

## Effects Of Age And Gender On Short-Term Weight Loss And Long-Term Weight Maintenance

Research Article

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## Abstract

**Objective:** To determine if there are differences in short-term weight loss and long-term weight maintenance success by age or gender.**Methods:** Patients were enrolled in a Midwestern weight loss clinic. The primary outcome measures were short-term weight loss success (achieving  $\geq 10\%$  of the initial body weight loss (IBWL) at three months) and long-term weight maintenance success (maintaining  $\geq 10\%$  IBWL at one year).**Results:** Patients 18 – 45 years were more likely to achieve short-term weight loss success compared to those in the two other age categories (45-64 and  $\geq 65$  years). However, age was not a significant predictor for long-term weight maintenance success. Females had decreased odds (OR=0.47, 95% CI 0.38, 0.59) of achieving short-term weight loss success, but had increased odds (OR=1.94, 95% CI 1.02, 3.67) of achieving long-term weight maintenance success.**Discussion:** Age and Gender effect were different for short-term weight loss and long-term weight maintenance success.**Key Words:** Weight Loss; Low-Calorie Diet; Percentage Of Initial Body Weight Loss**\*Corresponding Author:**

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Obesity, defined as a body mass index (BMI) greater than or equal to 30.0 kg/m<sup>2</sup>, affects more than one-third (35.7%) of US adults [1]. The prevalence of obesity in those aged 60 years and older (28.0%) is lower than among those aged 40 to 59 years (32.2%) [2]. Obesity is associated with impaired health-related quality of life, disability and fatigue [3,4], and with various medical conditions such as diabetes [5], hypertension, cardiovascular disease [5,6], knee replacement [5], and musculoskeletal disorders [6-8]. These conditions impact the elderly especially hard; those aged 65 years and older are more than eight times as likely as those aged 18 to 44 years to have been diagnosed with diabetes [2].

Obesity is an expensive risk factor. Finkelstein and colleagues reported that obese patients incur 46% increased inpatient costs, 27% more physician visits and outpatient costs, and 80% increased spending on prescription drugs when compared to normal weight controls [9], with annual extra medical costs attributable to obesity in the United States estimated at \$75 billion in 2003 [10]. Weight reduction is generally a cost-effective intervention: for each 1% reduction in body weight, lifetime medical expenditures may decline by \$440 for overweight and obese patients [11].

To reduce the prevalence of obesity, a medical weight loss program incorporating dietary changes and increased physical activity is a feasible alternative to bariatric surgery or pharmacotherapy, particularly for patients who cannot undergo metabolic or bariatric surgery [12,13]. Research has documented that a low-calorie diet can result in a mean weight loss of up to 13 kilograms over a 24-week period among obese patients [14].

Although research evaluating such programs has been conducted, very little research has explored if there are differences in short-term weight loss and long-term weight maintenance success by age or gender. Busetto et al. reported that 18% (5/28) of the older adults (65-80 years) in their study achieved  $\geq 10\%$  of their initial body weight loss (IBWL) at one year, whereas 38% (18/47) of the younger adults (18-64 years) achieved the same goal [15]. Their study concluded that being younger (18-64 years), being female, and having a lower baseline BMI were the only significant predictors for achieving  $\geq 10\%$  of their IBWL at one year [15]. However, the small sample size (N=75) reduced statistical power to reveal potentially significant factors. Additionally, achieving short-term weight loss success ( $\geq 10\%$  IBWL) during the intensive weight loss phase may predict achieving long-term weight maintenance success [16-18]

The objective of this study was to identify if there is a difference in the short-term weight loss or long-term weight maintenance success by age or gender among adults who participated in a weight loss program. Additionally, we sought to identify significant predictors for short-term weight loss success and long-term weight maintenance success.

## Methods

### Patients

The study sample included obese ( $BMI \geq 30 \text{ kg/m}^2$ ) men and women 18 years or older. This study included patients who were enrolled in a medically supervised weight loss program at Via Christi Weight Management clinic (VCWM) in Wichita, Kansas between 2003 and 2012. Patients were required to remain in the program for a minimum of 3 months (Phase 1, weight loss phase) and they could choose to stay in the program for as long as they want (Phase 2, weight maintenance phase). Individuals were excluded from participation if they met at least one of the following criteria: younger than 18 years old, pregnant, breastfeeding, active substance abuse, active eating disorder or behaviors, severe liver disease, renal failure, an active malignancy, or a wasting disease (i.e., Cushing's syndrome, bacterial endocarditis, osteomyelitis, or tuberculosis).

