Employment status and sick-leave following obesity surgery: a five-year prospective cohort study

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Abstract

Background. Severe obesity is a risk factor for lower participation in paid work, but whether employment increases and sick leave decreases after obesity surgery is not well documented.

Methods. We assessed 224 Norwegian patients with severe obesity (mean age: 40; mean BMI: 49; 61% female) regarding employment status (working versus not working) and the number of days of sick leave during the preceding 12 months, before and five years after obesity surgery (75% follow-up rate). Logistic regression analysis was used to study preoperative predictors of employment status after surgery.

Results. There were no change in the employment rate over time (54% versus 58%), but the number of days of sick leave per year was significantly reduced, from a mean of 63 to a mean of 26, and from a median of 36 to a median of 4. Most of this change was attributable to patients with zero days of sick leave, which increased from 25% to 41%. Being female, older, having low education level, receiving disability pension and not being employed before obesity surgery were important risk factors for not being employed after obesity surgery. The type of obesity surgery, BMI and marital status were not useful predictors.

Conclusions. Our findings suggest that undergoing obesity surgery is not associated with a higher rate of employment, but may reduce the number of days of sick leave. Additional interventions are likely needed to influence the employment status of individuals who undergo obesity surgery. Providing patients with education and targeted vocational rehabilitation are potentially useful interventions.

Introduction

34

35 Severe obesity, defined as having a body mass index (BMI) ≥ 40.0 or having obesity-related

36 diseases and a BMI ≥ 35, has been associated with lower employment rates, largely because of

37 the detrimental effect of obesity on health (Andersen et al. 2010; Gripeteg et al. 2012; Hawkins

38 et al. 2007; Hernæs et al. 2014; Neovius et al. 2008). Studies have also shown that obese subjects

39 are at increased risk for being discriminated against when applying for jobs, for being passed

40 over for promotion and for being made redundant (Puhl & King 2013). Thus, obesity has

41 economic consequences both on an individual level and for families (Lund et al. 2011; Puhl &

42 King 2013). Consequently, increasing participation in paid work can be an important effect of

43 the treatment of severe obesity. Such treatment can not only improve the well-being of

44 individuals and their families, but also reduce the increasing indirect obesity-related financial

45 costs faced by many societies (Lehnert et al. 2013).

46 Obesity surgery can be successful in terms of weight loss, the resolution of comorbidities and

47 improvements in quality of life (Andersen et al. 2014; Colquitt et al. 2009). One hypothesis is

48 that obesity surgery also leads to higher rates of employment; however, this is not well

49 documented. Several studies (Andersen et al. 2010; Hawke et al. 1990; Hawkins et al. 2007;

50 Martin et al. 1991; Narbro et al. 1999; Turchiano et al. 2014; Wagner et al. 2007), but not all

51 (Crisp et al. 1977; Gripeteg et al. 2012; Velcu et al. 2005), have suggested an overall positive

52 effect of obesity surgery on employment status or sick leave. However, these studies were

53 limited by small sample sizes ($N < 80$) (Andersen et al. 2010; Crisp et al. 1977; Hawkins et al.

54 2007; van Gemert et al. 1999; Velcu et al. 2005; Wagner et al. 2007), follow-up periods < 5

55 years (Andersen et al. 2010; Crisp et al. 1977; Hawke et al. 1990; Hawkins et al. 2007; Martin et

56 al. 1991; Turchiano et al. 2014; van Gemert et al. 1999; Wagner et al. 2007) or by the use of

57 outdated obesity surgery procedures such as ileojejunal bypass, non-adjustable gastric banding

58 and vertical banded gastroplasty (Crisp et al. 1977; Gripeteg et al. 2012; Hawke et al. 1990;

59 Narbro et al. 1999; van Gemert et al. 1999). We also know little regarding preoperative

60 predictors of employment status after obesity surgery. Providing additional information on these

61 issues may be useful for further research on how to assist patients undergoing bariatric surgery to

62 obtain and sustain participation in paid work.

63 In this paper we study employment status and sick leave before and five years after obesity

64 surgery. We also study whether preoperative age, sex, marital status, education level, BMI,

65 receipt of disability pension, employment status and type of obesity surgery predicted

66 employment status five years after obesity surgery.

