Journal of Gerontology: MEDICAL SCIENCES
2005, Vol. 60A, No. 8, 1007–1012

Weight Change, Weight Change Intention, and the Incidence of Mobility Limitation in Well-Functioning Community-Dwelling Older Adults

Jung Sun Lee,[1] Stephen B. Kritchevsky,[2] Frances Tylavsky,[3] Tamara Harris,[4] Eleanor M. Simonsick,[4] Susan M. Rubin,[5] and Anne B. Newman,[1] for the Health ABC Study

[1]Healthy Aging Research Program, Department of Epidemiology, University of Pittsburgh, Pennsylvania.
[2]J. Paul Sticht Center on Aging, Wake Forest University, Winston-Salem, North Carolina.
[3]Department of Preventive Medicine, University of Tennessee, Memphis.
[4]Clinical Research Branch, National Institute on Aging, Baltimore, Maryland.
[5]Prevention Sciences Group, University of California, San Francisco.

Background. Obesity increases the risk for functional decline in later years, but the functional consequences of weight change in older adults are currently unclear. The aim of this study was to determine whether weight, weight change, and weight change intention are associated with risk for mobility limitation in elderly persons.

Methods. This study included 2932 well-functioning black and white men and women aged 70 to 79 years, participating in the Health, Aging and Body Composition (Health ABC) Study, who were followed for 30 months. At baseline, reported weight change of 5 or more pounds during the previous year and weight change intention were assessed. Mobility limitation was defined as reported difficulty or inability to walk one-quarter mile or to climb 10 steps during two consecutive semiannual assessments during a period of 30 months.

Results. Approximately 30% of participants developed mobility limitation. Higher body mass index (BMI) was associated with increased risk for mobility limitation. Unintentional weight loss in the previous year was associated with increased risk for mobility limitation in the extremely obese, which was defined as BMI $\geq$ 35 (hazard ratios [HR], = 3.79; 95% confidence interval [CI], 1.84–7.79), and the normal BMI, which was defined as BMI $<$ 25 (HR, 2.55; 95% CI, 1.80–3.60). In persons with BMI 25 to 29.9, intentional weight loss (HR, 1.59; 95% CI, 1.12–2.25) and weight fluctuation with any intention (HR, 1.59; 95% CI, 1.10–2.28) increased the risk for mobility limitation. Unintentional weight gain or fluctuation did not confer additional risk for mobility limitation compared with weight stability, regardless of the level of body weight.

Conclusion. In this cohort of well-functioning elderly persons, functional consequences of past weight change depended on the type of weight change, intentionality, and current measured body weight.

OBESITY increases the risk for functional decline in later years (1–8). However, the functional consequences of weight change in older adults are currently unclear. Although weight loss adversely affects physical function in older men and women (1–3,9), weight gain has not been consistently associated with decreased functional health in obese older women (1,2,4). The relationship between weight fluctuation (weight loss followed by weight gain or vice versa) and function is also unknown.

Weight change can be either intentional or unintentional. Unintentional weight change is often associated with more severe disease or with unrecognized health problems (10–13), which could easily account for its association with increased risk for functional limitations. Nevertheless, the effect of unintentional weight change on physical function could be modified by a person's current weight. Identifying under what condition changes in weight adversely affect physical function in older adults could provide a framework on which to focus intervention strategies for optimizing mobility function in older adults.

The Health, Aging and Body Composition (Health ABC) Study was designed to understand pathways from independence to functional limitation of healthier older persons. Mobility limitation is one of the earliest manifestations of the disablement process and is the main focus of the study (14). The objective of this investigation was to identify the relationships among weight change in the previous year, weight change intention, and incident mobility limitation during a period of 30 months by the level of initial weight status (e.g., normal, overweight, obese) in well-functioning community-dwelling older adults. We hypothesized that weight change would affect mobility function, but the direction of association would differ by its intentionality. Specifically, we hypothesized that compared with persons with stable weight, those with unintentional weight loss would have an increased risk for mobility limitation regardless of current body weight, and those with intentional weight loss would have a decreased risk for mobility limitation, particularly overweight and obese older adults. We hypothesized further that weight gain and weight fluctuation, particularly when unintentional, would be associated with increased risk for mobility limitation independent of initial body weight.

