et al., 2000; Houston et al., 2007) and physical HRQOL (as measured by the SF–36) decline progressively with aging (Mishra, Hockey, & Dobson, 2014). If older adults have chronic health conditions brought on by aging and obesity, it is possible that their HRQOL may be diminished affecting the MCS and PCS scores of the SF–36.

In addition to reporting associations between HRQOL and age between HRQOL and weight status, research has reported an association between HRQOL and gender. Our findings are consistent with other studies. Jia and Lubetkin found that all age groups mean HRQOL scores of females with obesity were lower than those of males with obesity (Jia & Lubetkin, 2005). In younger age groups (i.e., adolescents and young adults 20–30 years of age), females had lower mental HRQOL scores (on average) than did males. A recent study by Dixon et al, found that although SF–36 scores of adolescent and young adults (20-30 years of age) males and females were comparable, females' mean MCS score was significantly lower than that of males (Dixon, Rice, Lambert, & Lambert, 2015). The researchers also reported statistically significant correlation between BMI and MCS (r = 0.34, p = .002) with trends similar in males and females in the cohort that was 18 years of age and older (Dixon et al., 2015).

For individuals with obesity across the range of age groups, MCS and PCS scores are differentially mediated by gender and age-related factors of psychosocial development. This according to Erickson's view, younger adults (i.e. those 18–39 years of age) primarily seek "love" (intimacy vs. isolation), while older age adults seek "care" and "wisdom" (Erickson, 2007). Given that age-related psychosocial development factors can affect self-rated HRQOL; this dissertation research used age cohort comparisons to ascertain possible effects of age and gender on the HRQOL of adults with obesity

Findings of Dissertation Research

First aim: HRQOL in adults with obesity. The first aim of this dissertation research project was twofold: to evaluate how obesity affected HRQOL in adults entering a weight loss program and to compare the HRQOL of these individuals to a normative general population by age and by gender.

HRQOL Gender differences. A significant difference was found in the PCS between females in this study and females in normative general population with females in this study having lower scores. Also, females in this study scored significantly lower in MCS sub-scores in social functioning and vitality sub-scores

HRQOL (PCS and MCS) age differences. In comparison with younger are groups, the mean PCS scores of the group 60 years of age and older were *lower*, but the mean MCS scores were *higher*. In comparison with the group that was 18–39 years of age, the mean MCS score of the age group that was 40–59 years of age was significantly higher. In this study, the MCS scores increased as age increased.

HRQOL compared to general population. For the age group 18-39 years of age, study group scores were significantly lower than the general population scores in all subscales except for bodily pain and mental health. For age group 40-59 years of age, study group scores were substantially lower than the general population scores except for Role Emotional. For the age group 60 years of age or older, study group scores were substantially lower than general population scores only for the PCS subscales of physical function, bodily pain, and vitality.

Second aim: Effects of a Weight Loss Program on Weight, BMI, and Blood

pressure. For chronic health conditions, obesity is a risk factor that is modifiable through lifestyle changes. For example, lifestyle changes that include increased physical activity (for 30 minutes per day) and that result in weight reduction (maintaining BMI in the range of 18.5–24.9 kg/m²) have been shown to be effective for both prevention and treatment of hypertension (Ross et al., 2009). Given these associations between lifestyle, weight reduction, and hypertension, the dissertation study's second aim was to evaluate how the effects of a structured intentional weight loss program on weight loss and blood pressure were influenced by age and gender.

Weight loss by age and gender. For the study group as a whole, weight decreased by an average of 41.57 pounds (16.56%). Weight decreased among females by an average of 37.94 pounds (15.87%) and among males by 51.25 pounds (18.12%). During the program, females lost less weight, on average, than did males. Weight loss in the group 60 years of age and older was less than that of the groups 40-59 years of age (by 3.81 pounds) and the 18-39 years of age (by 6.78 pounds)

Blood pressure changes. The factors that impact chronic health conditions examined in this study are obesity and hypertension. Despite the discontinuation of diuretic blood pressure medications at the onset of this program, in all age groups both systolic and diastolic blood pressure decreased significantly.

SBP by age and gender. On average, SBP decreased among females by 11.95 mmHg and among males by 13.19 mmHg. There were no significant differences in change of the SBP between genders or between age groups over the 16 weeks of initial weight loss program. From week 1 to Week 17, mean DBP decreased less for females (6.33 mmHg) than for males (7.72mmHg). During this period, mean DBP decreased less for the age group 60 years of age and older (5.31 mmHg) that for the groups 18-39 years of age (7.76 mmHg) and 40-50 years of age (7.69 mmHg). The DBP went down by 7.76 mmHg on average from Week 1 to Week 17 for the 18–39 year old age group, DBP went down by 7.69 mmHg on average for the 40–59 year old age group, and down by 5.31 mmHg on average for the 60+ year old age group. However, between-gender differences in DBP decrease were not statistically significant.