### Instrument

The clinic maintains an electronic database of patients who have voluntarily enrolled and attended weight loss counseling classes. Detailed patient questionnaires were used by VCWM to obtain participant demographics, history of attempts at weight loss, obesity-associated conditions, and current medications. Height, weight, blood pressure, and waist circumference were collected and verified by medical staff during the initial screening period, prior to the program start. Data points for each participant in weight loss and maintenance phases were entered into the clinical database at routine intervals. Body height was measured to the nearest 0.003 meter (0.1 inch) without shoes. Body weight was measured to the nearest 0.05 kg (0.1 pound) with light clothing and no shoes at baseline and at all treatment visits.

### Procedures

Data were de-identified before the analysis to protect patient privacy. The Human Subjects Committee at the University of Kansas School of Medicine-Wichita and the Institutional Review Board at Via Christi Health approved this study. All patients' clinical measures were entered into the original clinical database.

The medically supervised low-calorie diet (LCD) program limits clients' food choices to Health Management Resource (HMR®) meal replacements (shakes, soup, cereal packets, entrees) during the weight loss phase (Phase 1). Weight loss participants must intake a minimum of five meal replacement packets and two vitamin-mineral tablets per day and may choose to intake HMR entrees as needed (consuming a minimum of 800 kcal per day). All Phase 1 patients attended weekly health education classes for three months where they were taught basic principles of weight loss and weight management. When clients achieved their weight loss goal or lost their weight loss momentum (defined by prospective criteria), they entered the weight maintenance phase (Phase 2). Phase 2 includes a weekly weigh in and a 60-minute class emphasizing the following components: weekly attendance, mid-

week check-in call, daily record keeping, greater than or equal to 14 servings of meal replacements per week, greater than or equal to 35 one-cup servings of vegetables and fruits per week, and greater than or equal to 2,000 kcal of physical activity per week. Patients are encouraged to participate in the weight maintenance phase for a minimum of 12 months.

## Dependent and Independent Variables

Two primary dependent variables were the short-term weight loss success and long-term weight maintenance success. Short-term weight loss success was defined as achieving  $\geq 10\%$  IBWL at three months, consistent with the National Institute of Health guidelines[19]. The long-term weight maintenance success was defined as maintaining  $\geq 10\%$  IBWL at one year post initial enrollment in the program[20].

Four independent variables were included in the model: baseline weight, age (categorical variable;  $<45$  years, 45 to 64 years, and  $\geq 65$  years), gender, and weight loss status at three months (dichotomous variable; achieved  $\geq 10\%$  IBWL or achieved  $< 10\%$  IBWL at three months).

## Statistical Analysis

All statistical analyses were conducted using SAS for Windows version 9.3 (Cary, North Carolina). Descriptive statistics were presented as frequencies and percentages for categorical variables (e.g., gender) and means and standard deviations for continuous variables (e.g., age).

An analysis of variance (ANOVA) was conducted to identify the difference in weight loss among the three age groups. Generalized linear mixed regression analysis was conducted to compare the percentage of weight loss among the three age groups. Chi-square test was conducted to identify the proportion of patients achieving  $\geq 10\%$  IBWL among the three age groups. Separate logistic regression analyses were conducted to identify significant predictors of achieving two distinct outcomes: short-term weight loss success and long-term weight maintenance success. The selection of variables was conducted in a stepwise fashion. All statistical analyses were two-sided. P-value  $< 0.05$  was considered to be statistically significant.

## Results

Among the 2,054 adults who finished the three-month medical weight loss program, 1,534 (74.2%) remained in the program for more than three months but less than one year (the "drop-out group"). The other 520 (25.3%) adults stayed in the program for at least one year (the "completer group"). Among the overall population, 93.4% ( $n=1,891$ ) were Caucasian, 66.7% ( $n=1,369$ ) were female, and more than half (58.2%,  $n=1,195$ ) were between 45 and 64 years (Table 1). Approximately three-quarters (72.3%,  $n=1,484$ ) achieved  $\geq 10\%$  initial body weight loss (%IBWL) at three months. Chi-Square analysis was conducted to determine the difference of the demographic variables between the completer and drop-out group. The completer group had a significantly higher proportion of females (71.4% vs. 65.1%), Caucasians (96.5% vs. 92.3%), patients 45-64 years (64.2% vs. 56.2%) and  $\geq 65$  years old (12.9% vs. 6.6%). Additionally, 81% of the completer group achieved  $\geq 10\%$  IBWL at three months, whereas 69% of the drop-out group achieved  $\geq 10\%$  IBWL at three months.

