# Predictors for health-related quality of life in patients accepted for bariatric surgery

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**Abstract**

*Background*

The relationship between musculoskeletal pain, depression, and health-related quality of life (HRQL) in patients with severe obesity who are accepted for bariatric surgery should be further explored.

*Method*

In this cross sectional study, we measured HRQL with the generic questionnaire "Short-Form 36 Health Status Survey" (SF-36). Multiple regression analysis was used to explore associations between the predictors (musculoskeletal pain and depression) and the physical cumulative summary (PCS) and mental cumulative summary (MCS). Age, gender, body mass index, and the number of comorbidities were entered as covariates.

*Results*

The study subjects included 28 females and 23 males with a mean age of 37.7 years and a mean BMI of 51.9 $kg/m^2$. PCS and MCS scores were very poor compared to the age- and gender-adjusted population norm ($p<0.001$). The presence of musculoskeletal pain was associated with a score that was 10.97 points lower on the PCS ($p<0.001$) and 7.05 points lower on the MCS ($p=0.031$). The presence of depression was associated with a score that was 20.89 points lower on the MCS ($p<0.001$), while no significant association was found between depression and the PCS.

*Conclusions*

This study shows that musculoskeletal pain was strongly associated with lower scores on the PCS and MCS, while depression was strongly associated with lower score on the MCS.

**Introduction**

Why do many patients who are accepted for bariatric surgery have poor health-related quality of life (HRQL) while others have moderately reduced or even normal values? [1] We became interested in this question when assessing our patients' HRQL for the purpose of evaluating the effects of bariatric surgery. To shed some light on his issue could matter for several reasons. First, data related to this issue could reveal risk factors for poor HRQL and thereby guide clinicians in prioritizing patients for bariatric surgery. It may also generate hypothesis for how we can help patients who experience insufficient improvements in HRQL after surgery.

Some studies have suggested that the most important modifiable predictors of poorer HRQL in patients accepted for bariatric surgery are arthritis/ musculoskeletal pain [2, 3] and psychiatric disorders (depression, binge eating disorders, etc.) [2, 4, 5]. Such conditions may influence HRQL through several mechanisms [6, 7]. Higher body mass index (BMI) seems to be most closely related to poorer physical health [2, 5]. It also seems that cardiovascular risk factors (i.e., diabetes, dyslipidemia, and hypertension) may not predict HRQL in this patient group [2, 3, 8], but that coronary heart disease may have a negative influence if prevalent [3]. The number of comorbidities a patient has also seems to predict poorer HRQL [3].Sociodemographic characteristics such as age, gender, and ethnicity are typically reported to be predictive to some extent; however, it is difficult to identify any clear patterns here [2, 3, 5, 8, 9].

Although several variables seem to be associated with HRQL in this patient group, the prevalence of the two modifiable comorbidities musculoskeletal pain and depression seem to have a particular potential to explain much of the variance in HRQL [2, 3, 5]. To our knowledge, the predictive value of these two variables on HRQL (adjusted for each other) has only been investigated once before in this patient group

[2]. We therefore tested whether these findings could be reproduced in a patient group from a different population.

The aim of this study was to investigate whether musculoskeletal pain and depression were associated with overall HRQL in our patients, as measured with the generic health status measure "Short-Form 36 Health Status Survey" (SF-36), after adjusting for relevant and available covariates (age, gender, BMI, and other comorbidities). We hypothesized that musculoskeletal pain would be associated with poorer physical health and that depression would be associated with poorer mental health.

**Methods**

*Patients and study design*

The first 51 patients with severe obesity who were accepted for bilopancreatic diversion with a duodenal switch at Førde Central Hospital were invited to participate in the study. Our bariatric surgery program was initiated in 2001, and the inclusion criteria included BMI ≥ 40.0 or ≥ 35.0-39.9 with obesity-related co-morbidities, age 18-60, no alcohol or drug problems, no active psychosis, and failure to lose weight through other methods. All patient data was assessed using a standardized form to determine the patient's health status. Medical history and current health status were examined both by the patient's primary care physician and by a physician at the hospital prior to surgery (except musculoskeletal pain and urinary stress incontinence, which were only assessed by the patients and the physician at the hospital). The patients completed an HRQL questionnaire at home and brought it with them when they arrived for surgery.

