Reasons for Intentional Weight Loss, Unintentional Weight Loss, and Mortality in Older Men

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Background: We have examined the relationship between intentional and unintentional weight loss and the reasons underlying intention to lose weight and all-cause mortality and mortality due to cardiovascular disease (CVD) and non-CVD causes in older men.

Methods: Prospective study of 4869 men aged 56 to 75 years drawn from general practices in 24 British towns, who in 1996 completed questionnaires about intentional and unintentional weight loss over the preceding 4 years and were followed up for a subsequent 7 years.

Results: Unintentional but not intentional weight loss was associated with a significant increase in risk of all-cause mortality compared with men who reported no weight change, even after adjustment for lifestyle characteristics and preexisting disease (adjusted relative risk [RR], 1.71; 95% confidence interval [CI], 1.33-2.19; and RR, 1.00; 95% CI, 0.91-1.10, respectively). Men who lost weight intentionally as a result of personal choice showed significant benefit in all-cause mortality (RR, 0.59; 95% CI, 0.34-1.00; P = .05), which was largely owing to a significant reduction in mortality from non-CVD causes (RR, 0.36; 95% CI, 0.15-0.87). The benefit in these men was most apparent in markedly overweight men (BMI [calculated as weight in kilograms divided by the square of height in meters] ≥28) and in younger men (age <65 years). Men who lost weight intentionally owing to ill health or physician's advice showed an increased risk of all-cause mortality (RR, 1.37; 95% CI, 0.96-1.94). No harm or benefit was seen for CVD mortality, irrespective of reasons for intentional weight loss.

Conclusion: Intentional weight loss carried out for personal reasons is associated with a significant reduction in all-cause mortality in markedly overweight men, and the data suggest that the earlier the intervention, the greater the chance of benefit.

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Background: The health consequences of overweight and obesity are well recognized, and it is universally recommended that those who are overweight or obese should lose weight by a combination of dieting and increased physical activity. However, in most prospective studies involving older subjects, weight loss is associated with increased mortality compared with those with stable weight. Attention has been drawn to the importance of differentiating intentional weight loss from unintentional weight loss because it is generally acknowledged that unintentional weight loss may reflect ill health leading to increased mortality. In the few epidemiological studies on weight loss that have been able to differentiate intentional from unintentional weight loss, the findings have been inconsistent, and a recent review has even suggested that intentional weight loss is associated with increased mortality. We have shown that weight loss whether intentional or unintentional is often associated with adverse characteristics and disease in older men. Simply differentiating between intentional and unintentional weight loss without taking into account the reasons underlying the intention to lose weight may lead to biased results. We have examined the relationship between intentional and unintentional weight loss and the reasons underlying intention to lose weight and all-cause mortality and mortality due to cardiovascular disease (CVD) and non-CVD causes in men aged 56 to 75 years.

Methods: The British Regional Heart Study is a prospective study of CVD comprising 7735 men aged 40 to 59 years at recruitment selected from the age-sex registers of 1 group general practice in each of 24 towns in England, Wales, and Scotland. The criteria for selecting town, general practice, and subjects as well as methods of data collection have been reported. In 1978-1980, research nurses administered a standard questionnaire that included questions on smoking, alcohol intake, physical activity, and

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medical history (Q1). Height and weight were measured. In 1992 (Q92), 12 to 14 years after screening, a similar questionnaire was sent to all survivors. In 1996, a similar questionnaire (Q96) was posted to all surviving participants in Great Britain. In addition to information on body weight, information on intention regarding weight change was now obtained. Of the 5975 surviving and available participants, 5265 men (88%) completed the Q96 questionnaire, of whom 4869 (93%) provided information on weight change.

**BODY MASS INDEX**

At initial examination (1978-1980), body mass index (BMI; calculated as weight in kilograms divided by the square of height in meters) was used as an index of relative weight. In 1992 and 1996, the men were asked to state their current weight in pounds or kilograms, and BMI was calculated for each man based on their reported weight and height measured at initial screening. Obesity was defined as a BMI of 30 or greater.

