

Obesity and Physical and Emotional Well-Being: Associations between Body Mass Index, Chronic Illness, and the Physical and Mental Components of the SF-36 Questionnaire

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Abstract

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Objective: To clarify the associations between obesity and health-related quality of life by exploring the associations between physical and emotional well-being in relation to obesity and the presence of other chronic illness.

Research Methods and Procedures: The study data were collected as part of a postal-survey within the old Oxford Regional Health Authority of England in 1997. Completed questionnaires were returned by 8889 of 13,800 randomly selected adults aged 18 to 64 years. The main outcome measures were body mass index in five categories (underweight, normal weight, overweight, moderately obese, morbidly obese); chronic illness status (any vs. none and number of such illnesses 0, 1 to 2, 3+); and mean SF-36 questionnaire score in two summary component measures reflecting physical and emotional well-being.

Results: Of the subjects, 31% were overweight and an additional 11% were obese. Body mass index was significantly associated with health status, but the pattern varied according to whether the measure reflected physical or emotional well-being. Physical, but not emotional, well-

being deteriorated markedly with increasing degree of overweight and was limited in subjects who were obese but had no other chronic condition; subjects with chronic illnesses other than obesity were compromised in both dimensions. In terms of the number of chronic illnesses reported, the additional presence of obesity was associated with a significant deterioration in physical but not emotional well-being.

Discussion: Overweight and obesity are associated with poor levels of subjective health status, particularly in terms of physical well-being. The limitations in emotional well-being that are reported here and in other studies may be a result of confounding by the presence of accompanying chronic illness.

Keywords: subjective health-status, physical well-being, emotional well-being, health-related quality of life, chronic illness

Introduction

Obesity represents a major public health problem in developed countries (1). It is an independent risk factor for a variety of chronic diseases such as diabetes, hypertension, and coronary heart disease and is thus associated with high levels of potentially avoidable health care costs (2,3). Estimates of prevalence suggest that between 7% and 15% of subjects in developed countries are obese (4,5); the figure for the United States is markedly higher at around 33% (6).

Obesity is usually defined in terms of body mass index (BMI). The WHO-endorsed international classification defines obesity in three grades: BMI 25 to 29.9 kg/m² = Grade 1 obesity (moderate overweight); BMI 30 to 39.9 kg/m² = Grade 2 obesity (severe overweight); and BMI ≥ 40 kg/m² = Grade 3 obesity (massive/morbid obesity) (7,8). Thus, overweight is usually defined in terms of a BMI of 25

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or more, and obesity in terms of a BMI of 30 kg/m² or more. Underweight is usually defined as a BMI of less than 18.5 kg/m².

Health has been defined as a state of complete physical, psychological, and social well-being (9), reflected in the ability to be "confident and positive and able to cope with the ups and downs of life" (10). Although the importance of emotional well-being for health has recently been emphasized (10), the concept of emotional well-being is less well defined than that of physical well-being (11). With regard to the relationship between obesity and physical health, the impact of obesity is well documented, with it being generally acknowledged that obesity increases morbidity risk and decreases life expectancy (12). There are uncertainties, however, regarding the associations between obesity and health-related quality of life. Some studies have found obesity to be associated with compromised quality of life and mental well-being, assessed both using generic measures (13–15) and obesity-specific measures (16,17). Moreover, weight loss has been found to be associated with improvement in psychological well-being (18). Obese subjects have also been shown to have even poorer psychological profiles than other chronically ill people (19,20), and their BMI has been found to be positively correlated with reports of self-harm as well as borderline personality symptomatology (21).

Other studies, however, have not found any association between BMI and psychological disturbances, finding little difference between obese and non-obese individuals in terms of scores on standard psychological tests (20), even after adjusting for waist:hip ratio (22). In addition, some studies have found changes in weight not to be associated with changes in psychosocial functioning (23).

Although obesity is no doubt associated with some loss of quality of life, particularly in terms of physical well-being (14), epidemiological and clinical studies do not support the idea that overweight individuals are as a group more emotionally disturbed than lighter individuals (24). In this regard, one study found that obesity was associated with impaired physical but not emotional well-being, as assessed using both a general and an obesity-specific measure (25), and another found that in women, but not in men, BMI was not related to the impact of weight on self-esteem, which was substantial even in those of low BMI (17). It has thus been suggested that obesity affects the emotional health of only some obese persons (26), for example those that have associated binge eating (20,27–29) or other chronic conditions such as chronic pain (30). Thus the contradictory findings with regard to the association between obesity and emotional and psychological factors could be explained by sample differences.