*Outcome variables*

HRQL refers to the aspects of quality of life that specially relate to a person's health, and can be defined as self-perceived multidimensional health status [10, 11]. To measure HRQL, we used the SF-36 (Norwegian version 1.2), which is a well-established generic measure of the health burden of chronic diseases [12]. The questionnaire has demonstrated good validity and reliability [13]. SF-36 assesses eight dimensions of physical and mental health, each ranging from 100 (optimal) to zero (poorest). The subscales physical functioning, physical role limitations, bodily pain, and general health reflect physical health. The subscales vitality, social functioning, emotional role functioning, and mental health reflect mental health. The eight SF-36 subscales can be factor-analyzed and reduced to two summary scores, the physical component summary (PCS) and the mental component summary (MCS) [14]. These are the outcome variables in this study. To calculate the PCS and MCS, we used the oblique method, which allows physical and mental health to be correlated [15]. A higher score on both summary scales represents better health. Generally, 2 to <5 points is regarded as a small difference, 5 to <8 points as a moderate, and ≥ 8 points as a large difference. Norm data on the SF-36 was obtained from the Short Form 36 (SF-36) health survey in Norway 1998 (n=2323) [16].

*Predictors*

Our predictor variables were musculoskeletal pain and depression. Musculoskeletal pain was considered to be present if the patient answered yes to the following question: "do you have pain in the lower back, hips, knees, legs, or ankles and regularly use medication and/or have physiotherapy for such a condition?" Depression was considered to be present if the patient was on prescribed treatment for this comorbidity.

*Covariates*

Information on age, gender, and BMI were collected. Anxiety, asthma, coronary heart disease, diabetes, hyperlipidemia, hypertension, and pickwickian/sleep apnea were considered to be present if the patient was on prescribed treatment for these comorbidities. All patients were also screened for diabetes (fasting plasma glucose and hemoglobin A1c), dyslipidemia (fasting total/HDL cholesterol and triglycerides), and hypertension at the hospital. The presence of urinary stress incontinence was considered to be present if the patient reported having this condition. All comorbidities was assessed as not present (= 0) or present (= 1). We constructed a comorbidity-score of the eight comorbidities that were considered to be covariates, ranging from zero to eight points. This score was treated as a continuous variable, as has been done previously [3].

*Statistics*

A one-sample t-test was used to compare the SF-36 summary scores between the patients and the norm population. The mean SF-36 summary scores of the norm population were adjusted for age and gender to reflect the same distribution as that of our study sample. Associations between the SF-36 summary scores and the two predictors (musculoskeletal pain and depression) were investigated using multiple regression analysis. Age, gender, BMI, and the comorbidity-score were entered as covariates. Tests were performed to ensure that the underlying assumptions for the regression analysis were not violated. Unstandarized regression coefficients (B), standard errors, standardized regression coefficients (Beta), p-values, and adjusted $R^2$ for the two models are reported. A two-tailed *p*-value of $< 0.05$ indicated statistical significance. The SF-36 summary sores were calculated with the SF Health Outcomes

TM Scoring Software, basic version (Quality Metric Inc. Lincoln). The remaining

analyses were performed with the statistical program SPSS for Windows, version 15.0

(SPSS Inc. Chicago).

*Ethics*

Informed consent was obtained from all participants. This investigation conforms to the

principles outlined in the Declaration of Helsinki. The study was approved by The

Norwegian Social Science Data Services and by the Regional Committee of Ethics in

Medicine, West-Norway.

**Results**

*Patient characteristics*

All patients who were invited agreed to participate in the study. The patients had a high

mean BMI and a high prevalence of comorbidities (Table 1). The patients' PCS and

MCS scores were generally very low, and significantly lower than in the norm

population ($p<0.001$) (Table 2).

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Having musculoskeletal pain was associated with a score that was 10.97 points lower on

the PCS ($p<0.001$) (Table 3) and 7.05 points lower on the MCS ($p=0.031$) (Table 4).

The presence of depression was associated with a score that was 20.89 points lower on

the MCS ($p<0.001$) (Table 4), while no significant association was found between

depression and the PCS (Table 3). Of the covariates, higher BMI was associated with

poorer PCS scores ($p=0.041$) (Table 3). A higher comorbidity-score was associated with

a higher MCS score ($p<0.010$) (Table 4). Gender and age were associated with neither

PCS nor MCS (Table 3 and 4). The regression model explained 32.3% of the variance in the PCS (Table 3) and 40.9 % of the variance in the MCS (table 4).