**Table 1. Patient Demographics**

	Overall (N=2,054)	The "Completer Group" (N=520)	The "Drop-out Group" (N=1,534)	P-value
Gender				0.009
Male	685 (33.4%)	149 (28.7%)	536 (34.9%)	
Female	1,369 (66.7%)	371 (71.4%)	998 (65.1%)	
Race/Ethnicity*				0.030
Caucasian	1,891 (93.4%)	499 (96.5%)	1,392 (92.3%)	
African American	79 (3.9%)	10 (1.9%)	69 (4.6%)	
Hispanic	33 (1.6%)	5 (1%)	28 (1.9%)	
Asian American	4 (0.2%)	1 (0.2%)	3 (0.2%)	
American Indian	3 (0.2%)	1 (0.2%)	2 (0.1%)	
Other	15 (0.7%)	1 (0.2%)	14 (0.9%)	
Age Category**				<0.0001
18-44 Years	689 (33.6%)	119 (22.9%)	570 (37.2%)	
45-64 Years	1,195 (58.2%)	333 (64.2%)	862 (56.2%)	
≥ 65 Years	168 (8.2%)	67 (12.9%)	101 (6.6%)	
Weight Loss Status at 3 months				<0.0001
≥10% IBWL***	1,484 (72.3%)	421 (81%)	1,063 (69.3%)	
<10% IBWL	565 (27.5%)	99 (19%)	466 (30.4%)	
Unchanged	1 (0.1%)	0 (0%)	1 (0.1%)	
Gain Weight	4 (0.2%)	0 (0%)	4 (0.3%)	
Weight Loss Status at 1 year				N/A
≥10% IBWL	407 (78.3%)	407 (78.3%)	N/A	
<10% IBWL	98 (18.9%)	98 (18.9%)	N/A	
Unchanged	1 (0.2%)	1 (0.2%)	N/A	
Gain Weight	14 (2.7%)	14 (2.7%)	N/A	

Figure 1, 2 and 3 presented the result of participants' performance in terms of achieving  $\geq 10\%$  IBWL at two separate study endpoints, three months and one year, stratified by age category ( $<45$  years, 45-64 years, and  $\geq 65$  years) and gender. Among participants who stayed in the program for more than three months and less than one year, the average percentages of IBWL  $\geq 10\%$  at three months were 74.6%, 67.2%, and 58.4% for the 18-44 years, 45-64 years, and  $\geq 65$  years groups, respectively (Figure 1, combined gender category). Additionally, for each age category, men were more likely to achieve the short-term weight loss success (Figure 1).

A similar pattern was observed in those who stayed in the program for more than one year: the average percentages of short-term weight loss success were 82.4%, 82.9%, and 68.7% for the 18-44 years, 45-64 years, and  $\geq 65$  years groups, respectively (Figure 2, combined gender category). Men were also more likely to achieve short-term weight loss success across all three age categories (Figure 2). At the end of one year, the percentages of long-term weight maintenance success were 77.3%, 79.3% and 74.6% for the 18-44 years, 45-64 years, and  $\geq 65$  years groups, respectively (Figure 3). Within each age category, an inconsistent pattern appeared on achieving long-term weight maintenance success between males and females. For the 18-45 years group, 70% of males achieved long-term weight maintenance success, whereas 79.8% of females achieved long-term weight maintenance success. For the other two age groups, men were more likely to achieve long-term weight maintenance success.