67 Material & Methods

68 Patients 18 years of age or older who were accepted for bariatric surgery at Førde Central

69 Hospital in Norway between 2001 and 2008 were invited to participate in a prospective cohort

70 study. Data were collected before and five years after surgery. The patients underwent

71 biliopancreatic diversion with duodenal switch (BPD/DS), sleeve gastrectomy (SG), gastric

72 bypass (GBP) or a conversion to BPDS/DS from gastric banding. During the first years of this

73 study, BPD/DS was the primary choice of surgery at the hospital. This later changed to SG, as a

74 part of a two-stage strategy, in which BPD/DS is regarded as a last-resort operation.

75 The study conforms to the principles outlined in of the Declaration of Helsinki and was approved

76 by the Regional Committee for Medical and Health Research Ethics in Western Norway (REK

77 vest, ref. nr. 2013/1747).

Assessments

Employment status and days of sick leave were assessed by self-report questionnaires. The patients were asked whether any of their income came from paid work (coded as yes or no) and to estimate their average percentage position in paid work (0–100%). They also reported the number of days with sick leave in the preceding 12 months. The validity of assessing this information by self-report has been shown to be good in the Norwegian general population (Myrtveit et al. 2013). Income that came from paid work at the time of the question (coded as yes or no) was further validated by correlating this variable with the actual income based on public data from the Norwegian Tax Administration (Spearman rank correlation $= 0.87$, $p < 0.001$) in a random subsample of the patients ($n = 20$).

Body weight was measured in light clothing without shoes, with a precision of 100 grams. Height was measured in a standing position without shoes, with a precision of 1 centimetre. Weight and height were used to calculate the BMI (kg/m^2). We also assessed the patients age, sex, marital status (married/cohabiting or not), education level (primary school, high school or university/college) and whether the patients received any disability pension at the time of the question (coded as yes or no).

Statistics

We performed the statistical analyses using IBM SPSS version 22.0 for Windows and R version 3.1.1 for Windows (R Core Team 2014). All reported p-values are 2-sided, and p-values ≤ 0.05 are considered statistically significant. Continuous variables are reported as means, standard deviations, quartiles and/or 95% confidence intervals, whereas categorical variables are reported as counts and percentages. We used paired t-tests to test changes in continuous variables, and

100 McNemar's test to test changes in binary variables. To explore predictors of unemployment, we

101 fitted logistic regression models with employment status after five years as the dependent

102 variable. Explanatory factors were the preoperative variables age, sex, marital status, education

103 level, BMI, receipt of a disability pension, employment status and type of surgery. Age and BMI

104 were included in the analysis as continuous variables after testing for non-linearity. To detect any

105 problems with multicollinearity in the predictors, we examined the generalised variance-inflation

106 factors.

Results

108 By the five-year follow-up, we had employment data on 224 patients (75% follow-up rate)

109 (Fig. 1, Table 1). The overall rate of employment did not change over time, and was 54% at

110 baseline and 58% at follow-up ($p = 0.34$; Table 2). Most individuals were either unemployed or

111 worked full-time (83% at baseline and 82% at follow-up), and the mean full-time equivalent (i.e.,

112 the proportion of income that came from paid work) did not change over time (0.46 at baseline

113 and 0.49 at follow-up; $p = 0.54$; Table 2). However, there were changes in employment status of

114 the individual patients. Of the 102 patients who were not employed before surgery, 31 (30%) had

115 become employed after five years, and of the 122 patients who were employed before surgery,

116 23 (19%) had lost their employment after five years (Fig. 2).

117 Secondary stratified analyses showed that the employment rate in patients who received (some)

118 disability pension before surgery ($n = 70$) was 17% at baseline and 21% at follow up ($p = 0.55$),

119 while it was 71% at baseline and 74% at follow-up ($p = 0.64$) in patients who did *not* receive any

120 disability pension before surgery ($n = 146$). We also found that the proportion of patients

121   receiving disability pension did not change significantly (32% at baseline and 38% at follow up;

122    $p = 0.16$).

123   Although the overall rate of employment remained unchanged, the number of days of sick leave

124   per year was much reduced (Table 2). For patients who were employed at both time points, there

125   was a reduction from a mean of 56 to a mean of 28 ($p = 0.002$) and from a median of 40 to a

126   median of 5. Note that these estimates could be biased, as one might expect that the patients

127   losing their job from baseline to follow-up (and thus not included in the above calculations) were

128   patients with a large number of days of sick leave. We therefore also report the mean number of

129   days at each time point (for *all* patients employed at each time point). The results are very

130   similar, a reduction from 63 days to 26 days (means) or from 36 to 4 (medians). Most of this

131   change was attributable to patients with zero days of sick leave, which increased from 25%

132   (27/108) at baseline to 41% (46/113) at follow-up.