METHODS

Study Population

The Health ABC Study is a longitudinal investigation of the relationship between changes in body composition and functional decline. Study eligibility criteria included being

Table 1. Reported Weight Change and Weight Change Intention at Baseline in the Health ABC Study ($N = 2932$)

Weight Category	*N* (%)
Weight loss ≥5 lbs	569 (19.4)
Intentional	291 (9.9)
Unintentional	278 (9.5)
Weight gain ≥5 lbs	513 (17.5)
Intentional	25 (0.9)
Unintentional	488 (16.6)
Weight fluctuation	442 (15.1)
With any intention	275 (9.4)
Unintentional	167 (5.7)
Stable weight	1408 (48)

Note: Health ABC = Health, Aging and Body Composition.

age 70 to 79 years during the recruitment period and having no difficulty with activities of daily living or lower extremity functions, which were defined as difficulty walking one-quarter mile or climbing 10 steps without resting. Exclusion criteria included recent treatment for cancer, participation in a lifestyle intervention trial, or intention to move out of the study location within 3 years of baseline. We recruited participants from a random sample of Medicare beneficiaries and supplemented the group by community-based recruitment of black participants in designated zip code areas in and around Pittsburgh, Pennsylvania and Memphis, Tennessee. The main study cohort consisted of 3075 black (42%) and white men and women (52%). The analytic sample included 2932 participants after we excluded those for whom data were missing on incident mobility limitation ($n = 7$), without information on weight change ($n = 124$), and missing data on weight loss intention ($n = 16$). All procedures were in accordance with the ethical standards of the institutional review boards of the participating institutions, which approved the protocol and the informed consent forms.

Body Mass Index

We calculated body mass index (BMI) data from height and weight measured at the baseline examination. We separated the BMI values into four groups: normal range, BMI $<$ 25 kg/m^2; overweight, BMI 25 to 29.9 kg/m^2; obese, BMI 30 to 34.9 kg/m^2; and extremely obese, BMI $\geq$ 35 kg/m^2. These categories are consistent with the current National Institutes of Health obesity standard (6).

Weight Change and Weight Change Intention Groups

The baseline questionnaire included questions about weight change episodes and weight change intention during the past year. Participants were first asked "Have you lost 5 or more pounds at any time over the past 12 months?" If they answered yes, they were asked whether they had been trying to lose weight. Similarly, participants were also asked "Have you gained 5 or more pounds at any time over the past 12 months?" If they answered yes, they were asked whether they had been trying to gain weight.

We separated participants into one of four mutually exclusive weight change groups: weight loss (lost ≥5 pounds but did not gain ≥5 pounds during the last year), weight gain (gained ≥5 pounds, but did not lose ≥5 pounds during the last year), weight fluctuation (both lost and gained ≥5 pounds during the last year), and stable weight (neither lost nor gained ≥5 pounds during last year). We separated these groups further by weight change intention into one of seven mutually exclusive weight change intention groups: intentional weight loss, unintentional weight loss, intentional weight gain, unintentional weight gain, weight fluctuation with intention to lose or gain, unintentional weight fluctuation, and stable weight (Table 1). For the purposes of analyzing the relationship between weight change intention and mobility limitation, our analysis did not include intentional gain because this category was reported by only 25 (0.9%) participants.

Mobility Limitation

We determined the occurrence of mobility limitation during the first 30 months of study follow-up at annual clinic visits (12 and 24 months after baseline) or during telephone follow-up assessments (6, 18, and 30 months after baseline). During all assessments, participants were asked whether they experienced any difficulty walking one-quarter mile or climbing 10 steps without resting. Incident lower extremity functional limitation was considered to be present if a participant reported any difficulty or inability to walk one-quarter mile, climb 10 steps, or both at two consecutive semiannual follow-up interviews. If an interview was missed, a special Health ABC Study committee that considered additional information such as the reason for a missed study contact (severe illness, in nursing home) and proxy information adjudicated the presence of lower extremity functional limitation.

Confounding Variables

Sociodemographic, economic, lifestyle, and health factors are related to weight change, weight change intention, and functional limitation in older adults (15–18), and we considered them as potential confounding variables. Sociodemographic and economic factors included age, race, sex, and level of education ($<$12 years vs ≥12 years). Lifestyle factors included smoking (current, formal, never), drinking (current, formal, never), and physical activity (in kcal/kg per week). Physical activity in the past 7 days was assessed during the interviewer-administered questionnaire at baseline with an instrument derived from the leisure time physical activity questionnaire (19). Health factor included self-reported health status (excellent/very good/good vs fair/poor). Separate analysis models controlling for chronic disease variables showed results that were similar to those of models that did not include chronic disease variables (i.e., coronary heart disease, congestive heart failure, high blood pressure, knee osteoarthritis, peripheral artery disease, diabetes, and pulmonary disease). Because these chronic conditions were present before the weight change occurred, we present the results of the analyses without controlling for prevalent chronic disease conditions.

