Body Mass Index and Quality of Well-Being in a Community of Older Adults

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Background: The impact of obesity and associated conditions on health has not been assessed in older adults using a generic, utility-based measure of health-related quality of life (HRQOL). This study evaluates the relationship between body mass index (BMI) and HRQOL scores and gives estimates of quality-adjusted life years (QALYs) lost to overweight, obesity, and associated conditions.

Methods: A total of 1326 adults from the Rancho Bernardo longitudinal cohort study, with a mean age of 72 years, completed the Quality of Well-Being Scale (QWB), a generic health-related quality of life measure. Height, weight, exercise, and smoking status were also assessed. Differences in QWB scores between obese adults and those with a normal BMI were used to estimate the QALYs lost due to obesity and associated conditions.

Results: Participants were divided into four groups based on BMI: <20 (underweight); 20 to 24.9 (normal); 25 to 29.9 (overweight); >30 kg/m² (obese). Analysis of covariance controlling for age, gender, smoking history, and exercise showed a significant difference between group means (F(7,1310) = 30.79; p < 0.001). The normal BMI group had the highest QWB score (0.709), followed by the underweight (0.698), overweight (0.695), and obese (0.663) groups. The QWB score for the obese group was significantly lower than that for the normal and overweight groups. An estimated 2.93 million QALYs are lost in this country each year from obesity and associated conditions.

Conclusions: Obese older adults tend to have lower HRQOL than those who are overweight or of normal BMI. The lower QWB scores associated with obesity translate into millions of QALYs lost in this population.

Introduction

The percentage of people who are considered to be either overweight or obese continues to increase. In the United States, the prevalence of obesity, defined as a body mass index (BMI) of >30 kg/m², has increased from 23% in 1988–1994 to 30.5% in 1999–2000. If this rate continues unchanged, one third of the U.S. population is projected to be obese in 9 years, and 50% may be obese in 16 years.

Obesity impacts both morbidity and mortality. Rates of Type-2 diabetes, hypertension, hypercholesterolemia, osteoarthritis, and gallbladder disease all increase with higher BMI. Despite the evidence that obesity affects mortality and the evidence that being overweight affects risk factors, the effects of being overweight (BMI >25 and <30) on life expectancy has not been clearly established. The aggregated data suggest that those who are overweight (but not obese) live about the same amount of time as those who are “normal” weight.

If being overweight but not obese does not reduce life expectancy, what are the health consequences? Does being overweight reduce health-related quality of life (HRQOL)? The present study uses a generic quality of life measure (Quality of Well-being scale [QWB]) to assess the relationship of BMI to HRQOL and provides an estimate of the total impact of obesity and associated conditions in terms of quality-adjusted life years (QALYs).

Methods

Measures

Height, weight, exercise, and smoking status. In 1992–1995, as part of a study on osteoporosis, height, weight, exercise, and smoking status were assessed. Height was assessed using a stadiometer. Weight was assessed using a regularly calibrated balance beam scale. Participants were asked whether they had ever smoked and whether they currently “exercise or labor at least three times each week.”
Table 1. Characteristics of BMI groups