133   From the multiple logistic regression analysis we found that being female, being older, having a

134   low education level (only primary school), receiving disability pension and/or not participating

135   in paid work before surgery were important risk predictors for not being employed after obesity

136   surgery. Marital status, BMI and type of obesity surgery were not useful as predictors (Table 3a).

137   The predictor estimates did not change substantially when adjusted for other predictors, and the

138   predictors showed good explanatory power (Tjur's $D = 0.45$) (Tjur 2009).

139   One could be concerned that the patients receiving disability pension has a very high risk of

140   remaining unemployed, and therefore should be excluded from any analyses looking at

141   predictors of being employed. As a sensitivity analysis, we therefore repeated the analysis but

142   restricted to the patients not receiving *any* disability pension (Table 3b). The results are very

143   similar to the ones based on complete data.

144   Of the 224 patients analysed above, 119 patients also had BMI data at follow-up. For these

145   patients the mean BMI changed from 49.4 (SD: 8.0; CI: 48.3–50.5) at baseline to 31.3 (SD: 5.5;

146   CI: 30.6–32.0) five years after surgery ($p < 0.001$) (Fig. 3). The change in BMI ranged from −0.5

147   to 40.5. The mean percent BMI loss was 35.8 (SD: 11.6).

148   ## Discussion

149   The rate of employment in this cohort was much lower both before (54%) and five years after

150   obesity surgery (58%) than in the general Norwegian population (83%) with similar age and

151   gender distribution (Andersen et al. 2010). Even though the employment rate did not increase

152   after obesity surgery, the number of days of sick leave decreased significantly.

153   The previous literature on the effect of obesity surgery on employment status and sick leave

154   shows mixed results. However, direct comparisons with our study are difficult, due to clinically

155   and methodological differences (especially in the length of follow-up) and because the social

156   context in other studies may have influenced work availability, access to social benefits and paid

157   sick leave. Regarding long-term studies ($\geq$ 5 years) we have only identified two studies other

158   than ours that have reported participation or indicators of participation in paid work both before

159   and after obesity surgery (Gripeteg et al. 2012; Velcu et al. 2005). The stable employment rate in

160   the present study is comparable to findings of a US study (Velcu et al. 2005) that followed 41

161   patients who underwent GBP for five years, in which the rate of employment exhibited a

162   statistically non-significant improvement from 34% to 44% ($p = 0.13$). Finally, in a Swedish

163   study bariatric surgery was associated with a 17% ($p = 0.01$) reduction in disability pension for

164   up to 19 years in men but not in women (Gripeteg et al. 2012).

165   The reduction in sick leave in the present study was large, and suggests that productivity was

166   increased due to health benefits among those who had a paid job. We have not identified other

167   long-term studies (≥ 5 years) on sick leave after obesity surgery. However, our findings are in

168   agreement with a Swedish study reporting that patients aged 47–60 years who had undergone

169   obesity surgery had 16% ($p < 0.001$) fever sick days than controls 2–3 years postoperatively

170   (Narbro et al. 1999). However, no effect was found for patients younger than 47 years. In our

171   study, the reduction in sick leave was not influenced by age (data not reported).

172   Our finding that preoperative status with respect to employment and disability pension predicted

173   employment status after obesity surgery was as expected. Our study also suggests that being

174   female, being older, having low education level (only primary school) and being unemployed or

175   receiving disability benefits before surgery are important risk factors for not being employed

176   after obesity surgery. Of these risk factors, only low education is modifiable. Thus, providing

177   patients with education and targeted vocational rehabilitation might be a useful intervention.

178   The strengths of the present study are the long follow-up period and an acceptable attrition rate.

179   Furthermore, the surgery procedures represent modern obesity surgery. However, the study also

180   has certain limitations. First, we did not have a control group. Two previous observational

181   studies examined unemployed patients with severe obesity by comparing outcomes in patients

182   who underwent obesity surgery versus those who did not (Turchiano et al. 2014; Wagner et al.

183   2007). Both studies found a significant improvement in employment rates in the surgical groups.