Statistical Analyses

We analyzed differences in proportions and means of covariates across BMI categories, weight change, and weight change intention groups using chi square and analysis of variance tests, respectively. Calculation of

Table 2. Baseline Characteristics of 2932 Participants by Self-Reported Weight Change and Weight Change Intention Patterns: The Health ABC Study

Characteristics	Stable Weight ($N = 1408$)	Weight Loss ($N = 569$)		Weight Gain ($N = 513$)		Weight Fluctuation ($N = 442$)	
		Intentional ($n = 291$)	Unintentional ($n = 278$)	Intentional ($n = 25$)	Unintentional ($n = 488$)	With any Intention ($n = 275$)	Unintentional ($n = 167$)
Age, y (mean ± *SD*)	73.8 ± 2.9	73.5 ± 2.9	74.1 ± 2.9	74.9 ± 2.9	73.4 ± 2.8	73.1 ± 2.7	73.2 ± 2.8
Female, *n* (%)	664 (47.2)	158 (54.3)	160 (57.6)	13 (52.0)	287 (58.8)	135 (49.1)	90 (53.9)
Black, *n* (%)	514 (36.5)	118 (40.6)	141 (50.7)	18 (72.0)	228 (46.7)	97 (35.3)	89 (53.3)
Education <12 y, *n* (%)	321 (22.9)	63 (21.7)	82 (29.8)	11 (44.0)	134 (27.5)	65 (23.6)	51 (30.5)
Current smoking, *n* (%)	140 (10.0)	19 (6.5)	46 (16.6)	5 (20.8)	49 (10.0)	19 (6.9)	14 (8.4)
Current drinking, *n* (%)	751 (53.5)	126 (43.6)	119 (43.4)	11 (44.0)	233 (48.0)	137 (49.8)	73 (43.7)
BMI category (mean ± *SD*)	26.0 ± 4.2	30.1 ± 4.8	26.5 ± 5.2	23.9 ± 3.1	28.6 ± 4.5	29.1 ± 4.7	29.0 ± 5.1
<25, *n* (%)	610 (43.8)	38 (13.1)	117 (42.1)	16 (64.0)	91 (18.7)	47 (17.1)	36 (21.6)
25–29.9, *n* (%)	588 (41.8)	126 (43.3)	97 (34.9)	9 (36.0)	230 (47.1)	119 (43.3)	67 (40.1)
30–34.9, *n* (%)	165 (11.7)	81 (27.9)	50 (18.0)	0 (0.0)	123 (25.2)	80 (29.1)	43 (25.8)
≥35, *n* (%)	45 (3.2)	46 (15.8)	14 (5.0)	0 (0.0)	44 (9.0)	29 (10.6)	21 (12.6)
Weight change during adulthood, *n* (%)							
Stayed about same	704 (50.1)	51 (17.6)	100 (36.2)	8 (32.0)	140 (28.7)	66 (24.0)	42 (25.2)
Gradual gain	519 (36.9)	173 (59.7)	89 (32.3)	10 (40.0)	277 (56.8)	123 (44.7)	74 (44.3)
Gradual loss	44 (3.1)	8 (2.8)	30 (10.9)	0 (0.0)	5 (1.0)	2 (0.7)	2 (1.2)
Repeated fluctuation	88 (6.3)	51 (17.6)	42 (15.2)	4 (16.0)	59 (12.1)	79 (28.7)	45 (27.0)
Poorer self-reported health status, *n* (%)	170 (12.1)	46 (15.8)	70 (25.2)	8 (32.0)	94 (19.3)	45 (16.4)	42 (25.2)
Prevalent diseases, *n* (%)							
CHD	200 (14.5)	57 (20.1)	69 (25.5)	7 (29.2)	77 (16.3)	55 (19.9)	31 (19.0)
CHF	9 (0.6)	9 (3.1)	7 (2.5)	1 (4.0)	2 (0.4)	8 (2.9)	4 (2.4)
Diabetes	154 (11.0)	64 (22.0)	64 (23.2)	4 (16.0)	64 (13.1)	54 (19.9)	39 (23.4)
Hypertension	546 (39.2)	151 (52.3)	134 (48.9)	10 (40.0)	227 (46.9)	122 (44.3)	108 (65.1)
Knee osteoarthritis	55 (4.0)	24 (8.3)	19 (6.9)	0 (0.0)	30 (6.2)	21 (7.7)	15 (9.2)
PAD	76 (5.5)	12 (4.3)	17 (6.3)	4 (16.7)	21 (4.5)	15 (5.6)	11 (6.9)
Lung diseases	62 (4.4)	18 (6.2)	23 (8.3)	2 (8.0)	28 (5.8)	15 (5.5)	18 (10.8)
Depression	76 (5.4)	19 (6.6)	15 (5.4)	2 (8.0)	42 (8.6)	26 (9.6)	11 (6.6)

