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ORIGINAL CONTRIBUTIONS

The Influence of Socioeconomic Factors on Quality-of-Life After Laparoscopic Gastric Bypass Surgery

Karin Gryth[1] · Carina Persson[2,3] · Ingmar Näslund[1] · Magnus Sundbom[4] · Erik Näslund[5] · Erik Stenberg[1]

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Abstract

Introduction Patients with low socioeconomic status have been reported to experience poorer outcome after several types of surgery. The influence of socioeconomic factors on health-related quality-of-life (HRQoL) after bariatric surgery is unclear.

Materials and Methods Patients operated with a primary laparoscopic gastric bypass procedure in Sweden between 2007 and 2015 were identified in the Scandinavian Obesity Surgery Register. Patients with a completed assessment of health-related quality-of-life based on the Obesity-related Problem Scale (OP Scale) were included in the study. Socioeconomic status was based on data from Statistics Sweden.

Results A total of 13,723 patients (32% of the 43,096 operated during the same period), with complete OP scores at baseline and two years after surgery, were included in the study. Age, lower preoperative BMI, male gender, higher education, professional status and disposable income as well as not receiving social benefits (not including retirement pension), and not a first- or second-generation immigrant, were associated with a higher postoperative HRQoL. Patients aged 30–60 years, with lower BMI, higher socioeconomic status, women and those born in Sweden by Swedish parents experienced a higher degree of improvement in HRQoL. Postoperative weight-loss was associated with higher HRQoL (unadjusted B 16.3, 95%CI 14.72–17.93, $p < 0.0001$).

Conclusion At 2 years, a strong association between weight loss and improvement in HRQoL was seen, though several factors influenced the degree of improvement. Age, sex, preoperative BMI and socioeconomic status all influence the postoperative HRQoL as well as the improvement in HRQoL after laparoscopic gastric bypass surgery.

Keywords Bariatric surgery · Gastric bypass · Laparoscopy · Quality-of-life · Risk factors

Introduction

Obesity is associated with increased risk for multiple metabolic and cardiovascular sequelae [1, 2], cancer [3] and shorter life expectancy [4]. Bariatric surgery reduces the incidence of these sequelae, new cancer development and the risk for premature death in individuals with BMI > 35 kg/m^2 [5–8].

Living with severe obesity is also associated with several negative psychological consequences, body image concerns, low self-esteem and low health-related quality-of-life (HRQoL) [9, 10]. HRQoL is a multidimensional concept including physical/somatic, psychosocial/mental and social aspects. Different instruments can be used to estimate HRQoL, for example, the Obesity-related Problem Scale (OP Scale), focusing on the psychosocial burden of the disease [11]. HRQoL is known to improve after bariatric surgery, especially in men, younger patients and patients with satisfactory weight loss [12, 13].

Access to bariatric surgery for treatment of severe obesity is not equal based on socioeconomic status [14, 15]. Furthermore, patients with lower socioeconomic status and low level of education have an increased risk for short-term complications after bariatric surgery [16] and poorer outcome after other surgical procedures such as arthroplasty and

✉ Erik Stenberg
erik.stenberg@regionorebrolan.se

1 Department of Surgery, Faculty of Medicine and Health, Örebro University Hospital, SE-701 85 Örebro, Sweden

2 Department of Community Medicine and Public Health, Faculty of Medicine and Health, Örebro University, Örebro, Sweden

3 Department for Sustainable Development, Region Örebro County, Örebro, Sweden

4 Department of Surgical Sciences, Uppsala University, Uppsala, Sweden

5 Division of Surgery, Department of Clinical Sciences, Danderyd Hospital, Karolinska Institutet, Stockholm, Sweden

neurosurgery [17, 18]. Whether socioeconomic status and education level influence HRQoL after bariatric surgery remains unclear.

The aim of the present study was to investigate to what extent socioeconomic status influences HRQoL after laparoscopic gastric bypass surgery in a large nationwide cohort.

Methods

All patients operated with primary laparoscopic gastric bypass surgery in Sweden between June 1, 2007 and July 31, 2015, were identified in the Scandinavian Obesity Surgery Register (SOReg). Missing or incomplete registration of HRQoL estimates, and age < 18 years were exclusion criteria. Baseline characteristics, quality-of-life estimates and follow-up data were based on data from the SOReg. Data on socioeconomic factors (education, profession, disposable income, residence, marital status, social benefits and heritage) were based on data from Statistics Sweden.