<table>
<thead>
<tr>
<th>Variable</th>
<th>BMI &lt;20 (n=69)</th>
<th>BMI 20–24.9 (n=618)</th>
<th>BMI 25–29.9 (n=491)</th>
<th>BMI ≥30 (n=148)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>% female</td>
<td>89.9</td>
<td>67.6</td>
<td>50.1</td>
<td>57.4</td>
<td><strong>p&lt;0.001</strong></td>
</tr>
<tr>
<td>% married</td>
<td>49.3</td>
<td>72.0</td>
<td>75.5</td>
<td>70.3</td>
<td><strong>p=0.024</strong></td>
</tr>
<tr>
<td>% college degree</td>
<td>54.8</td>
<td>58.3</td>
<td>52.6</td>
<td>53.0</td>
<td>NS</td>
</tr>
<tr>
<td>% smoked (ever)</td>
<td>47.8</td>
<td>57.6</td>
<td>56.6</td>
<td>54.7</td>
<td>NS</td>
</tr>
<tr>
<td>% exercise or labor three times weekly</td>
<td>68.1</td>
<td>74.6</td>
<td>75.4</td>
<td>58.9</td>
<td><strong>p&lt;0.001</strong></td>
</tr>
<tr>
<td>% with diabetes</td>
<td>7.3</td>
<td>5.0</td>
<td>5.3</td>
<td>11.6</td>
<td><strong>p=0.019</strong></td>
</tr>
<tr>
<td>Age</td>
<td>76.9 (SD=12.2)</td>
<td>72.8 (SD=10.8)</td>
<td>71.6 (SD=10.0)</td>
<td>69.1</td>
<td><strong>p&lt;0.001</strong></td>
</tr>
<tr>
<td>Self-rated health (excellent, very good, good, fair, poor)</td>
<td>2.58 (SD=1.14)</td>
<td>2.19 (SD=0.93)</td>
<td>2.15 (SD=0.91)</td>
<td>2.44</td>
<td><strong>p&lt;0.001</strong></td>
</tr>
<tr>
<td>Non-adjusted Quality of Well-Being score</td>
<td>0.678</td>
<td>0.706</td>
<td>0.700</td>
<td>0.669</td>
<td><strong>p&lt;0.001</strong></td>
</tr>
<tr>
<td>Quality of Well-Being score adjusted for gender, age, smoking, and exercise</td>
<td>0.698 (SD=0.100)</td>
<td>0.709 (SD=0.105)</td>
<td>0.695 (SD=0.099)</td>
<td>0.663</td>
<td><strong>p&lt;0.001</strong></td>
</tr>
</tbody>
</table>

BMI, body mass index; NS, not significant; SD, standard deviation.

Quality of Well-Being Scale. Health-related quality of life was assessed using the QWB scale during a telephone interview conducted within 1 week of the clinic visit. The QWB16,17 is a generic measure of health-related quality of life that combines preference-weighted values for symptoms and functioning. The QWB provides a numerical point-in-time expression of well-being that ranges from zero (0) for death to one (1.0) for asymptomatic, optimum functioning. QWB scores can be integrated with the number of people affected and the duration of time affected to produce the output measure of QALYs,18 an integrated measure of time, morbidity, and mortality outcomes.

Analysis

Participants were divided into four groups based on their body mass index (BMI <20 kg/m², 20 to 24.9 kg/m², 25 to 29.9 kg/m², >30 kg/m²). These BMI cutoffs roughly correspond to the definitions proposed by the National Heart, Lung, and Blood Institute15 and World Health Organization6 definitions of underweight, normal weight, overweight, and obese. The cutoff between the underweight and normal groups was modified from 18.5 to 20 kg/m² in order to avoid an extremely small sample size of 11 in the <18.5 kg/m² group.

Analysis of variance (ANOVA) and covariance (ANCOVA) were used to examine differences between groups. Planned polynomial contrasts were used to examine whether the relationship between BMI and the QWB was linear, quadratic, or cubic.

Results

Participants were 1326 community-dwelling members of a longitudinal cohort in Rancho Bernardo, California; 61% female; almost entirely Caucasian; and an average age of 72 years. Eighty-two percent had received some education beyond high school, 72% were married, and 21% were widowed.

The mean BMI and mean QWB score for all participants were 25.4 (standard deviation [SD]=4.0) and 0.698 (SD=0.102), respectively. Characteristics of the four BMI groups are presented in Table 1. Only 11.2% of the cohort were classified as obese, and another 37.0% were overweight. Results of a one-way ANOVA comparing total QWB scores among the four BMI groups showed a significant difference between group means (F(3,1325)=6.23; p <0.001). More specifically, the unadjusted QWB score for the obese group was significantly lower than that for the normal weight group and the overweight group.

ANCOVA was used to compare QWB scores by BMI group, while controlling for age, gender, smoking history, and exercise. Age, gender, smoking, and exercise were all significant covariates and adjusted QWB scores differed by BMI group (F(7,1310)=30.79; p <0.001). A polynomial contrast indicated that the relationship was best described by a quadratic expression (p =0.005). Table 1 shows mean QWB scores adjusted for the covariates. Pairwise comparisons indicated that obese persons had significantly lower QWB scores than those of normal BMI and those considered overweight. The difference between the QWB means of obese persons and those of normal BMI was 0.709–0.663=0.046. This value (0.046) reflects the incremental loss in QALYs per person per year for people with a BMI >30.