184   However, we believe that this design may induce bias, as it does not include the possible risk that

185   the obesity surgery is associated with a reduction in the rate of employment among those who

186   were employed preoperatively. Thus, we believe that our naturalistic study provides more

187   information on outcomes following obesity surgery, as it included *all* patients, regardless of

188   preoperative employment status. It is possible that the rate of employment would have decreased

189   significantly in a control group that was randomised to not having obesity surgery, especially if

190   the alternative treatment had little effect on the patients' health. To conduct a randomised

191   controlled trial in this field is demanding, both practical and ethically (Sugerman & Kral 2005).

192   Because obesity surgery is currently the only known effective long-term treatment for severe

193   obesity (Kwok et al. 2014), we likely have to rely on well-conducted prospective cohort studies

194   (Wolfe & Belle 2014).

195   One other limitation of our study is that our primary outcomes were based on self-reports, and

196   recall bias may have occurred. However, we believe that the face validity regarding employment

197   status at the time of the question is good, as it is quite easy to know whether one is employed in

198   paid work. We also hypothesised that being employed was associated with higher actual overall

199   incomes, and this was supported by the validation approach described in the method section. On

200   the other hand, we think that the information on the number of days of sick leave per year may

201   have been influenced by recall bias. The recall bias could be systematic, for example in the form

202   of an underestimation of the number of days of sick leave only after surgery. However, we

203   believe that it is likely that the degree of recall bias was identical both before and after surgery.

204   Thus, if the recall bias was unsystematic, our finding would remain valid.

205   Finally, we lacked information of the patient's employment status in the years prior to seeking

206   surgical treatment for their obesity. It is not unlikely that long-term preoperative unemployment

207   is associated with lower chances of getting employed following obesity surgery. Thus, the

208   inclusion of this information would increase the value of future studies.

Conclusions

210   In conclusion, the employment rate remained stable while the number of days of sick leave was

211   reduced after obesity surgery. The reduction in days of sick leave is encouraging, and should be

212   further studied in terms of replication of results and cost-effectiveness. The significant predictors

213   of employment status in this study offer suggestions for future research. Providing patients with

214   education and targeted vocational rehabilitation are potentially useful interventions. The stories

215   of patients who joined or left the workforce after obesity surgery could be studied using

216   qualitative methods. Finally, we recommend looking for novel additional interventions intended

217   to increase the rate of employment in this patient group.

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Figure 1. Study population flow chart

Figure 2: Distribution of BMI before and five years after obesity surgery (density plots with jittered strip chart) (n = 224 at baseline, n = 219 at follow-up).
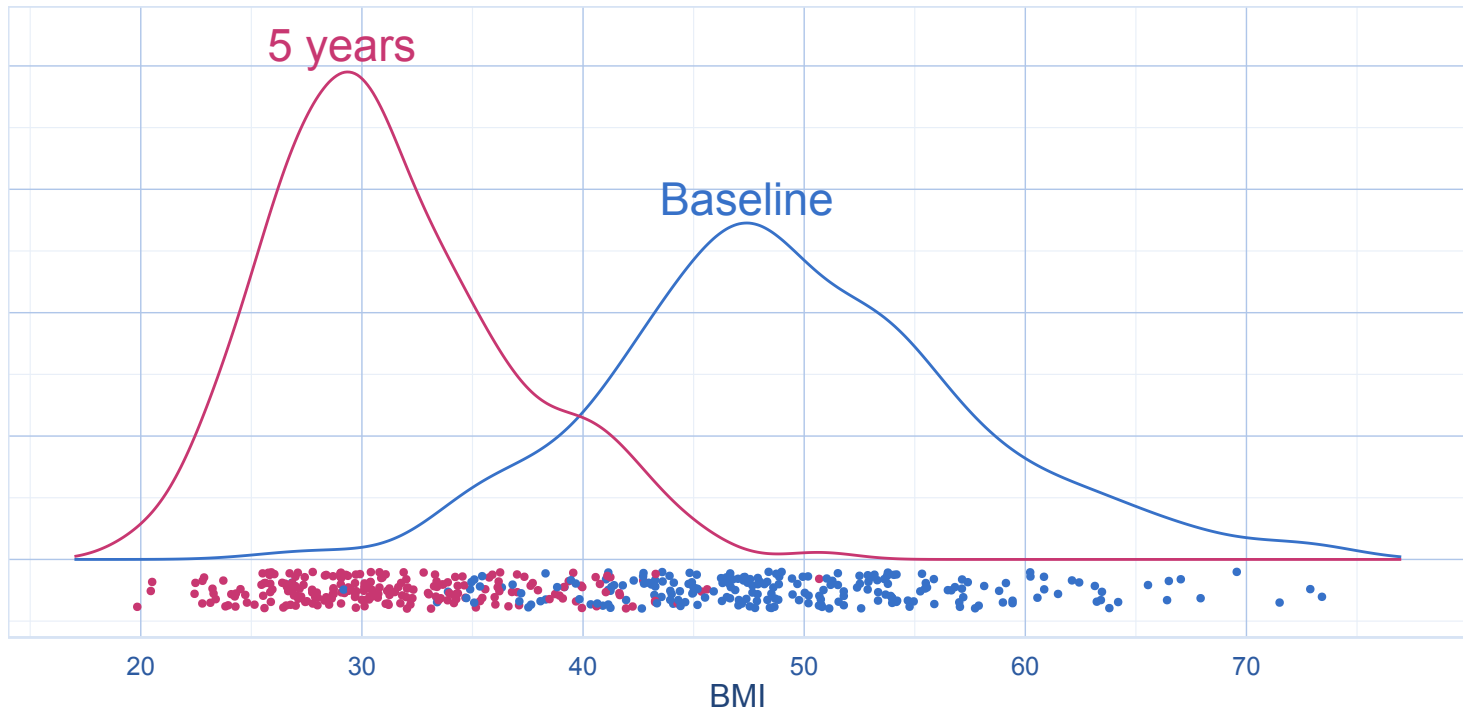
Figure 3: Parallel set plot showing the number and percentage of patients employed before and five years after obesity surgery. The widths of the lines are proportional to the number of patients