Comorbidity at baseline was defined as pharmacological treatment or continuous positive airway pressure treatment (in the case of sleep apnoea) for at least one of six specified obesity-related comorbidities (sleep apnoea, hypertension, type 2 diabetes, dyslipidaemia, dyspepsia/GERD and depression). Socioeconomic factors were subdivided into groups based on the International Standard Classification of Occupations from 1988 (ISCO-88) for profession, the Swedish Association of Local Authorities and Regions' definitions for residence and accepted standards for other variables.

Procedure

The surgical technique for laparoscopic gastric bypass surgery is basically standard throughout Sweden with 99% using the antecolic, antegastric laparoscopic gastric bypass procedure (Lönroth technique) [19], with a Roux limb of approximately 100 cm, and a biliopancreatic limb of 50 cm as standard.

Outcomes

Main outcome measure was improvement in health-related quality-of-life, estimated with the Obesity-related Problem Scale (OP Scale). The OP Scale is a disease-specific scale measuring the impact of obesity on psychosocial functioning, previously validated for patients undergoing bariatric surgery [11]. The scale consists of eight questions, on common obesity-related problems, aggregated into a score from 0 to 100 with lower scores representing better HRQoL [11].

Statistics

Quality-of-life was analysed as mean difference between baseline value and reported estimate at two years, using unadjusted linear regression (only adjusted for baseline OP-score) and adjusted linear regression adjusted for baseline OP-score, excess BMI loss at two years (%EBMIL = (Initial BMI − BMI two years after surgery)/(Initial BMI − 25)), age, sex, presence of sleep apnoea, hypertension, diabetes, dyslipidaemia, dyspepsia/GERD and depression.

Due to the multiplicity of variables analysed, the Bonferroni-Holm method was used to compensate for multiple calculations [20].

Sensitivity analyses of patients excluded were made using logistic regression for categorical variables and linear regression for continuous variables.

$P < 0.05$ was considered to be statistically significant.

IBM SPSS version 25 was used for all statistical analyses.

Ethics

The study was approved by the Stockholm Regional Ethics committee and was conducted in accordance with the ethical standards of the 1964 Helsinki Declaration and its later amendments.

Results

During the inclusion period, 43,096 patients operated with a primary laparoscopic gastric bypass procedure were identified. After exclusion of patients without registered baseline quality-of-life estimates ($n = 11{,}245$), incomplete baseline quality-of-life estimates ($n = 173$), non-registered quality-of-life estimates at two years ($n = 17{,}923$) and incomplete quality-of-life estimates at two years ($n = 32$); 13,723 patients (32%) remained within the study group.

Baseline characteristics of the study group are presented in Table 1. Sensitivity analysis of the excluded patients revealed younger age (40.2 vs. 42.1 years, $p < 0.001$), lower prevalence of hypertension (24.1% vs. 27.2%, $p < 0.001$), higher prevalence of depression (15.1% vs. 13.3%, $p < 0.001$), larger proportion of patients with lower disposable income (< 20th percentile 28.9% vs. 22.8%, 20–50th percentile 32.4% vs. 31.9%, $p < 0.001$), small differences in marital status (married/partner 41.9% vs. 45.1%, reference, divorced/widow/widower 16.1% vs. 15.4%, $p < 0.001$, single 42.0% vs. 39.5%, $p < 0.001$), higher proportion receiving disability pension/early retirement (12.9%, vs. 11.9%, $p < 0.001$) or social benefits (8.8% vs.4.9%, $p < 0.001$) and higher proportion of patients being born outside of Sweden by non-Swedish parents (15.8% vs. 12.5%, $p < 0.001$).