Note: *SD* = standard deviation; BMI = body mass index; CHD = coronary heart disease; CHF = congestive heart failure; PAD = peripheral artery disease; Health ABC = Health, Aging and Body Composition.

incidence rates was based on person-time from the date of study enrollment until the date of the first of two consecutive self-reports of mobility difficulty, date of death, or the date of the last study contact, whichever came first. Because obesity is strongly associated with mobility limitation, we performed our analyses separately for each of four baseline BMI categories. We used Cox proportional-hazards models to estimate risk for incident mobility limitation first by weight change groups, and then by weight change intention groups, while adjusting simultaneously for potential confounding variables. Persons who reported stable weight in each BMI-specific model served as the reference group. We found no violations when we assessed the statistical assumptions underlying the proportional hazards model using both graphical methods and a statistical test of the scaled Schoenfeld residuals. We conducted all statistical analyses using STATA, version 7.0 (20).

Results

For the year before baseline, 19%, 18%, 15%, and 48% of participants reported weight loss, weight gain, weight fluctuation, and stable weight, respectively (Table 1). Compared with those who reported stable weight, those who reported any type of weight change were less likely to be satisfied with their current weight and to have maintained stable weight during adulthood (Table 2). Unlike weight gain, which was reported mostly as unintentional, approximately one half of reported weight loss was intentional. Those who reported intentional weight loss were more likely to be heavier and dissatisfied with their current weight and to have better self-reported health status than were those with unintentional weight loss. Approximately 40% of reported weight fluctuation was unintentional. Participants who reported unintentional fluctuation were similar in many ways to those who reported weight fluctuation with any intention, except that their self-reported health status was poorer.

Approximately 30% of participants ($n = 877$) had incident mobility limitation during the 30 months of follow-up. They had a higher mean number of chronic conditions, were more likely to be older, female, black, less educated, and heavier, and to have poorer self-reported health status than were those in whom mobility limitation was not developed.

Incident mobility limitation was more common in persons with a higher BMI (Figure 1). Those who reported weight loss, particularly unintentional weight loss, had the highest incidence of mobility limitation, followed by those with unintentional weight fluctuation, intentional loss, weight fluctuation with any intention, unintentional gain, and stable weight. Figure 2 shows joint incidence rates (events/1000 person-time) by BMI and weight change intention group. Overall, persons with higher BMI values (≥25) were at increased risk for mobility limitation compared with those with normal BMI values and stable weight. Weight change contributed to risk for mobility limitation within BMI

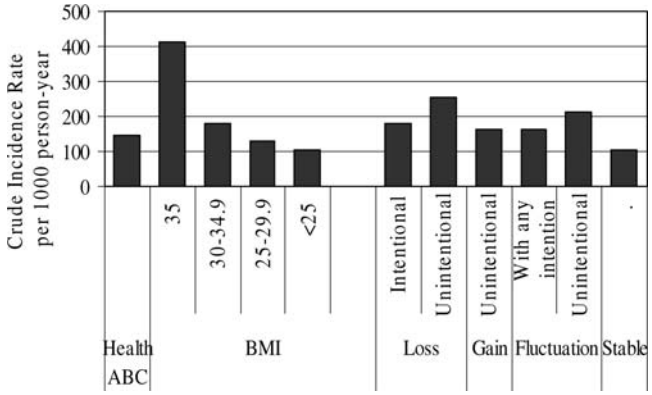

Figure 1. Crude incidence rates (events/1000 person-years) of mobility limitation by baseline body mass index (BMI) and reported recent weight change and intention groups in 2932 participants: the Health, Aging and Body Composition (Health ABC) Study.

category in a similar pattern as found overall, except for those who had unintentional weight loss. In three of the four BMI categories, unintentional weight loss was associated with mobility limitation, most notably in the extremely obese, in whom those with unintentional weight loss had an incidence rate that was approximately 18 times greater than that of persons with stable weight and normal BMI values.

Table 3 shows an analysis of the independent risk for mobility limitation. Within each BMI category, weight change groups were compared with the stable weight group. Among extremely obese and obese participants (BMI $\geq$ 30), those with any type of weight change (loss, gain, fluctuation) had a risk for mobility limitation that was similar to that of participants with stable weight. Among overweight and normal weight groups, however, weight loss was associated with increased risk for mobility limitation compared with persons of similar weight who had stable weights. Among the overweight group, weight fluctuation was associated with increased risk for mobility limitation compared with those with stable weight.