This paper reports on the prevalence of overweight and obesity in a representative sample of almost 9000 adults surveyed during 1997 in the four counties of the former Oxford Region of the United Kingdom (Third Oxford

Healthy Life Survey). Self-reported health status is measured using the SF-36, a well-validated 36-item questionnaire developed in the late 1980s and early 1990s to provide a comprehensive measure of physical, emotional, and social well-being (31). The measure provides scores within eight multi-item dimensions. Health-related quality of life is examined in relation to increasing degrees of overweight and chronic illness status (any vs. none, and number of reported illnesses). The extent to which chronic illness, overweight, and obesity are associated with these eight dimensions of subjective health status, as well as two further summary Physical and Mental Components, are thus assessed.

Research Methods and Procedures

During 1997, questionnaires were mailed to 14,868 individuals ages 18 to 64 years, who were randomly selected from the general practitioner records held by the Health Authorities for the four English counties of Berkshire, Buckinghamshire, Northamptonshire, and Oxfordshire. The questionnaires were accompanied by a letter from the Health Services Research Unit that explained the purpose of the study, with the goal of providing the Health Authorities with information to help them use their resources most effectively to meet the needs of local people. The questionnaire booklet contained questions on lifestyle, demographics (including the occupation of the respondent), weight and height, health service utilization (frequency of general practitioner visits), and a question about longstanding illness, disability, or infirmity, defined as "Anything that has affected your work or other regular daily activities over a period of time or is likely to affect you over a period in the future" (Figure 1). The SF-36 was also included. A scoring algorithm was used to transform the sum of the SF-36 item scores within each dimension to a scale ranging from 0 (poor health) to 100 (good health) (32). Two summary measures were further calculated from the item scores using the procedures recommended by the developers: a Physical Component (PCS) and a Mental Component (MCS) score (33–35). An earlier survey of more than 9000 individuals in the Oxford Region, also conducted by the Health Services Research Unit, provided UK population norms for the SF-36 (32). Likewise, data from this present survey were used to assess the SF-36 version 2 (35).

For those who did not respond to the initial questionnaire, a reminder postcard was mailed approximately 3 weeks later. If this elicited no response within 3 weeks, another questionnaire and letter was sent. One thousand and four questionnaires were returned by the Post Office as a result of incorrect postal address. A further 64 questionnaires were excluded because the subject had died ($n = 6$), was out of the age range ($n = 42$), or was unable to read or complete the questionnaire ($n = 16$). Therefore, the final denominator was 13,800.

13. Do you have any longstanding illness, disability or infirmity? (Anything that has affected your work or other regular daily activities over a period of time or is likely to affect you over a period in the future).
 Yes.....CONTINUE TO QUESTION 14
 No.....GO TO QUESTION 15
14. Please circle the numbers that best describe your longstanding illness, disability or infirmity. (If you have more than one longstanding illness, disability or infirmity please circle **all the numbers that apply**)
- Asthma..... 1
 - Problems with a single joint (such as knee, elbow etc.)..... 2
 - Arthritis (problems with multiple joints)..... 3
 - Back pain (including sciatica/lumbago/disc problems)..... 4
 - Raised blood pressure/hypertension..... 5
 - Depression..... 6
 - Diabetes..... 7
 - Problems with indigestion (including ulcer/hiatus hernia)..... 8
 - Heart disease (including angina)..... 9
 - Problems as the result of an injury or accident:
 Please say what..... 10
 - Problems with bowels (including irritable bowel/colitis/diverticulitis)..... 11
 - Migraine/persistent headaches..... 12
 - Epilepsy..... 13
 - Skin problem
 Please say what..... 14
 - Anxiety/Panic attacks/Phobias..... 15
 - Other
 Please say what..... 16

87 How tall are you? _____ or _____
 feet inches centimetres

88 How much did you weigh when you last weighed yourself?
 _____ or _____
 stones pounds kilograms

Figure 1. Booklet questions relating to longstanding illness, height, and weight.

For the analysis, subjects were initially divided into groups in terms of their BMI (<18.5 “underweight,” 18.5 to 24.99 “normal weight,” 25.0 to 29.99 “overweight,” 30.0 to 39.99 “moderately obese,” or 40.0+ “morbidly obese”) and their chronic illness status (any longstanding illness vs. none). Subjects were then grouped in terms of their combined obesity (BMI 30+) and chronic illness status (neither condition, obesity only, chronic illness only, or both conditions). The analyses were subsequently repeated after subjects had been categorized in terms of the number of longstanding illnesses reported (0, 1 to 2, 3+). Subjects were thus divided into six groups in terms of their combined BMI and obesity status (neither condition, obesity only, one to two chronic illnesses, three or more chronic illnesses, obesity and one to two chronic illnesses, obesity and three or more chronic illnesses).