Table 1 Baseline characteristics

	Missing data	
BMI, mean ± SD (kg/m^2)	0 (0.0%)	42.1 ± 5.28
Age, mean ± SD (years)	0 (0.0%)	42.2 ± 11.07
Comorbidity, *n* (%)	0 (0.0%)	6992 (51.0%)
Sleep apnoea, *n* (%)		1404 (10.2%)
Hypertension, *n* (%)		3738 (27.2%)
Diabetes, *n* (%)		1968 (14.3%)
Dyslipidaemia, *n* (%)		1395 (10.2%)
Dyspepsia/GERD, *n* (%)		1233 (9.0%)
Depression, *n* (%)		1826 (13.3%)
Smoking	3930 (28.6%)	
None		6664 (68.0%)
Previous smoking		1928 (19.7%)
Active smoking		1201 (12.3%)
Education	51 (0.4%)	
Primary education < 9 years		2152 (15.7%)
Secondary education		8364 (61.2%)
Higher education < 3 years		1561 (11.4%)
Higher education > 3 years		1595 (11.7%)
Profession	1884 (13.7%)	
Senior officials and management		512 (4.3%)
Professionals and technicians		2926 (24.7%)
Clerical support workers		1297 (11.0%)
Services and sales workers		4469 (37.7%)
Manual labour		1805 (15.2%)
Elementary occupation		830 (7.0%)
Disposable income	141 (1.0%)	
< 20th percentile		3095 (22.8%)
20–50th percentile		4337 (31.9%)
50–80th percentile		4472 (32.9%)
> 80th percentile		1678 (12.4%)
Residence	18 (0.1%)	
Large city and municipality		5011 (36.6%)
Medium-sized town and municipality		4618 (33.7%)
Small town, urban area, rural municipality		4076 (29.7%)
Marital status	13 (0.1%)	
Married/partner		6184 (45.1%)
Divorced/widow/widower		2108 (15.4%)
Single		5418 (39.5%)
Financial aid	0 (0.0%)	
None		11,188 (81.5%)
Retirement pension		232 (1.7%)
Disability pension/early retirement		1635 (11.9%)
Social benefits		668 (4.9%)
Heritage	15 (0.1%)	
Swedish-born, Swedish-descendant		11,319 (82.6%)
Swedish-born, non-Swedish-descendant		674 (4.9%)
Born outside Sweden		1715 (12.5%)

Data on weight loss was available for 13,481 patients at two years after surgery. The average BMI-loss at two years was 13.6 ± 4.3 BMI units, average percentage total weight loss (%TWL) was 32.1 ± 8.6%, percentage excess BMI-loss (%EBMIL) 82.5 ± 24.0%.

Mean OP-score at baseline, 61.6 ± 26.3, had improved to 20.7 ± 24.2 2 years after surgery ($p < 0.001$).

Younger patients and women reported worse OP-scores in the preoperative setting. Higher work status and manual labour, higher disposable income, being married/partner, not receiving social benefits (not including retirement pension) and being born in Sweden by Swedish parents were associated with better preoperative OP-scores (Table 2). At two years after surgery, higher age, lower BMI, male gender, higher education, higher work status (except for manual labour), higher disposable income, being married/partner, not receiving social benefits and being born in Sweden by Swedish parents were associated with better OP-scores (Table 2).

Better improvements in OP-score were seen amongst patients aged 30–60 years, with lower BMI, women, as well as those with higher education, higher work status, residents of small towns, married/partners, not receiving social benefits and born in Sweden by Swedish parents (Table 2).

There was a strong association between weight loss (%EBMIL) at two years and improvement in OP-score (unadjusted B 16.3, 95%CI 14.72–17.93, $p < 0.0001$). After adjustment for year of surgery, age, BMI, comorbid disease and %EBMIL, the following factors strongly influenced the effect of bariatric surgery on disease-specific health-related quality-of-life: level of education; disposable income; marital status; social benefits or not; and heritage. Place of residence and profession had less impact on the results (Table 3).

Discussion

Younger patients with higher BMI, single or divorced, women, first- or second-generation immigrants and patients with lower work status (except for manual labour) and lower income reported poorer preoperative health-related quality-of-life. All groups experienced significant improvement after gastric bypass surgery. However, age, sex, BMI, education and work status as well as income, receiving social benefits, marital status and ethnicity all influenced the degree of improvement.

Health-related quality-of-life prior to surgery increased with age, a finding consistent with previous reports that younger people with morbid obesity estimate their overall health and physical function as being lower than their older counterparts [21, 22]. The higher degree of improvement postoperatively amongst patients aged 30–60 years tended to nullify this difference two years after surgery, whereas patients younger than 30 years experienced less improvement two years after surgery. This difference may be the result of differences in self-image and expectations of bariatric surgery amongst younger patients. Whilst health concerns appear to be a strong motivation for weight loss amongst older patients, younger patients are more often motivated by appearance and social factors [23]. A higher focus on aesthetic appearance and factors not related to health benefits may increase the risk for disappointment with the postoperative result. Intimidation, discrimination and other negative social consequences of obesity frequently occur, and this problem appears to be particularly great amongst younger women [24]. Women with obesity generally report lower self-esteem [25], and the association between gender and HRQoL has been reported previously [26]. In the present study, women experienced greater improvement in their HRQoL after surgery, although they still reported a somewhat lower HRQoL compared with men two years after surgery.