Third aim: Week 17 changes in weight, BMI, and HRQOL. The third aim of this study was to evaluate the change in the HRQOL from Week 1 to Week 17 when the participants were transitioning back to making meal choices and off of meal supplements. All of the study

participants experienced weight loss from Week 1 to Week 17. The average weight loss was approximately 47 pounds (21.36 kg) per person, or an average weight loss of 17% from their baseline weight. BMI and the week in the program were statistically significant contributors to the PCS score. Staying until 17 weeks in the program increases the PCS score and lowering the SBP increases the PCS score, as SBP increases the PCS score decreases. In other words, the SBP and the PCS score during linear regression had inverse relationships.

Regression analysis of age, gender, number of weeks in program, SBP, DBP, and BMI determined that age, number of weeks in program, and BMI significantly influenced the mean PCS score. Regression analysis of only age and week in program determined that age contributed to the MCS score and staying in the program for 16weeks was associated with an increase in MCS score.

A key finding of this study was that the HRQOL scores were different by age at initial entry into the program and after the weight loss. The physical component summary scores that are related to how an individual rates their physical health were lower on entry to the program and were improved in older adults with weight loss. In contrast, the younger adults had the lowest MCS scores on entry into the program.

Implications and Recommendations for Policy and Research

The findings of this dissertation study have several implications for HRQOL and obesity research and for policies that aim to promote improved HRQOL for older adults who may have chronic health conditions.

Implications for policy. From this dissertation study and from preceding research emerge four implications for policy regarding older adults with obesity:

- Primary care providers typically do not counsel obese individuals on strategies for weight loss and for improving HRQOL. Given the magnitude of America's obesity epidemic and the severity of the epidemic's consequences, this deficit in patient education must be rectified.
- The fact that experiential HRQOL is influenced by age- and gender-related differences suggests that obesity counselling for older adults should use a targeted approach that takes into account these age- and gender-related factors.
- To enable older adults to make better decisions regarding issues that affect weight status, obesity counseling should include discussion of the impact of the adults' current physical functioning on their HRQOL. In addition, such counseling should include discussion of intentional weight loss—including benefits and risks specific to older adults.
- To enable older adults to make better decisions regarding issues that affect weight status, obesity counseling should also include discussion of the impact of their current blood pressure and their risks for other chronic health conditions. This discussion, too, should consider the benefits and risks of intentional weight loss.

The findings of this dissertation study have several implications for HRQOL and obesity research and for policies that aim to promote improved HRQOL for aging adults who may have chronic health conditions. This study measured the HRQOL in adults with obesity before and after their engagement in the intentional weight loss program that used behavior modification methods to achieve the specific objectives (i.e., increased physical activity and weight loss).

Implications for obesity counseling. When considering obesity counseling for older adults, the impact of their current physical functioning as related to HRQOL should be better

addressed to allow a more informed decision based on the understanding of the benefits and risks of intentional weight loss in older adults.

The differences in self-rated HRQOL by gender and age suggest a targeted approach to counselling obese individuals by age and gender. Primary care providers typically do not counsel obese individuals on strategies for weight loss and improving HRQOL.

This study found that an intentional weight loss program that includes group meetings and meal supplements can lead to weight loss, lowering of blood pressure, and improvement in HRQOL.

When considering obesity counseling for adults, the impact of their current blood pressure and risk for chronic health conditions should be addressed to allow a more informed decision based on the understanding of the benefits and risks of intentional weight loss. Future studies on the impact of weight loss immediately after weight loss and long term weight maintenance should be conducted. Because obesity and aging has occurred in epidemic proportions over the past two decades, future research should be directed at prevention of obesity at younger ages. Age specific goals and theory guided interventions should be studied to find the best methods for improving population health.

Implications for further research. Given current deficits in our understanding of the effects of weight loss on older adult HRQOL, further research on these effects is clearly warranted. In addition, further research should investigate factors that motivate older adults to seek and to initiate engagement in weight loss programs—and factors that will older adults to persist in maintaining a healthy weight and in improving their HRQOL. To augment research on healthy weight persistence factors, future studies should also be conducted on the effects of weight loss—both immediately after weight loss and on long term. Given that over the past two

decades obesity and aging have occurred in epidemic proportions, future research should be directed at prevention of obesity at younger ages. Finally, age-specific goals and theory-guided interventions should be studied to find the best methods for improving population health.