*Secondary analysis*

The prevalence of musculoskeletal pain was 91.7% (11 out of 12) among the patients with a diagnosis of depression while it was 56.4% (22 out of 39) in patients without this diagnosis. The prevalence of depression was 33.3%  (11 out of 33) in patients reporting musculoskeletal pain and 5.9% (1 out of 17) in patients who did not report this condition (p=0.037, Fisher's Exact test). Patients experiencing both musculoskeletal pain and depression (22.6%, 11 out of 51) also had a higher mean comorbidity-score (3.7, SD 1.3) than those not having both of these comorbidities (2.03, SD 0.89) (p<0.001, independent t-test).

**Discussion**

This study shows that musculoskeletal pain was strongly associated with lower scores on the PCS and MCS, while depression was strongly associated with lower score on the MCS.  Our secondary analysis also shows that almost all of the patients with depression also had musculoskeletal pain, and that these patients had more comorbidities than other patients.

Our data supports the hypothesis based on the study by Dixon et al. [2], and further suggests that musculoskeletal pain and depression may have an even larger predictive value in other populations. In the study by Dixon et al., the comorbidities were assessed in a similar manner as in the present study. The prevalence of depression (19%) and arthritis/joint pain (72%) were also similar. Dixon et al. found that arthritis/joint pain was associated with poorer PCS but not poorer MCS. In our study,

musculoskeletal pain was also associated with poorer MCS. The reason for this discrepancy could be that our patients had more pain or differences between the modified Australian version of the SF-36 and the one that was used in the current study. They also found that depression was associated with both poorer PCS and MCS. The statistical power in their study was, however, higher than in the present one and this might explain why we found no such association. Our finding that higher BMI was associated with lower PCS was expected as this variable is directly related to physical functioning [2]. Our data also indicate that the number of comorbidities a patient has may not predict poorer PCS and MCS when adjusting for musculoskeletal pain and depression. In fact, the morbidity-score was associated with a higher MCS in the present study, a finding that we are unable to explain.

Several mechanisms may explain our findings. One is that obesity increases the biomechanical load on joints, ligaments, and muscles during activity, which may trigger pain and interfere with physical functioning [6]. Musculoskeletal pain can also be quite bothersome and affect mental well-being. Obesity may also induce depressive symptoms when it leads to impaired functioning in daily life, and depression may reduce mental well-being and functioning [7, 17]. It is, therefore, possible that the association between comorbidities such as depression and HRQL may be bidirectional [11]. The associations between the comorbidities and HRQL may also partly represent a tautology. Depression and musculoskeletal pain are not pure objective conditions, but will also be related to the patient's evaluation of own health. As such, comorbidities and HRQL can to some degree be regarded as overlapping constructs  [18].

Our finding that almost all patients with morbid obesity and depression had musculoskeletal pain is interesting. We have not found any similar data in the literature; however, the prevalence of such pain is generally high in patients with morbid obesity

[6]. In other patient groups, the prevalence of chronic pain has been reported to be very high in patients suffering from depression [19]. An explanation for this could be that chronic pain induces depression and that depression causes and intensifies pain (the depression-pain syndrome). Both serotonin and norepinephrine have been shown to diminish peripheral pain signals. This might explain how depression, which is associated with a dysregulation of these key modulating neurotransmitters along a shared pathway, may contribute to the presence of painful symptoms [19].

Or finding may have some clinical implications. First, the patients' low HRQL prior to surgery indicates that the received treatment for musculoskeletal pain (analgesics and/or physiotherapy) and depression (antidepressants) does not seem to give sufficient relief from these sufferings. This indicates that the underlying cause of these comorbidities; namely obesity, must be treated. Second, since patients with both musculoskeletal pain and depression seem to have a particularly high risk for having poor HRQL and having a high prevalence of other comorbidities, this could be something to consider when prioritizing patients for bariatric surgery. Finally, if bariatric surgeries do not lead to sufficient improvements in HRQL, we hypothesize that musculoskeletal pain and depression could be key targets for additional treatment. Preliminary data have indicated that patients who experienced little or no change in these two comorbidities after surgery had a smaller improvement in SF-36 scores than those who experienced improvements in these conditions [20].