The mean QWB score for people who were overweight but not obese (0.695) was not significantly different (p =0.083) than the normal weight group (0.709) (post hoc power analysis indicated a power of 0.97 and an alpha of 0.01).

Discussion

After adjusting for age, gender, smoking, and exercise, obese subjects had QWB scores that were 0.046 lower than those of normal BMI. Interestingly, HRQOL for
overweight people did not differ significantly from the HRQOL for those with normal BMI.

The effects of obesity and associated conditions on quality of life are important. The 0.046 reduction in QWB scores in obese older adults is similar in size to the reduction associated with arthritis, stroke, ulcer, asthma, and anxiety. The reduction of 0.046, relative to age-matched controls, is larger than that associated with colitis, glaucoma, migraine, and thyroid disease, each of which has reductions of about 0.030.

Data gathered in 1999–2000 as part of the National Health and Nutrition Examination Study (NHANES) estimated the rate of obesity in the United States to be 30.5%. Based on the current estimated population of the United States of 209 million people aged ≥18, approximately 63.7 million people are obese. Therefore, a crude estimate of 2.93 million (63.7 million × 0.046) QALYs are lost each year to obesity based on the scores obtained in this study. In other words, there is a loss of 1 QALY for every 20 people who live 1 year with obesity.

The estimated figure of 2.93 million QALYs lost does not consider all possible impacts of obesity, such as healthcare costs or money spent to alter body weight, and only considers people aged ≥18. Although it is known that obesity has become a major problem among children and adolescents, the current study does not allow for calculations of QALYs for these groups. Our QALY estimate does not include deaths resulting from obesity, since the assessment was cross-sectional, and subsequently, is quite conservative. Longitudinal analysis could provide more precise estimates.

Our results are consistent with a report by Le Pen et al., who found that obesity but not overweight was associated with lower scores on the SF-36 Health Survey (Medical Outcomes Trust, Boston MA). In the present study, QWB scores for the overweight group were not significantly lower than those in the normal BMI group. People classified as overweight have a higher risk for many comorbidities and some studies have shown increased mortality rates. However, most large epidemiologic studies show little effect of overweight on mortality.

The quality-of-life consequences of being overweight but not obese are inconsistent across studies. Finkelstein et al. show smooth curves between BMI and SF-36 subscales, suggesting that many aspects of HRQOL decline rather rapidly through the range of BMIs greater than about 24 kg/m². However, the Le Pen et al. study did not find significant differences in QOL between a “pre-obese” group (BMI >27 and <30) and those with normal BMI. Most other studies do not specifically examine or report results on the overweight or pre-obese range, but instead, concentrate on those with BMIs >30. Therefore, it remains unclear whether being overweight using the current classification (BMI of 25 to 29.9) has any direct impact on HRQOL.

This study had several important limitations. For example, the BMI has been criticized as a measure of body fat and may be particularly misleading for people who are physically fit. People who are athletic or lift weights can be classified as overweight even though they have little body fat. Although this may be less of an issue in older people, participants were quite active given their age.

In addition, the sample was not representative of older people in the United States. Participants in the Rancho Bernardo Study were generally well educated, Caucasian, and middle to upper class on the Hollingshead Index. Therefore, it is likely that the QWB scores in this study were higher than the U.S. population of older adults. Therefore, these results and estimates of QALYs lost by the U.S. population should be interpreted with caution.

Another limitation dealt with the QALY estimates. We were not able to incorporate mortality data into the QALY estimates due to attrition of participants, and the QALY calculations assumed that there was no difference between young and old participants on the QOL measures. It was expected that the impact of obesity could be larger if mortality data were included and that the impact on QALYs would change with age. However, few studies have shown mortality effects of being overweight but not obese. Future studies should include mortality outcomes and more detailed analysis by age. Results from this study should be considered as preliminary estimates based on partial data.

Finally, this analysis was cross-sectional and did not support causal attributions about the direct impact of obesity on HRQOL. Obesity coexists with many comorbidities not directly measured in this study, and it is not possible to remove the variance associated with other specific diseases. The results suggest that obese but not overweight people have lower QOL, but the study was not designed to expose the causal pathway.

In summary, the association between BMI and HRQOL was small and curvilinear, yet the total societal impact of obesity and associated conditions on QALYs is large because so many people are affected.

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