Statistical Methods

The PCS and MCS were obtained by an initial factor analysis of the study data using principal components analysis and orthogonal rotation in accordance with the recommendations of the Summary Score developers (33,34). This produced a two-factor solution corresponding to two factors loading on either the physical or mental dimensions of the SF-36 (see Table 1). These two factors accounted for 71.4% of the variance in the eight dimensions. The final creation of the Summary Scores proceeded as reported by Jenkinson et al. (35) by multiplying each subject’s SF-36 dimension *z* score by its respective factor coefficient and then standardizing each to a *T* score with a mean of 50 and a standard deviation of 10.

Chi-squared statistics were used to test for associations between categorical variables. The SF-36 scores were ap-

Table 1. Factor score coefficients from the principal component analysis used to derive the PCS and MCS summary scale

SF-36 dimension	Component 1,	Component 2,
	MCS	PCS
Physical functioning	-0.227	0.456
Role physical	-0.102	0.362
Bodily pain	-0.130	0.367
General health	0.036	0.199
Vitality	0.278	-0.050
Social functioning	0.272	-0.028
Role emotional	0.329	-0.110
Mental health	0.460	-0.050

proximately normally distributed; therefore, *t* tests and *F* tests were used to test for differences in SF-36 scores among groups of subjects. Logistic regression was used to assess the independence of the relationship between BMI group and chronic illness status (any vs. none) after adjusting for age and gender. Analysis of variance was used to assess whether SF-36 scores differed among the BMI, obesity, and chronic illness categories, and Tukey's *b* range test was used to identify homogeneous subsets of means that are not significantly different from each other. Age, gender, and frequency of health service utilization were adjusted for in multi-way analysis of variance models. All analyses were performed using SPSS Version 7.5 for Windows 95 (36). The significance level was set at two-sided $p < 0.05$ throughout.

Results

Sample Characteristics

Completed questionnaires were returned by 8889 of the 13,800 individuals, giving a response rate of 64.4%. The response rates differed among the four counties: 59.2% (Berkshire), 67.4% (Northamptonshire), 64.6% (Buckinghamshire), and 68.1% (Oxfordshire). The mean (\pm SD) age of the respondents was 41.6 (\pm 12.6). Thirty-eight percent of subjects ($n = 2918$) were assigned to social classes I or II (professional and managerial or technical occupations), 43% ($n = 3336$) to class III (skilled occupations, non-manual, and manual), and 19% ($n = 1453$) to classes IV or V (partly skilled and unskilled occupations) (37). Seventy-two percent were married/cohabiting, 19% were single, and 9% were divorced/separated/widowed. In terms of ethnicity, 95% were white, 3% Asian, and 1% black.

In order to estimate the representativeness of the respondents, their gender, age, social class distribution, and ethnicity were compared with 1991 census data for the four

counties (37). There was a slight over-representation of women (56% compared with 50%); a slight under-representation of younger individuals (34% were aged 18 to 34 compared with 42%) and over-representation of older ones (42% were aged 45 to 64 compared with 35%); and in men, but not in women, an over-representation of individuals in the non-manual social classes I through III nonmanual (58% compared with 47%) and under-representation of individuals in the manual classes III manual through V (43% compared with 52%). The ethnic distribution of the respondents was almost exactly equal to that of the census.

Current Weight

Almost 8600 respondents ($n = 8594$) provided data on their weight and height (see Figure 1). Their mean (\pm SD) weight and BMI were 72.2 (\pm 14.6) kg and 24.9 (\pm 4.3) kg/m², respectively. Although slightly more than half of the subjects ($n = 4805$, 56%) were of normal weight (BMI 18.5 to 24.9), almost one third ($n = 2682$, 31%) were overweight (BMI 25.0 to 29.9), and an additional 11% were either moderately (BMI 30.0 to 39.9; $n = 852$, 10%) or morbidly obese (BMI \geq 40.0; $n = 69$, 1%).

Chronic Disease and Use of Health Services

More than 40% of the respondents ($n = 3584$, 41.8%) reported suffering from some longstanding illness. Fifteen percent of subjects reported one such illness, 13% two, and 15% three or more (up to a maximum of 11). The most common individual conditions were back pain ($n = 1336$, 16%) and single joint problems ($n = 891$, 10%); most other conditions on the list (see Figure 1) were reported by between 5% and 7% of the respondents. The exceptions were heart disease, diabetes, and epilepsy, which were reported by between 1% and 2% respondents. A further 830 respondents (10%) reported "other" longstanding illnesses.