**PERCEIVED WEIGHT CHANGE**

At Q96 the men were asked to report their current weight and whether their weight had changed in the previous 4 years (ie, from Q92: not changed, increased, decreased, do not know). If they considered that their weight had changed, they were asked whether this was intentional. If intentional, they were asked whether this was the result of (1) personal choice, (2) ill health, or (3) physician's advice. Data on perceived weight change were available in 4869 men (184 did not know and 178 did not reply to this question). A further 83 men reported that their weight fluctuated. Because of the focus on weight loss and because of the small numbers involved, these men have been excluded from analyses, leaving 4786 men. In the initial analyses the men were classified into the following 4 weight change categories on the basis of their reported perceived weight change: (1) stable (no change) (n=2539; 53%), (2) gained (n=1378; 29%), (3) unintentional weight loss (n=527; 11%), and (4) intentional weight loss (n=342; 7%). The intentional weight loss group was further divided into those who lost weight as a result of personal choice (n=178) and those who lost weight as a result of illness or physician's advice (n=164). Perceived reported weight change has been validated in a previous report from this study and has been shown to be strongly associated with reported change in weight measurement. Among those who reported unintentional weight loss, in 76% their reported body weight was less than that reported in 1992 (Q92). Among those claiming intentional weight loss, the corresponding proportion was 70%. Among those who reported weight gain, the reported body weight was more than 1 kg than in 1992 in 74%.

**CARDIOVASCULAR RISK FACTORS (Q96)**

From the combined information at screening (Q1), at Q92 and Q96 the men were classified at Q96 as those who (1) never smoked (2) were long-term ex-smokers (ex-smokers since screening), (3) have given up smoking since screening (current smokers at baseline who no longer report smoking at Q96), and (4) current smokers at Q96. The longest held occupation of each man was recorded at screening, and the men were grouped into 1 of 6 social classes: I, II, and III nonmanual (nonmanual groups) and III manual, IV, and V (manual groups). Those whose longest occupation was with the Armed Forces formed a separate group. The men were grouped into 6 broad categories based on their total physical activity score: inactive, occasional, light, moderate, moderately vigorous, and vigorous. The men were classified into 5 groups based on estimated weekly alcohol intake at Q96: none, occasional, light, moderate, and heavy. Heavy drinking is defined as drinking more than 6 units (1 UK unit=8-10 g of alcohol) daily or on most days.

**INDICATORS OF ILL HEALTH (Q96)**

The men were asked to describe their present health status as excellent, good, fair, or poor. They were asked whether a physician had ever told them that they had conditions affecting the heart (eg, angina or myocardial infarction [heart attack or coronary thrombosis]), stroke, “other heart trouble,” aortic aneurysm, high blood pressure, hardening of the arteries in the leg, and a number of other medical conditions including cancer, bronchiitis, asthma, and diabetes.

**FOLLOW-UP**

All men have been followed up for all-cause mortality, cardiovascular morbidity, and the development of type 2 diabetes mellitus from screening to October 2002. Information on death was collected through the established “tagging” procedures provided by the National Health Service registers. Cardiovascular deaths include all those with International Classification of Diseases, Ninth Revision codes 410 to 439. All deaths in the period to October 2003 have been recorded, and follow-up has been achieved for 99% of the cohort. The present report is concerned only with the men who completed the Q96 questionnaire and with follow-up since Q96, giving a follow-up period of 7 years for each man.

**STATISTICAL ANALYSIS**

The Cox proportional hazards model was used to assess the adjusted relative risk (RR) for each weight change category compared with the stable group. Adjustments were made for confounding factors measured at Q96. In the adjustment, smoking (never, long-term ex-smokers, recent ex-smokers, and current smokers), social class (manual, nonmanual, and Armed Forces), BMI (6 groups: ≤22, 22-23, 24-25, 26-27, 28-29, ≥30), physical activity (inactive, occasional, light, at least moderately active), alcohol intake (none, occasional, light, moderate, and heavy), and perceived health status (excellent or good, fair, and poor) were fitted as categorical variables. Obesity (BMI ≥30) (yes/no) in 1992 and presence of disease were fitted as dichotomous variables (yes/no).