When intentionality of weight change was considered (Table 4), unintentional weight loss was associated with

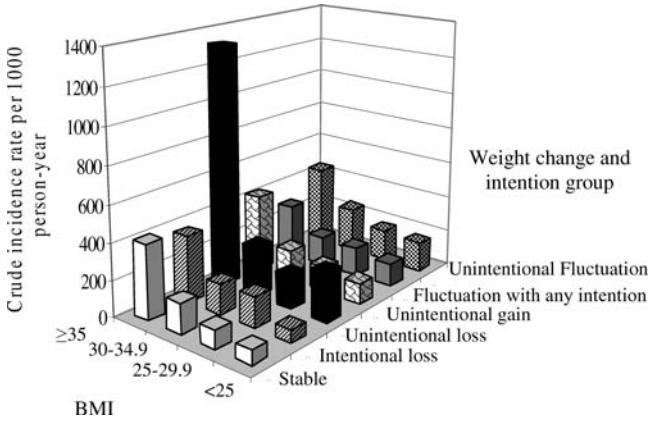

Figure 2. Crude incidence rates (events/1000 person-years) of mobility limitation by body mass index (BMI) and reported weight change and intention groups in 2932 participants: the Health, Aging and Body Composition (Health ABC) Study.

Table 3. Adjusted Hazard Ratios With 95% Confidence Interval for Mobility Limitation by Weight Change Groups Stratified by Body Mass Index Category: The Health ABC Study

BMI	Weight Change Group	*N*	Adjusted HR (95% CI)*
≥35	Weight loss	60	1.06 (0.64–1.77)
	Weight gain	44	0.88 (0.50–1.55)
	Weight fluctuation	50	0.82 (0.47–1.43)
	Stable weight (reference)	45	1.00
30–34.9	Weight loss	131	1.22 (0.83–1.81)
	Weight gain	123	0.95 (0.63–1.43)
	Weight fluctuation	123	1.32 (0.88–1.96)
	Stable weight (reference)	165	1.00
25–29.9	Weight loss	223	1.51 (1.13–2.01)
	Weight gain	239	1.30 (0.97–1.73)
	Weight fluctuation	186	1.49 (1.09–2.02)
	Stable weight (reference)	588	1.00
<25	Weight loss	155	2.03 (1.46–2.82)
	Weight gain	107	1.47 (0.97–2.24)
	Weight fluctuation	83	1.37 (0.87–2.16)
	Stable weight (reference)	610	1.00

Notes: Stable weight group in each body mass index (BMI) category was used as a reference group.

*Hazard ratios (HRs) were adjusted for age, sex, race, education, current smoking, current drinking, physical activity, and poorer self-reported health status.

CI = confidence intervals; Health ABC = Health, Aging and Body Composition.

increased risk for mobility limitation compared with participants with stable weight, although it was not significant in all BMI categories. In extremely obese and normal weight participants, those who had unintentional weight loss exhibited a three- to four-fold increased risk for mobility limitation compared with those who had stable weight. In overweight participants, those who had intentional loss and weight fluctuation with any intention showed increased risk for mobility limitation. Intentional weight loss did not show a consistent pattern for risk for mobility limitation across BMI categories.

Discussion

In a sample of well-functioning community-dwelling older adults, reported weight change in the past year was common, and it was associated with the development of mobility limitation. Heavier older persons had a greater risk for mobility limitation compared with leaner persons. Weight loss did not protect against developing mobility limitation in overweight to extremely obese older persons. In fact, weight loss showed an adverse effect on mobility status relative to stability in persons who were overweight or of normal weight.

The effect of weight loss on mobility limitation, however, differed by intention. Only unintentional weight loss predicted mobility limitation, particularly in extremely obese persons and those of normal weight. These findings suggest that the association between weight loss and functional decline reported in previous studies (1–3) may be a result of unintentional weight loss that reflects existing disease. This is consistent with other recent findings showing that weight loss is associated with higher mortality and morbidity rates only when it is unintended (21–24). Consideration of intention or reason for weight change

appears critical for understanding the effects of weight change on physical function.