In terms of health service utilization, 37% of subjects reported that they had visited their general practitioner on one occasion, or not at all, during the previous year; 36% of subjects reported two to three visits, and 27% four or more. This frequency was significantly related to the number of longstanding illnesses reported such that 16% of subjects with no reported longstanding illness had visited their general practitioner four or more times over the past year, compared with 31% of those with one illness, 38% of those with two illnesses, and 55% of those with three or more ($\chi^2 = 1134$, $df = 6$, $p < 0.001$). There was little difference between the groups in terms of the proportion reporting two to three general practitioner visits.

Association between Chronic Disease and Weight

The risk of suffering from any longstanding illness was associated with increasing BMI, with the proportion of subjects reporting a longstanding illness increasing linearly from 35% of those who were underweight to 68% of those

who were morbidly obese (χ^2 for linear trend = 114.4, $df = 1$, $p < 0.001$). In terms of the number of longstanding illnesses reported, 11% of underweight subjects reported three or more such illnesses, compared with 12% of normal weight subjects, 16% of overweight subjects, 25% of moderately obese, and 42% of morbidly obese subjects; there was little difference among the BMI groups in terms of those reporting one to two illnesses. After adjusting for age and gender in a logistic regression analysis, the risk of suffering from any longstanding illness was independently related to BMI: subjects with a BMI of 30 to 39.9 or 40 or above were significantly more likely to suffer from any such illness than subjects who were lighter (ORs = 1.53 [95% CI 1.12 to 2.11], $p < 0.01$; 2.75 [95% CI 1.52 to 4.97], $p < 0.001$, respectively).

BMI was also found to be significantly associated with the frequency of health service utilization in that, whereas 36% of both the underweight and moderately obese subjects had visited their general practitioner four or more times within the last year, this was true of around 25% of both normal weight and overweight subjects and 61% of those who were morbidly obese ($\chi^2 = 103.5$, $df = 8$, $p < 0.001$). There was little difference in terms of the proportion visiting their general practitioner on two to three occasions.

Associations between Weight and SF-36 Scores

Table 2 shows the mean SF-36 scores in each of the eight dimensions and for the two summary measures by BMI category. The overall mean dimension scores provide community normative data for adults aged between 18 and 64 years. In all dimensions, there were statistically significant ($p < 0.001$) differences in SF-36 score among the BMI categories that remained after adjusting for age, gender, and frequency of health service utilization. However, the pattern of SF-36 scores by BMI category differed according to whether the SF-36 dimension reflected physical, emotional, or social well-being.

Physical Well-Being

In these dimensions (Physical Functioning, Role Physical, Bodily Pain), the subjects who had moderate or morbid obesity had significantly lower scores than subjects in all other BMI categories, including those who were underweight. In particular, the scores of subjects who had morbid obesity were lower than those with moderate obesity, although the difference was statistically significant only for Physical Functioning (mean [\pm SE] difference 14.2 [\pm 2.4]; 95% CI 7.6 to 20.9). Individuals of normal weight reported the best physical well-being, having in each of the dimensions a significantly higher score than subjects who were overweight. The underweight subjects did not report any statistically significant limitation in physical well-being compared with normal weight and overweight subjects, but their scores were significantly higher than those who were obese.

This was reflected in the Physical Component Score, which was highest in those subjects of normal BMI (but on post hoc tests formed a homogeneous subset with underweight and overweight subjects) and lowest in those who were moderately obese and particularly those who were morbidly obese (each forming a separate subset) (quadratic effect $F = 36.2$, $p < 0.001$) (Table 2 and Figure 2).

Emotional and Social Well-Being

In these dimensions (Mental Health, Role Mental, Vitality, Social Functioning) the mean scores of the moderately and morbidly obese subjects were, with the exception of Vitality (obese subjects having significantly lower scores), similar to those of the underweight subjects. For all dimensions, the highest scores were recorded by those who were either of normal weight or overweight. The scores of the latter group were slightly higher in all dimensions except Vitality.

These patterns are reflected in the Mental Health Component scores: subjects who were underweight, moderately obese, or morbidly obese had similar mean scores and formed a homogeneous subset. Scores increased fairly progressively from those who were underweight to those who were overweight, and then decreased with increasing severity of obesity (quadratic effect $F = 32.8$, $df = 1$, $p < 0.001$) (Table 2 and Figure 2).

In terms of the subjects' assessments of their own health, the General Health score differed significantly among almost all BMI categories. Normal weight subjects had the highest score, followed by overweight and underweight subjects (who did not have significantly different scores); moderately and morbidly obese subjects had the lowest scores.