**RESULTS**

During the follow-up period of 7 years, there were 858 deaths from all causes (381 CVD and 477 non-CVD causes) in the 4786 men (a rate of 27.4/1000 person-years).  

Table 1 gives the personal characteristics and prevalence of disease in the weight change categories. Those who reported unintentional weight loss had the lowest mean BMI in 1992 and 1996. Those who lost weight intentionally as a result of ill health were far more likely to have been obese in 1992 compared with those who lost weight because of personal choice. Weight loss, whether intentional or unintentional, was associated with a considerably increased prevalence of ill health. The increased prevalence of ill health in those who lost weight intentionally was largely due to those who reported intentional weight loss as a result of ill health. Men who lost weight intentionally as a result of personal choice showed rates similar to the stable weight group and were lighter and far healthier compared with men who lost weight intentionally because of ill health.
PERCEIVED WEIGHT CHANGE AND MORTALITY

Compared with the stable group, unintentional but not intentional weight loss was associated with a significant increase in risk of all-cause mortality after adjustment for age, social class, smoking, physical activity, alcohol intake, current BMI, and obesity at 1992 (Table 2). The increased risk of mortality in the unintentional weight loss group was seen for both CVD and non-CVD causes. The weight gain and intentional weight loss group did not show significant differences from the stable group in all-cause mortality, CVD mortality, or non-CVD mortality. Further adjustment for disease status reduced the risk in the unintentional weight loss group, but the differences remained significant. When the intentional weight loss group was separated by reason for intentional weight loss, those who lost weight as a result of personal choice showed significantly lower risk of mortality compared with the stable group after adjustment for lifestyle characteristics and disease status ($P=.05$), largely owing to a significant decrease in non-CVD mortality. Those who lost weight as a result of ill health showed higher risk compared with the stable group, but the difference was of marginal significance ($P=.08$). The increase in mortality was largely due to non-CVD causes. Both groups showed similar risk of CVD mortality to the stable group.

We further divided the perceived “no weight change” group into those who reported poor or fair health and those who reported good or excellent health, the former representing men who are more likely to have ill health. Those who perceived poor or fair health showed a significantly higher risk of all-cause mortality compared with those who perceived good or excellent health (RR, 1.60; 95% CI, 1.30-1.98), and the risk was similar to those who reported intentional weight loss as a result of ill health (RR, 1.75; 95% CI, 1.22-2.51). Intentional weight loss due to personal reasons was still associated with lower risk of all-cause mortality, albeit nonsignificant, compared with perceived “no weight change” and good or excellent health (RR, 0.66; 95% CI, 0.38-1.13).

CAUSE-SPECIFIC MORTALITY

Of non-CVD deaths, 64% were attributed to cancer, 19% to respiratory causes, and 17% to other non-CVD causes. Although the numbers were small, those with intentional weight loss from personal choice showed lower mortality risk for both cancer and noncancer causes compared with those who perceived no weight change. Intentional weight loss due to ill health and unintentional weight loss were associated with a higher mortality risk for cancers and death from respiratory and other non-CVD causes.

BMI IN 1992, INTENTIONALITY OF WEIGHT LOSS, AND MORTALITY

We examined the relationship between intentionality of weight loss and mortality by BMI levels in 1992 because this was the most recent point at which BMI was obtained prior to reported weight change (Table 3). Since a BMI of 28 or greater has been shown in this cohort to be associated with significantly increased all-cause mortality, the men were divided into 2 groups (BMI <28 and BMI ≥28). The benefit of intentional weight loss as a
result of personal choice was most apparent in the heavier men (BMI ≥28), although a test for interaction to see whether the effects differed according to BMI was not statistically significant (P = .40).

**AGE, INTENTIONALITY OF WEIGHT LOSS, AND MORTALITY**

When examined by age (<65 years and ≥65 years in 1996), the benefit of intentional weight loss as a result of personal choice was more marked in younger men, although the number was small. Unintentional weight loss was associated with increased risk in both age groups. However, a test for interaction to assess whether the effects of intentional weight loss as a result of personal choice differed with age was not statistically significant (P = .25).