Some limitations of this study should be considered. First, due to the cross-sectional design it is not possible to draw any causal conclusions. Second, our set of predictors was not exhaustive. Third, we cannot rule out the possibility that misclassification of comorbidities has occurred and somewhat biased the results. It has been shown that primary care physicians often fail to accurately diagnose patients with

major depression [19]. However, if this is the case in the present study, it is more likely that it would decrease the strength of the association between depression and the MCS than increase it. On the other hand, many undiagnosed cases of depression in people who also suffer from musculoskeletal pain would lead to overestimation of the association between musculoskeletal pain and the summary scores (especially the MCS). Data on musculoskeletal pain were based on self-report. However, the correlation between musculoskeletal pain and the SF-36 bodily pain scale was strong (r=0.61, p<0.001), supporting its validity. Forth, the sample size was rather small; however, this was somewhat compensated for by large effect sizes. Finally, the SF-36 is regarded as a well-suited instrument for exploring generic HRQL in morbidly obese patients [21]; however, we realize that data on obesity-specific HRQL would also be interesting.

**Conclusions**

Our data indicate that patients who are accepted for bariatric surgery and experience musculoskeletal pain and/or depression are at particular risk for having lower overall HRQL. However, more confirmatory research is needed, using a larger sample size and validated instruments for musculoskeletal pain and depression. Future studies evaluating the effect of bariatric surgery on HRQL should also attempt to identify patients who report no or little improvement in musculoskeletal pain and depression after adequate weight loss, and explore the effectiveness of providing these patients with additional treatment.

**Acknowledgements**

**References**

[1]     Fontaine KR, Barofsky I. Obesity and health-related quality of life. Obes Rev 2001; 2:173-82.

[2]     Dixon JB, Dixon ME, O'Brien PE. Quality of life after lap-band placement: influence of time, weight loss, and comorbidities. Obes Res 2001; 9:713-21.

[3]     Sendi P, Brunotte R, Potoczna N, Branson R, Horber FF. Health-related quality of life in patients with class II and class III obesity. Obes Surg 2005;15:1070-6.

[4]     De Zwaan M, Mitchell JE, Howell LM, et al. Two measures of health-related quality of life in morbid obesity. Obes Res 2002;10:1143-51.

[5]     Masheb RM, White MA, Toth CM, Burke-Martindale CH, Rothschild B, Grilo CM. The prognostic significance of depressive symptoms for predicting quality of life 12 months after gastric bypass. Compr Psychiatry 2007;48:231-36.

[6]     Janke EA, Collins A, Kozak AT. Overview of the relationship between pain and obesity: What do we know? Where do we go next? J Rehabil Res Dev 2007;44:245-62.

[7]     Dixon JB, Dixon ME, O'Brien PE. Depression in association with severe obesity: changes with weight loss. Arch Intern Med 2003;163:2058-65.

[8]     Kolotkin RL, Crosby RD, Pendleton R, Strong M, Gress RE, Adams T. Health-related quality of life in patients seeking gastric bypass surgery vs non-treatment-seeking controls. Obes Surg 2003;13:371-7.

[9]     White MA, O'Neil PM, Kolotkin RL, Byrne TK. Gender, race, and obesity-related quality of life at extreme levels of obesity. Obes Res 2004;12:949-55.

[10]     Cramer JA, Spilker B. Quality of life and pharmacoeconomics an introduction. Philadelphia: Lippincott-Raven, 1998, pp 1-46.

[11]     Wilson IB, Cleary PD. Linking clinical variables with health-related quality of life. A conceptual model of patient outcomes. JAMA 1995;273:59-65.

[12]    Ware JE, Kosinski M, Gandek B. SF-36 health survey : manual & interpretation guide. Lincoln, RI: QualityMetric Inc., 2000.

[13]    Loge JH, Kaasa S, Hjermstad MJ, Kvien TK. Translation and performance of the Norwegian SF-36 Health Survey in patients with rheumatoid arthritis. I. Data quality, scaling assumptions, reliability, and construct validity. J Clin Epidemiol 1998;51:1069-76.

[14]    Ware JE, Kosinksi M. SF-36 physical and mental health summary scales: a manual for users of version 1. Lincoln, RI: QualityMetric Inc., 2001.

[15]    Simon GE, Revicki DA, Grothaus L, Vonkorff M. SF-36 summary scores: are physical and mental health truly distinct? Med Care 1998;36:567-72.