Differences in SF-36 Score between Obese Individuals and Those with Other Chronic Illnesses

Subjects were categorized into four groups according to their obesity (BMI 30+) and chronic illness (any longstanding illness) status: those that had neither condition ($n = 4578$, 53.4%); those that were obese only ($n = 407$, 4.7%); those that had chronic illness only ($n = 3075$, 35.9%); and those that had both conditions ($n = 509$, 5.9%). The four categories differed independently in terms of gender ($\chi^2 = 28.02$, $df = 3$, $p < 0.001$), mean age (linear term $F = 487.1$, $df = 1$, $p < 0.001$), and (by definition) mean body mass index ($F = 2948$, $df = 3$, 8565, $p < 0.001$), as shown in Table 3. They also differed in terms of their reported frequency of health service use: 16% of those with neither condition had visited their general practitioner four or more times over the past year, compared with 20% of those with obesity only, 40% of those with chronic illness only, and 53% of those with both conditions ($\chi^2 = 971.8$, $df = 6$, $p < 0.001$). The frequency of two to three visits did not differ notably among the groups.

Table 2. Distribution of SF-36 scores by BMI category and the statistical significance of the differences among the categories after adjusting for age, gender, and frequency of health service utilization. The categories forming separate homogeneous subsets on post hoc tests are also shown.

SF-36 dimension	BMI					F	p value	Homogeneous subsets†
	<18.5	18.5-24.99	25.0-29.99	30.0-39.99	40.0+			
	underweight; mean (±SD) (n = 220*)	normal weight; mean (±SD) (n = 4646*)	overweight; mean (±SD) (n = 2580*)	moderate obesity; mean (±SD) (n = 814*)	morbid obesity; mean (±SD) (n = 67*)			
Overall	mean (±SD) (n = 8561*)	mean (±SD) (n = 4646*)	mean (±SD) (n = 2580*)	mean (±SD) (n = 814*)	mean (±SD) (n = 67*)			
Physical functioning	87.99 (19.65)	90.37 (17.7)	87.13 (19.5)	79.92 (24.5)	65.67 (25.8)	77.6	<0.001	1,2,3 4 5
Role physical	87.17 (22.01)	88.90 (20.5)	86.82 (21.7)	80.80 (27.1)	74.63 (26.8)	31.4	<0.001	1,2,3 1,4 5
Role mental	85.75 (21.18)	86.41 (20.4)	86.63 (20.0)	83.06 (25.0)	78.80 (26.0)	12.7	<0.001	2,3,4 1,4,5
Social functioning	82.77 (23.24)	83.58 (22.7)	83.67 (22.2)	78.41 (27.0)	72.10 (29.0)	16.5	<0.001	2,3,4 1,4 1,5
Mental health	71.92 (18.15)	72.17 (18.0)	72.81 (17.4)	69.76 (20.2)	66.32 (20.1)	8.6	<0.001	1,2,3,4 1,4,5
Vitality	58.04 (19.60)	59.19 (19.2)	58.27 (19.3)	52.56 (20.9)	47.28 (22.7)	26.3	<0.001	1,2,3 1,4 5
Bodily pain	78.80 (23.01)	80.55 (22.0)	78.14 (23.2)	72.22 (26.0)	64.90 (25.4)	31.6	<0.001	1,2,3 4 5
General health	71.07 (20.43)	73.29 (19.7)	70.10 (20.2)	64.16 (21.7)	56.86 (24.2)	48.4	<0.001	1,2,3 4 5
Mental component	50.04 (9.98) (n = 7847)	50.05 (10.0)	50.62 (9.48)	49.18 (11.1)	48.14 (10.9)	9.1	<0.001	2,3,4,5 1,4,5
Physical component	50.02 (9.98) (n = 7847)	51.16 (9.17)	49.41 (10.0)	45.99 (12.1)	40.55 (13.1)	64.5	<0.001	1,2,3 4 5

* n represents the smallest number within each domain.

† 1 = underweight, 2 = normal weight, 3 = overweight, 4 = moderate obesity, 5 = morbid obesity.

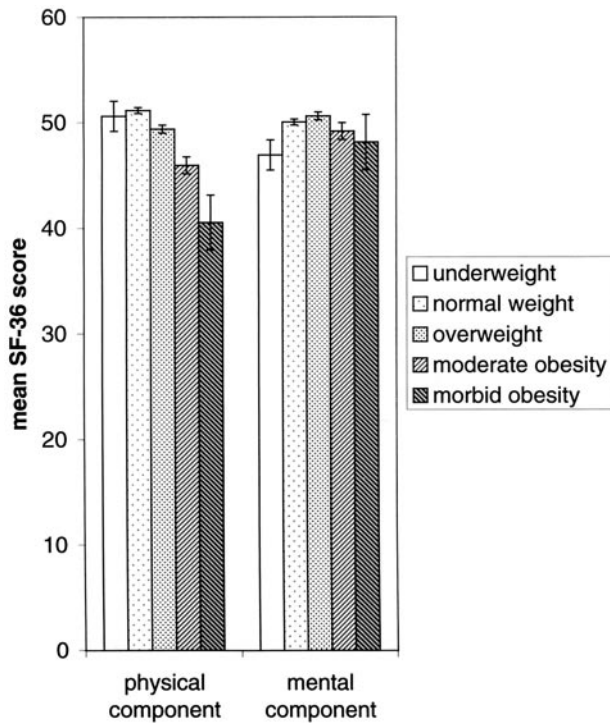


Figure 2. Mean (95% CI) SF-36 Physical and Mental Component summary scores by BMI category.