**COMMENT**

The statement that “weight loss causes increased mortality” has been a topic of much debate. In this study of men aged 56 to 75 years, unintentional but not intentional weight loss was associated with significantly increased risk of all-cause mortality and was associated with both mortality from CVD and non-CVD causes. Men who perceived weight gain in this study showed no significant difference in all-cause mortality from those who perceived no weight change. Intentional weight loss overall was associated with neither increased risk nor benefit compared with those who reported no weight change. However, when reason of intent was considered, intentional weight loss as a result of personal choice was associated with a significant reduction in all-cause mortality, largely owing to a significant reduction in non-CVD mortality. The benefit in these men was most apparent in markedly overweight men (BMI ≥28) and in younger men (age, 56-64 years). Intentional weight loss as a result of ill health or physician’s advice, however, was associated with a small increase in mortality, largely owing to death from non-CVD causes. Men who lost weight intentionally as a result of physician’s advice or ill health tended to have a greater prevalence of disease and tended to be heavier than those who lost weight intentionally as a result of personal choice. It is likely that these men had been prompted to lose weight as a result of having already developed disease.

Intentional weight loss, irrespective of underlying reason, showed no benefit for CVD mortality. Virtually all studies on intentional weight loss have failed to find any benefit for CVD mortality in overweight subjects. The lack of benefit in the present finding is consistent with our previous report showing that significant benefit to the cardiovascular system from weight loss was only seen in younger men (age, 40-49 years) who were markedly overweight (BMI, 27.5-29.9). The lack of benefit for CVD in these older men who are now aged 56 to 75 years suggests that once atherosclerotic vascular disease is established, it is not readily or markedly reversed.

**PREVIOUS STUDIES**

Prospective studies on intentional and unintentional weight loss and mortality have been inconsistent. An overview concluded that intentional weight loss does not appear to either increase or decrease longevity. In the Cancer Prevention Study I, intentional weight loss was associated with lower all-cause, cancer-related, and diabetes-related mortality among overweight women with obesity-related conditions or diabetes but not in women with no illness. In a separate study in men, weight loss was only...
associated with lower diabetes-related mortality and no benefit was seen for all-cause mortality.\textsuperscript{7} In the Iowa Women's Health Study, intentional weight loss was associated with lower incidence of obesity-related cancers\textsuperscript{21} but not all-cause mortality.\textsuperscript{7} By contrast, the Israeli Ischaemic Heart Disease Study observed an increased risk between intentional weight loss and mortality.\textsuperscript{7} However, in a recent US study of more than 6000 overweight and obese persons, self-reported intentional weight loss was associated with significantly lower mortality rates, whereas unintentional weight loss was associated with higher mortality rates.\textsuperscript{10} The authors did not look at specific causes of death. The differences in findings between these studies may relate to the reasons underlying intentional weight loss. Increased mortality was seen in those whose intentional weight loss was due to health reasons but not in those losing weight for personal reasons. Thus in many studies, those who lost weight intentionally may have included subjects who intended to lose weight but may have lost weight for other than personal reasons (eg, illness-related weight loss). Those who perceived poor or fair health but reported no weight change showed risk similar to those who reported intentional weight loss as a result of ill health, suggesting that ill health predisposes to mortality rather than weight loss per se. Simply differentiating between intentional and unintentional weight loss may not eliminate the bias in determining the effects of intentional weight loss on mortality.

**UNINTENTIONAL WEIGHT LOSS**

In virtually all studies, unintentional weight loss was associated with increased mortality,\textsuperscript{6-11} and it is generally accepted that unintentional weight loss reflects underlying disease. Men who lost weight unintentionally tended to be much lighter than men with a stable weight, and unintentional weight loss was strongly associated with prevalence of ill health. Although adjustment for health status diminished the increased risk associated with unintentional weight loss, excess risk still remained. This is likely to be owing to undetected disease or to undiagnosed disease not measured in the present study.