Contrary to expectations, in overweight older persons, intentional weight loss did not appear to be more beneficial than weight stability for maintaining mobility. Caution, however, is warranted in interpreting these findings, because the sample sizes of the heavier subgroups reporting intentional weight loss were small. Our previous study in this cohort showed that older adults trying to lose weight were more likely to have indications for weight loss than were those not trying to lose weight (25). Therefore, these findings may be due in part to the underlying reasons for intending to lose weight. Achieved intentional weight loss in older adults may result not only from deliberate efforts to lose weight but also from the effects of underlying weight-related health conditions. Another caution relates to the available criteria for defining weight loss as 5 or more pounds. This amount of loss may have a proportionally greater effect in participants with low BMI values compared with obese persons. Although our analyses were stratified by baseline BMI values, absolute weight loss at different levels of BMI groups may have differential effects on mobility in older adults. Thus, it is difficult to determine the pure beneficial effect of intentional weight loss on maintaining mobility in obese and overweight older adults.

Although we could not find a statistically significant protective effect of intentional weight loss on physical function in this sample of relatively healthy elderly persons, the evident trend in the small samples begs for continued attention to the potential utility that appropriate weight management strategies may have on reducing mobility limitation in later years. Currently, weight loss is recommended for overweight and obese older adults in the same manner as in younger adults, but controversy continues about the long-term health effects of weight loss in elderly persons (13,26–32). More careful research using intervention study designs is needed to determine whether intentional weight loss can benefit older adults and to identify the type of older adult who would derive the most benefit. Such research would provide a foundation for developing appropriately tailored weight loss and management guidelines for older adults.

Unlike previous epidemiologic studies that found negative effects of weight fluctuation and weight gain on all-cause mortality rates, especially death from cardiovascular causes (4,30,33–35), we found no increased risk associated with either unintentional weight fluctuation and unintentional gain for mobility limitation relative to weight stability across different levels of body weight. Weight fluctuation with intention to lose or gain was associated with increased risk for mobility limitation only among overweight participants. Because of several methodologic and conceptual issues in defining weight fluctuation and considering the intent of weight change (36,37), we do not know clearly whether weight fluctuation leads to detrimental metabolic consequences and health outcomes. Untangling these methodologic and conceptual issues in older adults may require more careful attention to age-related physiologic changes and pathophysiologic processes as a result of prevalent chronic conditions. It is also critical to have a better understanding of the patterns and natural history of weight variability in older adults in relation to underlying causes, weight change intention, and health outcomes.

Table 4. Adjusted Hazard Ratios With 95% Confidence Intervals for Mobility Limitation by Weight Change Intention Groups Stratified by BMI Category: The Health ABC Study

BMI	Weight Change Intention Group	*N*	Adjusted HR* (95% CI)
≥35	Intentional loss	46	0.80 (0.46–1.39)
	Unintentional loss	14	3.79 (1.84–7.79)
	Unintentional gain	44	0.91 (0.52–1.60)
	Fluctuation with any intention	29	0.68 (0.35–1.33)
	Unintentional fluctuation	21	1.00 (0.49–2.02)
	Stable weight (reference)	45	1.00
30–34.9	Intentional loss	81	1.12 (0.70–1.79)
	Unintentional loss	50	1.40 (0.84–2.32)
	Unintentional gain	123	0.95 (0.63–1.43)
	Fluctuation with any intention	80	1.16 (0.72–1.85)
	Unintentional fluctuation	43	1.63 (0.97–2.74)
	Stable weight (reference)	165	1.00
25–29.9	Intentional loss	126	1.59 (1.12–2.25)
	Unintentional loss	97	1.41 (0.96–2.09)
	Unintentional gain	230	1.24 (0.92–1.67)
	Fluctuation with any intention	119	1.59 (1.10–2.28)
	Unintentional fluctuation	67	1.35 (0.86–2.11)
	Stable weight (reference)	588	1.00
<25	Intentional loss	38	0.78 (0.34–1.78)
	Unintentional loss	117	2.55 (1.80–3.60)
	Unintentional gain	91	1.37 (0.86–2.18)
	Fluctuation with any intention	47	1.20 (0.65–2.22)
	Unintentional fluctuation	36	1.69 (0.92–3.11)
	Stable weight (reference)	610	1.00

Notes: The stable weight group in each body mass index (BMI) category was used as a reference group. Hazard ratios (HRs) were adjusted for age, sex, race, education, current smoking, current drinking, physical activity, and poorer self-reported health status. CI = confidence interval; Health ABC = Health, Aging and Body Composition.