[16]    Loge JH, Kaasa S. Short form 36 (SF-36) health survey: normative data from the general Norwegian population. Scand J Soc Med 1998;26:250-8.

[17]    Fabricatore AN, Wadden TA, Sarwer DB, Faith MS. Health-related quality of life and symptoms of depression in extremely obese persons seeking bariatric surgery. Obes Surg 2005;15:304-9.

[18]    Katschnig H. Quality of life in mental disorders: challenges for research and clinical practice. World Psychiatry 2006;5:139-45.

[19]    Bair MJ, Robinson RL, Katon W, Kroenke K. Depression and pain comorbidity: a literature review. Arch Intern Med 2003;163:2433-45.

[20]    Ahroni JH, Montgomery KF, Watkins BM. Laparoscopic adjustable gastric banding: weight loss, co-morbidities, medication usage and quality of life at one year. Obes Surg 2005;15:641-7.

[21]    Wadden TA, Phelan S. Assessment of quality of life in obese individuals. Obes Res 2002;10:50-7.

Table 1. Patient characteristics (n = 51)

| Variables | |
| --- | --- |
| Age, mean (SD) | 37.7 (8.0) |
| Gender, men/women | 23/28 |
| Body mass index (kg/m$^2$), mean (SD) | 51.9 (7.5) |
| Anxiety, n (%) | 7 (13.7) |
| Asthma, n (%) | 11 (21.6) |
| Coronary heart disease, n (%) | 1 (2.0) |
| Depression, n (%) | 12 (23.5) |
| Hypertension, n (%) | 40 (78.4) |
| Hyperlipidemia, n (%) | 26 (51) |
| Diabetes, n (%) | 14 (27.5) |
| Musculoskeletal pain, n (%) | 33 (64.7) |
| Pickwickian/sleep apnea, n (%) | 6 (11.8) |
| Urinary stress incontinence, n (%) | 17 (33.3) |

Table 2. SF-36 summary scores in the study sample compared to the norm population.

| Summary scores | Sample  n=51 Mean (SD) | Norm population [a] Mean | p-value |
|---|---|---|---|
| PCS | 32.3 (10.2) | 53.7 | <0.001 |
| MCS | 37.8 (12.7) | 51.3 | <0.001 |

PCS: physical cumulative summary. MCS: mental cumulative summary.

[a] The norm population mean values were adjusted for age and gender [16].

Table 3. Multiple linear regression analysis with the physical cumulative summary

(PCS) as the dependent variable (n=51)

| Independent variables | Unstandarized coeff. | St. error. | Standarized coeff. | P-value |
|---|---|---|---|---|
| | B | | Beta | |
| Age | -0.13 | 0.15 | -.10 | 0.404 |
| Gender | 1.41 | 2.52 | .07 | 0.579 |
| Body mass index | -0.36 | 0.17 | -.26 | 0.041 |
| Comorbidity-score | 0.47 | 1.32 | .06 | 0.726 |
| Musculoskeletal pain | -10.97 | 2.72 | -.52 | <0.001 |
| Depression | -5.23 | 3.85 | -.22 | 0.181 |

Dichotomous variables: Gender, male = 0 and female = 1; Musculoskeletal pain, not

present = 0 and present = 1; Depression, not diagnosed = 0 and diagnosed = 1.

Adjusted $R^2$ = 32.3%.

Table 4. Multiple linear regression analysis with the mental cumulative summary

(MCS) as the dependent variable (n=51)

| Independent variables | Unstandarized coeff. | St. error. | Standarized coeff. | P-value |
|---|---|---|---|---|
| | B | | Beta | |
| Age | -0.17 | 0.18 | -.11 | 0.354 |
| Gender | -1.76 | 2.94 | -.07 | 0.552 |
| Body mass index | -0.35 | 0.20 | -.20 | 0.088 |
| Comorbidity-score | 4.13 | 1.54 | .40 | 0.010 |
| Musculoskeletal pain | -7.05 | 3.17 | -.27 | 0.031 |
| Depression | -20.89 | 4.49 | -.71 | <0.001 |

Dichotomous variables: Gender, male = 0 and female = 1; Musculoskeletal pain, not

present = 0 and present = 1; Depression, not diagnosed = 0 and diagnosed = 1.

Adjusted $R^2$ = 40.9%.