Table 4 shows the mean SF-36 scores in each dimension for subjects in each category. There were statistically significant differences (all $p < 0.001$) among the categories in terms of scores in all SF-36 dimensions. These remained after adjusting for age, gender, and frequency of health service utilization. Post hoc tests revealed, however, that although the SF-36 scores differed significantly between all pairs of categories for the majority of the physical dimensions, this was not true of the emotional dimensions. The mean scores for each of the Physical Functioning, the Role Physical, and the Vitality and General Health dimensions differed significantly

among all four categories, being highest in those subjects with neither obesity nor chronic illness and reducing progressively to those with obesity only, those with chronic illness only, and those with both conditions. All four categories formed separate homogeneous subsets. However, for the emotional dimensions of Role Mental, Mental Health, and Social Functioning, and the physical dimension of Bodily Pain, post hoc tests revealed that there was no significant difference between subjects with neither condition and those with obesity only, these subjects having the highest scores and forming a separate homogeneous subset, whereas subjects with chronic illness only and those with both conditions had progressively lower scores, forming separate homogeneous subsets.

This difference between the physical and emotional dimensions was reflected in the mean Mental and Physical Component Scores (Table 5 and Figure 3). Thus, while the scores on both components differed significantly among the categories (for both $p < 0.001$), in the physical dimension all categories formed homogeneous subsets, whereas in the emotional dimension the subjects with chronic illness only and both chronic illness and obesity formed a homogeneous subset, having the lowest scores, and the subjects with obesity only and neither condition formed a separate homogeneous subset having the highest scores.

On further categorizing the subjects into groups according to their obesity status and actual number of chronic illnesses reported, physical well-being was observed to deteriorate with increasing number of illnesses reported and with the additional presence of obesity: each of the six groups formed a separate homogeneous subset. Thus, both obesity and number of longstanding illnesses were independently related to level of physical well-being (both $p < 0.001$) and subjects with obesity together with three or more accompanying chronic illnesses reported particularly poor physical well-being (Table 5). In terms of emotional well-being, however, significant deterioration was evident only among those subjects who reported three or more longstanding illnesses. Moreover, within those who reported the same

Table 3. Mean age, BMI, and gender distribution with 95% CIs in obesity/chronic illness categories

Obesity/chronic illness	n*	(%)	Age		BMI		Gender	
			Mean (±SD)	95% CI	Mean (±SD)	95% CI	n (%) female	95% CI
Neither condition	4578	(53.4)	38.98 (12.1)	38.6–39.3	23.64 (2.9)	23.6–23.7	2480 (54)	53–56
Obesity only	407	(4.7)	42.30 (10.8)	41.2–43.4	33.25 (3.5)	32.9–33.6	228 (56)	51–61
Chronic illness only	3075	(35.9)	44.45 (12.6)	44.0–44.9	24.05 (2.9)	23.9–24.1	1743 (57)	55–58
Both conditions	509	(5.9)	47.30 (11.9)	46.3–48.3	34.15 (4.6)	33.8–34.6	337 (66)	62–70

* Numbers may vary due to missing data.

Table 4. Mean (\pm SD) SF-36 scores in obesity/chronic illness categories. All scores differ statistically significantly ($p < 0.001$) among the categories. The results of post hoc tests after adjusting for age, gender, and frequency of health service utilization are also shown, indicating groups forming separate homogeneous subsets.

Obesity/chronic illness	n*	n* (%)	SF-36 dimension							
			Physical functioning	Role physical	Role mental	Social functioning	Mental health	Vitality	Bodily pain	General health
Neither	4578	(53.4)	94.54 (11.8)	94.13 (13.1)	89.72 (16.6)	88.57 (17.9)	75.38 (16.0)	63.32 (17.1)	87.33 (16.4)	78.85 (15.5)
Obesity only	407	(4.7)	88.88 (16.5)	91.46 (15.7)	89.70 (18.0)	86.78 (21.4)	75.16 (17.4)	59.90 (18.2)	85.21 (17.5)	74.26 (16.2)
Chronic illness only	3075	(35.9)	80.98 (23.4)	78.85 (26.8)	81.13 (24.3)	75.78 (26.4)	67.72 (19.4)	52.06 (20.5)	68.21 (25.2)	61.81 (21.8)
Both	509	(5.9)	70.65 (27.4)	71.18 (30.8)	77.16 (28.4)	70.85 (29.1)	65.04 (21.2)	45.89 (21.2)	60.59 (26.6)	55.00 (22.3)
Homogeneous subsets†			1-4	1-4	1,2 3-4	1,2 3-4	1,2 3-4	1-4	1,2 3-4	1-4

* Numbers vary due to missing data.