The results of this study should be viewed with its limitations in mind. Measures of weight change and weight change intention were self-reported and therefore may be subject to response biases. Our current classification may have limitations to reflect the patterns of weight change episodes and weight change intention among participants during the past year, as well as weight change starting from baseline to the development of mobility limitation. More longitudinal data on measured body weight and weight change intention collected in the Health ABC Study will provide opportunities to better understand these important, but understudied, issues. Although the Health ABC Study has the shortcomings of an observational study, including incomplete control of potential confounding factors (38), the findings still provide some important insight on the relationship among weight, weight change, weight change intention, and physical function. Strategies to identify underlying causes of unintentional weight loss may be an important step for reducing the burden of disability in older persons who have known or unrecognized health problems.

Conclusion

This study of incident mobility limitation related to reported recent weight change and weight change intention shows that weight change is common in well-functioning

community-dwelling older adults in their 70s and contributes to mobility limitation, but in ways that depend on the type of weight change and intentionality. With an increasing prevalence of obesity and related complications including disability in older adults, it is important to understand and identify ways to delay and ultimately prevent the disablement process associated with obesity in older adults. Appropriate weight management strategies may have the potential to maintain and preserve independent living in older adults.

ACKNOWLEDGMENTS

Funded by National Institute on Aging contracts N01-AG-6-2106, N01-AG-6-2101, and N01-AG-6-2103.

The abstract of this article was presented at the Gerontological Society of America meeting, November 24, 2003.

Address correspondence to Jung Sun Lee, PhD, Healthy Aging Research Program, University of Pittsburgh, 130 North Bellefield Avenue, Pittsburgh, PA 15213. E-mail: jung-sun.lee@mail.cscc.unc.edu