Two logistic regression analyses were conducted to identify pre-

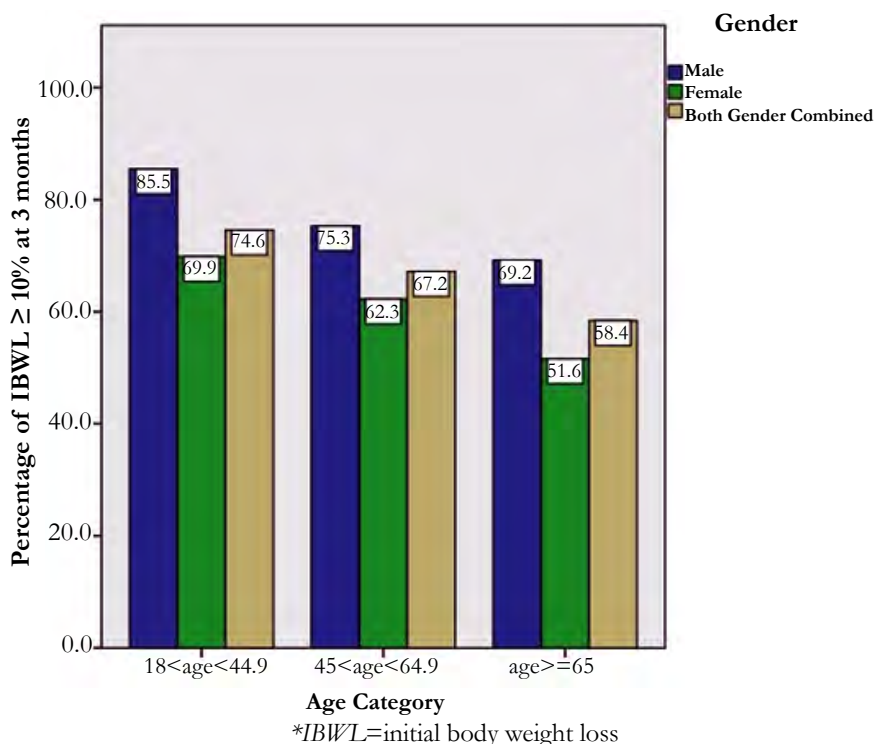
dictors associated with short-term weight loss success and long-term weight maintenance success. Predictors for short-term weight loss success included gender, age group (18-44 years, 45-64 years, and  $\geq 65$  years), and baseline weight. The results of this analysis were presented in Table 2. Patients had increased the odds of achieving short-term weight loss success if they were male (OR=2.0, 95% CI 1.61, 2.50) and age 18-44 years (OR=2.04, 95% CI 1.41, 2.93) and age 45-64 years (OR=1.56, 95% CI 1.11, 2.19) as compared to older patients (aged  $\geq 65$  years).

Another logistic regression analysis was conducted to identify factors predicting long-term weight maintenance success (achieving  $\geq 10\%$  IBWL at one year). The findings were presented in Table 3. Patients were more likely to maintain  $\geq 10\%$  IBWL at one year if they were female (OR=1.94, 95% CI 1.02, 3.67), had a higher baseline weight (OR=1.08, 95% CI [1.04, 1.14] for every five kilograms increased in the baseline weight), and had achieved  $\geq 10\%$  IBWL at three months (OR=7.76, 95% CI [4.58, 13.3]). Age was not a significant predictor for long-term weight maintenance success.

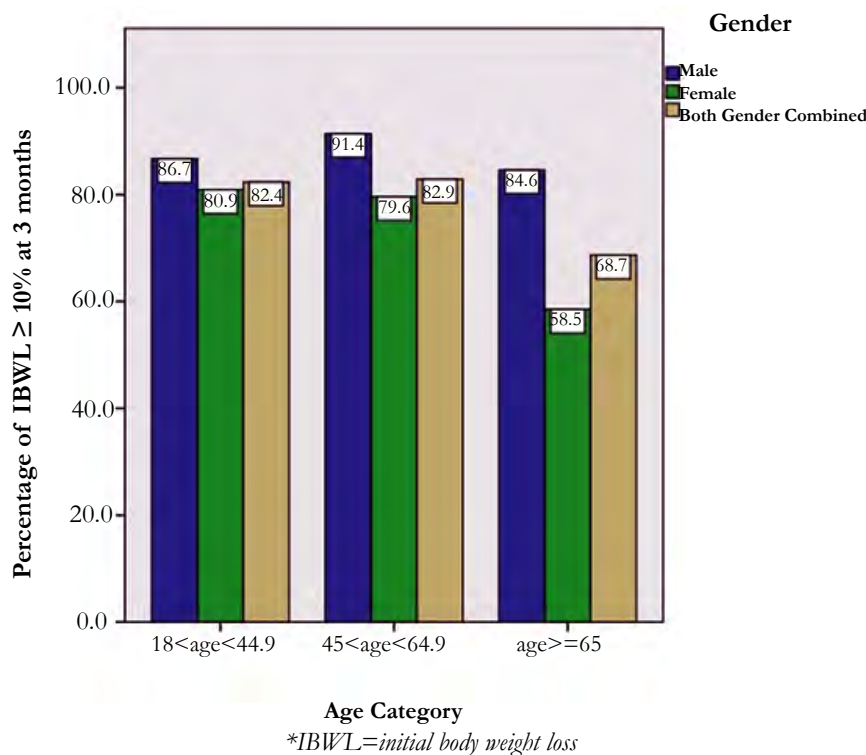
## Discussion

Age and gender play different roles for short-term weight loss success and long-term weight maintenance success. Younger adults and males in our study had increased odds of achieving short-term weight loss success (achieving  $\geq 10\%$  IBWL at three months). However, females were more likely to achieve long-term weight maintenance success (achieving  $\geq 10\%$  IBWL at one year) compared to males. Age was not associated with long-term weight maintenance success. Additionally, baseline weight was not