BMI itself is strongly related to improvement in HRQoL [13, 21, 26]. The strong association between preoperative BMI and postoperative HRQoL are well in line with previous studies [10, 13]. Although heavier patients (in particular younger patients) tend to lose more weight after bariatric surgery, they still have difficulties reaching a BMI < 30 [27].

In most societies, the level of education gives a good estimate of socioeconomic status. Before surgery, patients with less than nine-year education reported a slightly lower HRQoL. However, after surgery, patients with higher education improved more than patients with lower education. Although the difference is likely to be multifactorial, one contributing factor may be differences in health literacy (the ability to understand access and use information to make decisions about their health). Although higher education itself does not always lead to high health literacy, a lower level of education is strongly associated with lower health literacy [28, 29].

In general, patients with higher professional status reported better HRQoL before and after surgery. An interesting exception to this is the group "manual labourers", who reported better HRQoL both before and after surgery. Due to the nature of their work, this group is likely to have a higher level of daily physical activity and less often a sedentary lifestyle, both factors influencing HRQoL [30]. Furthermore, a higher income was associated with a higher HRQoL prior to surgery, a difference that became even greater after surgery. Both higher professional status and higher income were thus positive factors for improvement in HRQoL after bariatric surgery. This is well in line with a previous study from ten countries stating that level of education and income are clearly related to self-assessed health [31]. Furthermore, low income may be a barrier to effective postoperative weight loss [32], which in part may contribute to the lower postoperative HRQoL amongst patients with lower income. Patients taking early retirement, disability pension or requirement of social benefits also experience lower HRQoL before and after surgery. In a previous study by Raoof et al., being out of work (due to sick leave,