REFERENCES

1. Harris TB, Savage PJ, Tell GS, et al. Carrying the burden of cardiovascular risk in old age: associations of weight and weight change with prevalent cardiovascular disease, risk factors, and health status in the Cardiovascular Health Study. *Am J Clin Nutr*. 1997;66:837–844.
2. Launer LJ, Harris T, Rumpel C, Madans J. Body mass index, weight change, and risk of mobility disability in middle-aged and older women. The epidemiologic follow-up study of NHANES I. *JAMA*. 1994;271:1093–1098.
3. Jensen GL, Friedmann JM. Obesity is associated with functional decline in community-dwelling rural older persons. *J Am Geriatr Soc*. 2002;50:918–923.
4. Fine JT, Colditz GA, Coakley EH, et al. A prospective study of weight change and health-related quality of life in women. *JAMA*. 1999; 282:2136–2142.
5. Visser M, Harris TB, Langlois J, et al. Body fat and skeletal muscle mass in relation to physical disability in very old men and women of the Framingham Heart Study. *J Gerontol A Biol Sci Med Sci*. 1998; 53:M214–M221.
6. National Institute of Health. *Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults: The Evidence Report*. Bethesda, MD: National Institute of Health, NHLBI; 1998.
7. Felson DT, Anderson JJ, Naimark A, Walker AM, Meenan RF. Obesity and knee osteoarthritis. The Framingham Study. *Ann Intern Med*. 1988;109:18–24.
8. Apovian CM, Frey CM, Wood GC, et al. Body mass index and physical function in older women. *Obes Res*. 2002;10:740–747.
9. Tully CL, Snowdon DA. Weight change and physical function in older women: findings from the Nun Study. *J Am Geriatr Soc*. 1995;43: 1394–1397.
10. Wallace JI, Schwartz RS. Involuntary weight loss in elderly outpatients: recognition, etiologies, and treatment. *Clin Geriatr Med*. 1997;13:717–735.
11. Wannamethee SG, Shaper AG, Whincup PH, Walker M. Characteristics of older men who lose weight intentionally or unintentionally. *Am J Epidemiol*. 2000;151:667–675.
12. Meltzer AA, Everhart JE. Unintentional weight loss in the United States. *Am J Epidemiol*. 1995;142:1039–1046.
13. Willett WC. Weight loss in the elderly: cause or effect of poor health? *Am J Clin Nutr*. 1997;66:737–738.
14. Simonsick EM, Newman AB, Nevitt MC, et al. Measuring higher level physical function in well-functioning older adults: expanding familiar approaches in the Health ABC Study. *J Gerontol A Biol Sci Med Sci*. 2001;56:M644–M649.
15. Stuck AE, Walthert JM, Nikolaus T, et al. Risk factors for functional status decline in community-living elderly people: a systematic literature review. *Soc Sci Med*. 1999;48:445–469.
16. Visser M, Kritchevsky SB, Goodpaster BH, et al. Leg muscle mass and composition in relation to lower extremity performance in men and women aged 70 to 79: the health, aging and body composition study. *J Am Geriatr Soc*. 2002;50:897–904.
17. Williamson DF, Serdula MK, Anda RF, Levy A, Byers T. Weight loss attempts in adults: goals, duration, and rate of weight loss. *Am J Public Health*. 1992;82:1251–1257.
18. Serdula MK, Mokdad AH, Williamson DF, et al. Prevalence of attempting weight loss and strategies for controlling weight. *JAMA*. 1999;282:1353–1358.
19. Taylor HL, Jacobs DR Jr, Schucker B, et al. A questionnaire for the assessment of leisure time physical activities. *J Chronic Dis*. 1978;31:741–755.
20. STATACorp. STATA Statistical Software: Release 7.0. College Station, TX: STATA Press; 2001.
21. Williamson DF, Pamuk E, Thun M, et al. Prospective study of intentional weight loss and mortality in overweight white men aged 40–64 years. *Am J Epidemiol*. 1999;149:491–503.
22. Williamson DF, Thompson TJ, Thun M, et al. Intentional weight loss and mortality among overweight individuals with diabetes. *Diabetes Care*. 2000;23:1499–1504.
23. Gregg EW, Gerzoff RB, Thompson TJ, Williamson DF. Intentional weight loss and death in overweight and obese U.S. adults 35 years of age and older. *Ann Intern Med*. 2003;138:383–389.
24. French SA, Folsom AR, Jeffery RW, Williamson DF. Prospective study of intentionality of weight loss and mortality in older women: the Iowa Women's Health Study. *Am J Epidemiol*. 1999;149: 504–514.
25. Lee JS, Kritchevsky SB, Tylavsky FA, et al. Weight loss intention in well-functioning community-dwelling elderly: associations with diet quality, physical activity, and weight change. *Am J Clin Nutr*. 2004; 80:466–474.
26. Flegal KM, Troiano RP, Ballard-Barbash R. Aim for a healthy weight: What is the target? *J Nutr*. 2001;131:440S–450S.
27. French SA, Jeffery RW, Folsom AR, Williamson DF, Byers T. Relation of weight variability and intentionality of weight loss to disease history and health-related variables in a population-based sample of women aged 55–69 years. *Am J Epidemiol*. 1995;142:1306–1314.
28. Pamuk ER, Williamson DF, Serdula MK, Madans J, Byers TE. Weight loss and subsequent death in a cohort of U.S. adults. *Ann Intern Med*. 1993;119:744–748.
29. Rajala SA, Kanto AJ, Haavisto MV, et al. Body weight and the three-year prognosis in very old people. *Int J Obesity*. 1990;14: 997–1003.
30. Reynolds MW, Fredman L, Langenberg P, Magaziner J. Weight, weight change, mortality in a random sample of older community-dwelling women. *J Am Geriatr Soc*. 1999;47:1409–1414.
31. Strawbridge WJ, Wallhagen MI, Shema SJ. New NHLBI clinical guidelines for obesity and overweight: Will they promote health? *Am J Public Health*. 2000;90:340–343.
32. Heiat A, Vaccarino V, Krumholz HM. An evidence-based assessment of federal guidelines for overweight and obesity as they apply to elderly persons. *Arch Intern Med*. 2001;161:1194–1203.
33. Blair SN, Shaten J, Brownell K, Collins G, Lissner L. Body weight change, all-cause mortality, and cause-specific mortality in the Multiple Risk Factor Intervention Trial. *Ann Intern Med*. 1993;119:749–757.
34. Hamm P, Shekelle RB, Stamler J. Large fluctuations in body weight during young adulthood and twenty-five-year risk of coronary death in men. *Am J Epidemiol*. 1989;129:312–318.
35. Lissner L, Odell PM, D'Agostino RB, et al. Variability of body weight and health outcomes in the Framingham population. *N Engl J Med*. 1991;324:1839–1844.
36. Wing RR. Weight cycling in humans; a review of the literature. *Ann Behav Med*. 1992;14:113–119.
37. Iribarren C, Sharp DS, Burchfiel CM, Petrovitch H. Association of weight loss and weight fluctuation with mortality among Japanese American men. *N Engl J Med*. 1995;333:686–692.
38. Kuller LH. Invited commentary on 'Prospective Study of Intentionality of Weight Loss and Mortality in Older Women: the Iowa Women's Health Study' and 'Prospective Study of Intentional Weight Loss and Mortality in Overweight White Men Aged 40–64 Years.' *Am J Epidemiol*. 1999;149:515–516; discussion 517–520.

Received March 5, 2004
Accepted May 18, 2004
Decision Editor: John E. Morley, MB, BCh