**LIMITATIONS**

The number of men who lost weight intentionally as a result of personal choice is small, and the concept of intentional and unintentional weight loss is based on perceived weight change. However, we have shown in this cohort that perceived weight change is highly correlated with reported change in body weight.\textsuperscript{14} When analyses were restricted to those whose perceived weight loss was consistent with reported change in body weight, the pattern of relationships remained unchanged. Maintaining weight loss over several years is usually difficult, and those who succeed and are healthy may have lost weight because of changes in other health-related behaviors. We do not have information on how weight loss was achieved, nor whether weight reduction by decrease in caloric intake or by an increase in energy expenditure (physical activity) may differentially influence outcome. While randomized controlled trials will better address the direct effects of weight loss on disease incidence, our data support the concept that weight loss reduces total mortality\textsuperscript{8} and indicate that the benefit of intentional weight loss could be underestimated in observational studies if the decisions underlying the intention to lose weight are not taken into account.

**CONCLUSIONS**

In this study of older men (age, 56-75 years), intentional weight loss carried out for personal reasons was associated with a significant reduction in all-cause mortality compared with no weight change. While no ben-

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**Table 3. Perceived Weight Change and Adjusted Relative Risk of Total Mortality by Reported BMI in 1992 (4 Years Prior to Reported Weight Change) and Age**

<table>
<thead>
<tr>
<th>BMI/Age</th>
<th>No Change</th>
<th>Weight Gain</th>
<th>Unintentional Weight Loss</th>
<th>Personal Reason</th>
<th>Physician's Advice/Ill Health</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Intentional Weight Loss</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>BMI (1992)</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>&lt;28 (585/347; 26.5/1000 person-years)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cases/No. of men</td>
<td>207/1982</td>
<td>129/892</td>
<td>142/399</td>
<td>15/24</td>
<td>15/74</td>
</tr>
<tr>
<td>Adjusted RR (95% CI)*</td>
<td>1.00 (Referent)</td>
<td>1.02 (0.81-1.36)</td>
<td>1.17 (1.07-2.14)</td>
<td>0.81 (0.45-1.46)</td>
<td>1.59 (0.93-2.70)</td>
</tr>
<tr>
<td>≥28 (216/1061; 35.4/1000 person-years)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cases/No. of men</td>
<td>99/426</td>
<td>54/397</td>
<td>40/108</td>
<td>4/48</td>
<td>19/82</td>
</tr>
<tr>
<td>Adjusted RR (95% CI)*</td>
<td>1.00 (Referent)</td>
<td>0.58 (0.40-0.83)</td>
<td>1.48 (0.99-2.21)</td>
<td>0.23 (0.06-0.95)</td>
<td>0.97 (0.57-1.64)</td>
</tr>
</tbody>
</table>

**Age**

| <65 y (182/2024; 13.1/1000 person-years) | | | | | |
| Cases/No. of men | 85/1016 | 47/657 | 35/170 | 3/95 | 12/66 |
| Adjusted RR (95% CI)* | 1.00 (Referent) | 0.74 (0.50-1.10) | 1.74 (1.12-2.69) | 0.28 (0.07-1.13) | 1.33 (0.70-2.51) |
| ≥65 y (676/2762; 38.8/1000 person-years) | | | | | |
| Cases/No. of men | 329/1523 | 153/721 | 156/357 | 13/83 | 25/78 |
| Adjusted RR (95% CI)* | 1.00 (Referent) | 0.92 (0.75-1.13) | 1.66 (1.35-2.04) | 0.73 (0.41-1.30) | 1.38 (0.90-2.10) |

Abbreviations: BMI, body mass index (calculated as weight in kilograms divided by the square of height in meters); CI, confidence interval; RR, relative risk.

*Adjusted for age, smoking, social class, physical activity, current BMI, social class, perceived health status, history of hypertension, coronary heart disease, stroke, diabetes, other cardiovascular disease conditions, and cancer.
efit was seen for CVD mortality, significant benefit was seen for non-CVD mortality, which was most apparent in markedly overweight and obese men (BMI \( \geq 28 \)) and in the younger men (age, 55-64 years), suggesting that benefit is possible even later in life. It would appear that if weight loss in elderly men is to be of any benefit to those who are markedly overweight or obese, the earlier in life the weight loss occurs, the greater the chance of benefit.

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