Limitations

Significant limitations exist in any study that uses a secondary dataset. Participants in the study collectively represented all age groups but resided in a single geographic region (northern California). All of the participants were well insured and predominantly of higher socioeconomic status. Furthermore, as a result of their socioeconomic status, these participants may have had more leisure time to engage in health programs. The particular weight-loss program used in the study was expensive, and participation was initiated via self-referral. The program drew mostly White, middle-to-high income participants, and as a result, neither the study's findings, nor the weight-loss program itself, may not be generalizable to other racial-ethnic groups, to non-English-speaking individuals, or to those with lower income. As with any study whose sample comprises volunteers, the volunteer participants in this dissertation study may have been healthier and more adherent to participation requirements than would be the case with participants drawn randomly from the general population; accordingly, the sample recruitment's self-selection approach may have influenced intervention outcomes via selection bias. On participants entry into the program, participant assessments were conducted by several different medical providers; this procedural requirement could have influenced outcome measurement via a minor performance bias. Program outcomes may also have been influenced by attrition bias. The participants' SF-36 scores were not always collected by the medical assistant, and as a result, the study's reported attrition rate may have been higher than the weight loss program's actual attrition rate. Also, the HRQOL tool used for measurement, the SF-36, is not specific to

age or obesity and therefore, may not be adequate for determining a direct relationship between HRQOL and obesity or weight loss. Moreover, SF–36 scores are derived from self-rating—and are thereby subject to over-reporting of positive behavior and under-reporting of negative behavior.

Summary

This study suggests that obesity negatively affects HRQOL both physically and mentally and that intentional weight loss can improve the physical and mental aspects of HRQOL. While obesity may contribute to lower MCS scores for younger adults and women, the PCS scores for aging adults with obesity were lower. This suggests a high BMI at a younger age may lead to deficits in the HRQOL most especially for females and may be related to psychosocial development.

Older adults have a higher incidence of chronic health conditions and are more affected by the physical constraints involved with obesity and aging. Therefore, providers should offer to these adults' health-promoting programs to prevent obesity and maintain a healthy weight. These programs must have a social support component and a coaching component. In order to design of these programs, researchers should be informed by behavior modification and motivation theories. Furthermore, in order to meet the needs of younger as well as older adults, the design of these programs should also be informed by theories concerning psychosocial developmental stages of aging.

References

- Dixon, J. B., Rice, T. L., Lambert, E. A., & Lambert, G. W. (2015). Obese adolescents report better health-related quality of life than obese young adults. *Obesity Surgery*. doi:10.1007/s11695-015-1677-8
- Erickson, H. L. (2007). Philosophy and theory of holism. *Nursing Clinics of North America*, 42(2), 139–163. doi:DOI: 10.1016/j.cnur.2007.03.001
- Gregg, E. W., Beckles, G. L., Williamson, D. F., Leveille, S. G., Langlois, J. A., Engelgau, M. M., & Narayan, K. M. (2000). Diabetes and physical disability among older U.S. adults. *Diabetes Care*, 23(9), 1272–1277. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/10977018
- Houston, D., Ding, J., Nicklas, B. J., Harris, T. B., Lee, J. S., Nevitt, M. C., . . . Kritchevsky, S.
 B. (2007). The association between weight history and physical performance in the Health, Aging and Body Composition study. *International Journal of Obesity (London),* 31(11), 1680–1687. doi:10.1038/sj.ijo.0803652
- Jia, H., & Lubetkin, E. I. (2005). The impact of obesity on health-related quality-of-life in the general adult US. *Journal of Public Health: Oxford Journals*, 27(2), 156–164. doi:10.1093/pubmed/fdi025
- Mishra, G. D., Hockey, R., & Dobson, A. J. (2014). A comparison of SF–36 summary measures of physical and mental health for women across the life course. *Quality of Life Research*, 23(5), 1515–1521. doi:10.1007/s11136-013-0586-3
- Ogden, C. L., Carroll, M. D., Curtin, L. R., McDowell, M. A., Tabak, C. J., & Flegal, K. M. (2006). Prevalence of overweight and obesity in the United States, 1999–2004. *JAMA*, *295*(13), 1549-1555. doi:10.1001/jama.295.13.1549

Ross, K. M., Milsom, V. A., Rickel, K. A., Debraganza, N., Gibbons, L. M., Murawski, M. E., & Perri, M. G. (2009). The contributions of weight loss and increased physical fitness to improvements in health-related quality of life. *Eating Behaviors*, 10(2), 84–88. doi:10.1016/j.eatbeh.2008.12.002

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