† 1 = neither, 2 = obesity only, 3 = chronic illness only, 4 = both.

number of chronic illnesses, the presence of accompanying obesity was associated with no further significant deterioration in emotional well-being, the two groups instead forming one homogeneous subset. This was particularly evident among those reporting three or more chronic conditions (Table 5) and is reflected in the lack of an independent association between obesity and emotional well-being ($F = 0.81$, $df = 1$, 7807 , $p = 0.37$), whereas the number of longstanding illnesses retained an independent association ($F = 195.0$, $df = 3$, 7807 , $p < 0.001$).

Discussion

The results from this study suggest that in 1997 in the Oxford Region of the UK 42% of subjects were moderately overweight or obese. This estimate is lower than the 58% obtained for the Anglia and Oxford Region from the 1996 Health Survey for England (38). Possible explanations for this discrepancy could include the relatively low response rate in this survey (64%); the difference in the geographical area of the two surveys; and the different type of data collection. The Health Survey for England data was obtained by interview and physical measurement, whereas the data reported here were obtained by self-report; it is well known that individuals tend to report that they are slightly lighter and taller than they actually are (39).

Nevertheless, the within subject comparisons that are presented here are unlikely to be affected by any possible under-representation of overweight individuals. The SF-36 is well known to provide a valid and reliable measure of health status (40,41), and in particular, the Mental Component Summary measure has been found to be a particularly good measure of mental health (33) and general quality of life (42). Therefore, the use of recently developed obesity-specific health state measures (16,17,25,43), although likely to present a different picture on account of the different dimensions measured, would have been unlikely to alter the results significantly. It must be remembered, however, that the cross-sectional nature of the study design limits any conclusions that can be drawn with regard to the causal mechanisms underlying the observed associations. In addition, information was not collected on the duration of obesity or whether the subject had ever attempted to lose weight. These factors may be important in explaining the association between BMI and health-related quality of life.

We found overweight and obesity to be associated with decreasing levels of both physical and emotional well-being. This deterioration in health status was, however, more evident in the physical than in the emotional dimensions; in the emotional and social dimensions overweight and obese subjects scored no lower than underweight subjects. This is consistent with results of other studies that have suggested that the burden of obesity is primarily perceived as physical in nature (14,15,20,22,23,25). In one study, BMI (along with the presence of pain, age, and

Table 5. Mean (\pm SD) SF-36 component scores and 95% CIs in obesity/chronic illness categories. All scores differ significantly ($p < 0.001$) among the categories. The results of post hoc tests after adjusting for age, gender, and frequency of health service utilization are also shown, indicating groups forming separate homogeneous subsets.

Obesity/chronic illness	n	(%)	SF-36 component score			
			MCS		PCS	
			Mean (\pm SD)	95% CI	Mean (\pm SD)	95% CI
Obesity/any chronic illness						
Neither	4245	(54.5)	51.34 (8.9)	51.1–51.6	53.85 (5.7)	53.7–54.0
Obesity only	374	(4.8)	51.15 (9.8)	50.2–52.1	51.61 (6.8)	50.9–52.3
Chronic illness only	2720	(34.9)	48.36 (10.9)	48.0–48.8	45.3 (11.8)	44.9–45.8
Both	450	(5.8)	47.49 (11.7)	46.4–48.6	40.4 (13.4)	39.2–41.7
Homogeneous subsets*			1,2 3,4		1–4	
Obesity/number of chronic illnesses						
Neither	4245	(54.5)	51.34 (8.9)	51.1–51.6	53.84 (5.7)	53.7–54.0
Obesity only	374	(4.8)	51.15 (9.8)	50.2–52.1	51.61 (6.8)	50.9–52.3
1–2 chronic illnesses	1856	(23.8)	50.35 (9.6)	49.9–50.8	47.61 (10.3)	47.1–48.1
Obesity/1–2 chronic illnesses	235	(3.0)	49.62 (10.8)	48.2–51.0	45.47 (10.7)	44.1–46.8
3+ chronic illnesses	864	(11.1)	44.11 (12.3)	43.3–44.9	40.46 (13.2)	39.6–41.3
Obesity/3+ chronic illnesses	215	(2.8)	45.16 (12.3)	43.5–46.8	34.91 (13.9)	33.1–36.8
Homogeneous subsets†			1,2,3 2,3,4	5,6	1–6	

* 1 = neither, 2 = obesity only, 3 = chronic illness only, 4 = both.