Table 2 Health-related quality-of-life at baseline and 2 years after surgery

	N	Base-line OP-score	OP-score at 2 years	Mean difference	Unadjusted P^a
Age					
< 30	2015	67.9 ± 24.30	30.0 ± 29.93	37.9 ± 31.38	Reference
30–40	3445	65.2 ± 29.94*	21.7 ± 23.98*	43.5 ± 29.79	< 0.0001*
40–50	4519	60.1 ± 46.48*	18.6 ± 23.07*	41.4 ± 29.88	< 0.0001*
50–60	2984	57.6 ± 26.77*	17.5 ± 22.95*	40.1 ± 29.02	< 0.0001*
> 60	760	52.2 ± 28.25*	16.5 ± 22.34*	35.7 ± 29.61	< 0.0001*
BMI					
< 40	5192	61.8 ± 25.95	17.9 ± 22.95	43.8 ± 29.84	Reference
40–50	7504	61.3 ± 26.60	21.8 ± 24.50*	39.6 ± 29.77	< 0.0001*
50–60	945	61.2 ± 26.07	27.0 ± 26.39*	34.7 ± 30.56	< 0.0001*
> 60	82	64.6 ± 23.87	29.7 ± 25.31*	34.8 ± 28.01	< 0.0001*
Sex					
Female	10,556	65.2 ± 24.95	22.0 ± 24.67	43.2 ± 29.82	Reference
Male	3167	49.3 ± 26.98*	16.4 ± 22.07*	32.9 ± 29.96	0.005*
Education					
Primary education < 9 years	2152	62.9 ± 27.43	25.5 ± 27.43*	37.3 ± 31.91	< 0.0001*
Secondary education	8364	61.3 ± 26.39	20.7 ± 24.02	40.6 ± 29.98	Reference
Higher education < 3 years	1561	61.1 ± 25.65	17.8 ± 21.87*	43.3 ± 27.95	< 0.0001*
Higher education > 3 years	1595	61.2 ± 24.80	16.8 ± 21.02*	44.4 ± 29.05	< 0.0001*
Profession					
Senior officials and management	512	54.2 ± 27.08*	10.8 ± 16.51*	43.4 ± 28.28	< 0.0001*
Professionals and technicians	2926	59.9 ± 25.76*	15.7 ± 20.34*	44.1 ± 27.75	< 0.0001*
Clerical support workers	1297	60.9 ± 25.67*	19.7 ± 23.13*	41.3 ± 28.72	0.013
Services and sales workers	4469	64.9 ± 25.06	22.5 ± 24.69	42.4 ± 30.67	Reference
Manual labour	1805	54.4 ± 27.46*	17.2 ± 21.86*	37.2 ± 29.01	< 0.0001*
Elementary occupation	830	62.4 ± 26.52	23.8 ± 25.82	38.6 ± 31.68	0.039
Disposable income					
< 20th percentile	3095	65.8 ± 26.12	29.6 ± 27.52	36.2 ± 31.66	Reference
20–50th percentile	4337	63.6 ± 25.46*	22.0 ± 24.51*	41.6 ± 30.11	< 0.0001*
50–80th percentile	4472	59.1 ± 26.30*	16.5 ± 21.11*	42.5 ± 29.24	< 0.0001*
> 80th percentile	1678	55.5 ± 26.79*	12.5 ± 18.76*	42.9 ± 27.39	< 0.0001*
Residence					
Large city and municipality	5011	61.1 ± 26.40	21.3 ± 24.69	39.7 ± 30.18	Reference
Medium-sized town and municipality	4618	61.9 ± 26.53	20.7 ± 23.94	41.2 ± 30.12	0.066
Small town, urban area, rural municipality	4076	61.7 ± 25.92	20.0 ± 23.87*	41.7 ± 29.46	0.001*
Marital status					
Married/partner	6184	60.0 ± 26.40	17.4 ± 22.46	42.6 ± 29.60	Reference
Divorced/widow/widower	2108	63.0 ± 26.42*	22.3 ± 25.46*	40.7 ± 30.78	< 0.0001*
Single	5418	62.7 ± 26.06*	23.9 ± 25.11*	38.8 ± 29.91	< 0.0001*
Financial aid					
None	11,188	60.9 ± 26.11	18.7 ± 22.58	42.3 ± 29.30	Reference
Retirement pension	232	50.0 ± 27.54*	15.4 ± 20.74	34.5 ± 28.07	0.705
Disability pension/early retirement	1635	64.1 ± 29.93*	28.7 ± 28.32*	35.4 ± 31.92	< 0.0001*
Social benefits	668	69.6 ± 25.06*	37.6 ± 29.51*	32.0 ± 33.12	< 0.0001*
Heritage					
Swedish-born, Swedish-descendant	11,319	61.0 ± 26.24	19.3 ± 23.23	41.7 ± 29.33	Reference
Swedish-born, non-Swedish-descendant	674	62.7 ± 26.67	24.1 ± 26.49*	38.6 ± 30.57	< 0.0001*
Born outside Sweden	1715	64.6 ± 26.35*	28.7 ± 27.64*	35.9 ± 33.14	< 0.0001*

[a] Adjusted for baseline OP-score

*Significant p value ($p < 0.05$) after correction for multiple calculations

retirement or unemployment) was associated with less improvement in HRQoL after bariatric surgery [13]. Besides the obvious economic stress of not being employed, the loss of social support and social relationships established at work may also contribute to this difference in self-reported quality of life [33]. The social support of partnership/marriage is linked to higher subjective quality of life [34] and may well explain the higher HRQoL reported by patients in a relationship/marriage situation at the time of surgery. Despite challenges to the relationship that many couples experience after bariatric surgery [35], a shared economy may cause less economic stress than that experienced by singles, divorced, widows or widowers who generally have a lower disposable income.

First- and second-generation immigrants had a lower self-reported HRQoL than patients born in Sweden by Swedish parents. Furthermore, this group reported significantly less improvement after surgery. This

Table 3 Standardized coefficients for the improvement in health-related quality-of-life 2 years after surgery