**Figure 1. Percentage of patients achieving IBWL  $\geq 10\%$  at three months for those who stayed in the program for more than three months but less than one year**



**Figure 2: Percentage of patients achieving IBWL  $\geq 10\%$  at three months for those who stayed in the program for more than one year**



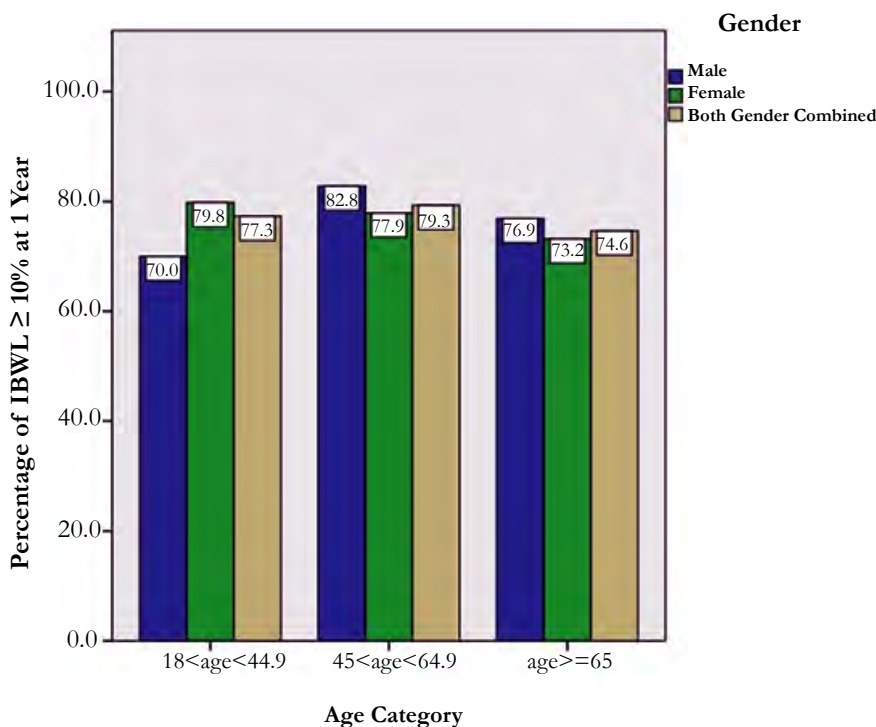
a significant predictor for achieving the short-term weight loss success; however, it was a significant predictor for achieving long-term weight maintenance success.

Maintenance of long-term weight loss goals has been demonstrated to be a challenge [21-24]. The study population also suffered a high dropout rate at one year. But among the 520 adults who remained in the program for at least one year, 78.3% maintained  $\geq 10\%$  IBWL, a rate significantly higher than the 3%-20% reported in the literature [15,25-29]. Prior studies suggest that eating less fat, exercising more, and using prescription weight loss medications were associated with increased odds of losing  $\geq 10\%$

IBWL [29].

Patients 18-44 and 44-65 years were more likely to achieve the short-term goal of  $\geq 10\%$  IBWL at three months compared to those  $\geq 65$  years. However, in our population, age was not a statistically significant predictor of maintaining  $\geq 10\%$  IBWL at one year. This differs from other research [28,30], a difference that might be partially attributable to different cutoffs for measuring weight loss success. For example, Lloyd and Khan reported that persons who successfully achieved weight loss goal at three months (defined as achieving only  $> 5\%$  initial body weight loss) were more likely to be older, male, and obese class I (BMI 30.0-

Figure 3. Percentage of patients achieving IBWL ≥ 10% at one year for those who stayed in the program for more than one year



\*IBWL=initial body weight loss

Table 2. Factors Predicting the Weight Loss Success at 3 Months\*

Factors	OR with 95% Confidence Interval	P
<b>Age Category</b>		<.0001
18-44 Years	2.04 [1.41,2.93]	
45-64 Years	1.56 [1.11,2.19]	
≥ 65 Years	1	
<b>Gender</b>		<.0001
Male	2 [1.61,2.50]	
Female	1	