† 1 = neither, 2 = obesity only, 3 = one to two chronic illnesses, 4 = obesity/one to two chronic illnesses, 5 = more than three chronic illnesses, 6 = obesity/more than three chronic illnesses.

gender) was found to be a predictor of impaired quality of life with respect to physical domains of the SF-36 but not predictive of decrements in the Mental Component of health-related quality of life (15). One possible explanation that was given for this lack of relationship between BMI and emotional well-being was that the study used subjects who were seeking treatment for overweight and thus likely to have homogeneous levels of emotional problems, levels which are higher than overweight people in general. However, a later study of subjects recruited directly from the community similarly found that the SF-36 emotional and social dimensions were not associated with increasing levels of overweight and obesity, whereas the physical dimensions were (25). The observations we report here, because the subjects were also recruited directly from the community, further argue against this possible explanation. Additionally, the lack of association remains after adjusting for the frequency of health service utilization, which suggests that the relationship is not attenuated by the effect of medical treatment for the conditions.

Our results do suggest, however, as has been proposed by Wadden and Stunkard (26), that obesity is associated with decreased emotional health in some obese persons, particularly those who have accompanying chronic conditions. We found that subjects with both obesity and other chronic conditions, who constituted slightly more than half (56%) of those with obesity, reported particularly poor physical and emotional health. This was especially true of those with three or more chronic conditions and highlights a sector of the community that appears to be particularly vulnerable to impaired well-being, both physical and emotional. In this regard, it is notable that, among groups of subjects with similar levels of chronic illness, the additional presence of obesity was associated with significant deterioration in physical but not in emotional well-being. Consequently, after adjusting for the number of longstanding illnesses reported, there was an independent relationship between obesity and physical well-being but not emotional well-being. Thus the studies that have found obesity to be related

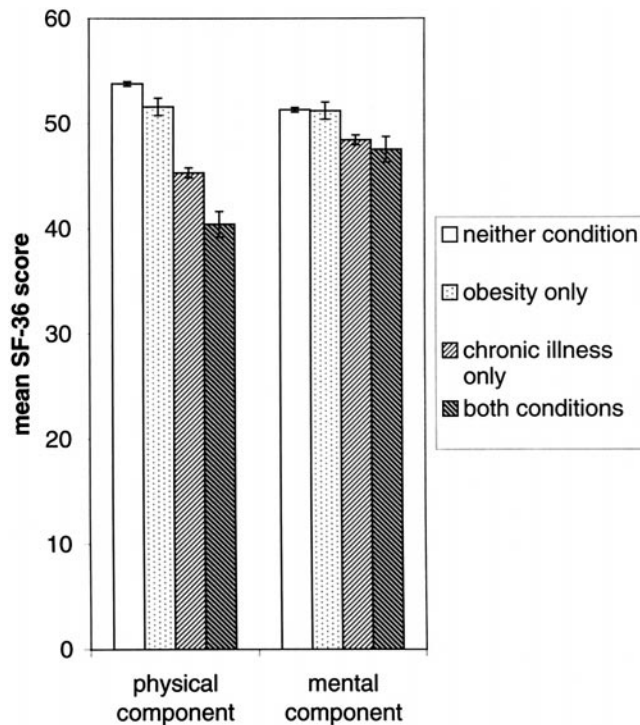


Figure 3. Mean (95% CI) SF-36 Physical and Mental Component summary scores by obesity/chronic illness group.

to poor health-related quality of life (16,44) could well reflect confounding by comorbidity.

Our results also lend some support to the idea of “Healthy” obesity (45,46) in those subjects with no accompanying chronic illness, although it must be remembered that physical well-being was found to be compromised in all obese subjects. Additionally, subjects with obesity alone did report significantly lower general health scores than subjects of normal weight. This observation is consistent with the results of an earlier study (47) in which obesity was associated with lower ratings of health among subjects with similar levels of morbidity and functional well-being and suggests that obese individuals are indeed aware of the health risks of obesity. The obese subjects with accompanying comorbidity also rated their health particularly poorly, which is consistent with their reported increase in health service utilization. Such an association between BMI alone and physician visits has been observed previously (48,49) but was not found to translate through to increased use of preventive health services (48). In view of the greater health risks associated with obesity, the importance of encouraging the utilization of such measures cannot be underestimated (50).

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