	Adjusted *B* (95%CI)	Adjusted *P*[a]
Education		
Primary education < 9 years	Reference	Reference
Secondary education	4.70 (3.60–5.80)	< 0.0001*
Higher education < 3 years	2.70 (1.50–3.89)	< 0.0001*
Higher education > 3 years	1.85 (1.29–2.44)	< 0.0001*
Profession		
Senior officials and management	2.15 (1.40–2.90)	< 0.0001*
Professionals and technicians	2.20 (1.67–2.73)	< 0.0001*
Clerical support workers	0.86 (− 0.59–2.31)	0.243
Services and sales workers	Reference	Reference
Manual labour	0.83 (− 0.77–2.43)	0.311
Elementary occupation	− 1.21 (− 2.10–− 0.31)	0.008*
Disposable income		
<20th percentile	Reference	Reference
20–50th percentile	5.72 (4.58–6.87)	< 0.0001*
50–80th percentile	4.51 (3.96–5.06)	< 0.0001*
>80th percentile	3.65 (3.14–4.16)	< 0.0001*
Residence		
Large city and municipality	Reference	Reference
Medium-sized town and municipality	1.23 (0.31–2.14)	0.009*
Small town, urban area, rural municipality	1.03 (0.55–1.50)	< 0.0001*
Marital status		
Married/partner	Reference	Reference
Divorced/widow/widower	− 4.64 (− 5.75–− 3.55)	< 0.0001*
Single	− 1.67 (− 2.11–− 1.23)	< 0.0001*
Financial aid		
None	Reference	Reference
Retirement pension	− 5.66 (− 8.53–− 2.79)	< 0.0001*
Disability pension/early retirement	− 5.00 (− 5.59–− 4.40)	< 0.0001*
Social benefits	− 4.55 (− 5.13–− 3.98)	< 0.0001*
Heritage		
Swedish-born, Swedish-descendant	Reference	Reference
Swedish-born, non-Swedish-descendant	− 3.19 (− 4.89–− 1.50)	0.0002*
Born outside Sweden	− 4.14 (− 4.7–− 3.67)	<0 .0001*

[a] Adjusted for operation year, baseline OP-score, age, sex, BMI, sleep apnoea, hypertension, diabetes, dyslipidaemia, dyspepsia/GERD, depression and %EBMIL

*Significant *p* value ($p < 0.05$) after correction for multiple calculations

difference in improvement in HRQoL may well be caused by low social support and low health literacy. Furthermore, preoperative education and postoperative follow-up programmes are usually designed to suit the majority of patients, i.e. the middle-aged, Swedish-born population with easy access to a follow-up clinic. Inability of the system to adapt to the requirements of other patient groups may result in fewer attending important follow-up visits [36].

All socioeconomic subgroups examined in this study reported significantly improved HRQoL. However, groups generally viewed as having lower socioeconomic status consistently reported less improvement in their HRQoL. It is thus obvious that this group together with younger patients, higher BMI and women require better support in the pre- and postoperative periods. Further studies are needed to identify the specific needs of these groups and at a later stage to evaluate the effects of specifically targeted interventions.

Strengths and Limitations

The main strength of this study lies in the high number of patients included, and the very high quality of data provided by the two registers (SOReg and Statistics Sweden). The major weaknesses lie in the high proportion of patients without a self-reported HRQoL and the retrospective nature of the study. Although patients not reporting their HRQoL generally came from the groups with poorer postoperative HRQoL, the sensitivity analysis differences were small implying acceptable generalisability to all patients operated with laparoscopic gastric bypass surgery in Sweden. However, the homogeneity of the study group may limit the reproducibility in other parts of the world. Using the OP Scale to estimate HRQoL, we focused our attention on the effects of gastric bypass surgery on psychosocial aspects of HRQoL. Although this is an aspect often emphasised by patients with severe obesity [11], this itself may be a limitation since greater focus on physical or mental dimensions could have modified the results. Furthermore, the first two years after a bariatric surgical procedure is often referred to as the "honeymoon period" due to the rapid weight loss and peaking in perceived quality-of-life [23]. Although HRQoL tends to decrease to some extent after the first two years, patients generally remain more satisfied with their situation than they were prior to their operation [12, 23].

Conclusion

Two years after bariatric surgery, a strong association between weight loss and improvement in HRQoL was seen, though several factors influenced the degree of improvement. Younger patients with higher preoperative BMI and lower socioeconomic status showed less improvement in self-reported HRQoL after gastric bypass surgery.

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Compliance with Ethical Standards

Conflict of Interest Ingmar Näslund received consultant fees from Baricol Bariatrics AB, Sweden; AstraZeneca AB, Sweden; and Ethicon, Johnson & Johnson A7S, Denmark, for work unrelated to the contents of this study. The other authors declare that they have no conflict of interest.

Ethical Approval The study was conducted in accordance with the ethical standards of the 1964 Helsinki Declaration and its later amendments and with the approval of the regional ethics committee in Uppsala, Sweden.

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