\*All measures in Table 2 were presented as Odds Ratio (OR) [95% Confidence Interval (CI)]

Table 3. Factors Predicting the Weight Maintenance Success at 1 Year\*

Factors	OR with 95% Confidence Interval	P-Value
<b>Gender</b>		0.042
Male	1	
Female	1.94 [1.02,3.67]	
<b>Baseline Weight (in kg)**</b>	1.08 [1.04,1.14]	0.001
<b>Weight Loss Status at 3 Months</b>		<0.0001
Achieved ≥ 10% IBWL	7.76 [4.58,13.3]	
Achieved < 10% IBWL	1	

\*All measures in Table 3 were presented as Odds Ratio (OR) [95% Confidence Interval (CI)] unless stated otherwise.

\*\*The odds ratio estimate along with its 95% Confidence Interval is based on every 5 kilograms increase in the baseline weight.

34.9 kg/m<sup>2</sup>) [30]. Other differences may stem from the source of the data. For one-year outcomes, Kraschnewski et al. reported that adults 75-84 years had increased odds of achieving ≥ 10% IBWL compared to those 20-34 years [28]. However, their analyses were based on the self-reported data from National Health and Nutrition Examination Survey, whereas this current study used clinically measured data.

It is also worthwhile to point out the fact that for the older adult

population (age ≥ 65years), 68.7% achieve the short-term weight loss success (≥ 10% IBWL at three months), and 74.6% of the same population achieve the long-term weight maintenance success (≥ 10% IBWL at one-year). Our projects demonstrated that long-term weight maintenance success is feasible and promising through the lifestyle intervention. Similar finding were reported by other researchers [31-33]. Older adults should be encouraged to stay in the weight loss program, despite the slow progress of

losing weight at the end of three months.

Baseline weight was a significant predictor for long-term weight maintenance but not for short-term weight loss success. This result differs from other research. Høie and Bruusgaard concluded that baseline weight was a significant predictor for short-term but not long-term weight loss [34]. The difference might be explained by the clinical settings and length of the intervention. Specifically, our study used three months as the weight loss phase and one year as the weight maintenance phase, whereas Høie and Bruusgaard used two months as the weight loss phase and 15.2 months for long-term weight loss. Additionally, we used a low-calorie diet (800 kcals) coupled with physical activity as the intervention, which differed from their intervention of utilizing a very low-calorie diet (430 kcals per day).

Males were more likely to achieve short-term weight loss success in our population, but less likely to achieve long-term weight loss goals. Prior studies are conflicting. Similar findings to our own were reported by Sartorio et al [35]. Likewise, Kraschnewski et al reported that females were more likely to achieve  $\geq 10\%$  IBWL at one year [28]. Contrary to the aforementioned research, Ovbiosa-Akinbosoye and Long reported that males were more likely than females to lose weight in one year [36]. This difference may be due to different study settings. Ovbiosa-Akinbosoye and Long conducted their study in a comprehensive workplace wellness program setting, versus our physician-directed weight management clinic.

Finally, we identified that weight loss success at three months was a significant predictor for longer-term weight maintenance success. Similar findings have been documented by others [16-18,37]. Jeffery et al. concluded that adults who reached weight goals had better long-term weight maintenance than those who did not [16]. Additionally, a 24-month clinical trial concluded that the initial six-month reduction in weight (loss %) was the main predictor for long-term success in weight loss [17]. Other research has also documented that meeting early weight loss goal is one of the strongest predictors of long-term weight maintenance [18,38].

## Limitations

This study is subject to several limitations. There was a high attrition rate at the end of one year; following phase 1 weight loss, 75% of adults dropped out of the phase 2 maintenance program prior to completing one year. Second, greater than 90% of the program's population was Caucasian, and only 3.9% of the overall population was African American. This may limit the generalizability of our findings to other racial or ethnic groups. Additionally, due to the small proportion of African Americans, we were unable to assess the effect of race on the outcomes of interest.

## Conclusions

In this study population, older adults ( $\geq 65$  years) had decreased odds of achieving the short-term goal of losing  $\geq 10\%$  of their initial body weight compared to younger adults (18-44 and 45-64 years). Males were more likely to achieve short-term weight loss compared to females. However, at one year, the age effect diminished, and females were more likely to achieve the long-term goal of maintaining  $\geq 10\%$  of their initial body weight. All participants, especially older adults, should be encouraged to stay in the program to achieve the long-term weight maintenance success.

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