122 (54%) 99 **Employed** 99 **130 (58%)**

23 31

102 (46%) 31 23 **94 (42%)**

71 **Unemployed** 71

Baseline **5 years**
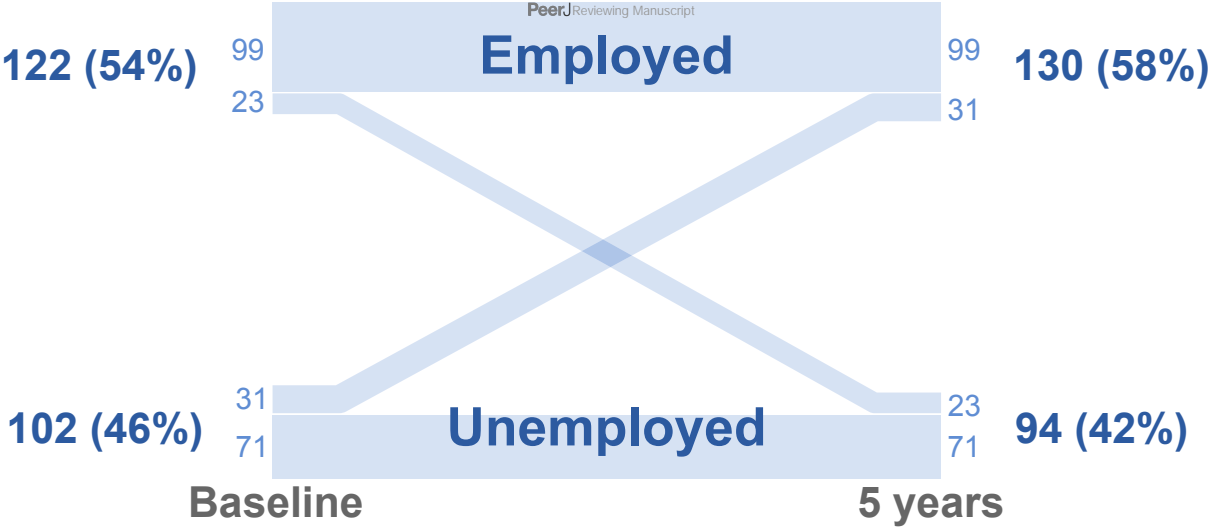
Table 1. Patient characteristics at baseline ($N = 224$)

	Mean/count	SD/(%)
Age	40	9
Sex		
Female	136	(61%)
Male	88	(39%)
Married/cohabitation	130	(58%)
Education ($n = 222$)		
College/university	56	(25%)
High school	107	(48%)
Primary school	59	(27%)
BMI	49	8
Disability pension ($n = 216$)	70	(32%)
Surgery method		
Biliopancreatric diversion with duodenal switch	154	(69%)
Sleeve gastrectomy	51	(23%)
Gastric bypass	5	(2%)
Revisions	14	(6%)

Table 2. Employment status and days per years with sick leave before and five years after obesity surgery (*n*= 224)

* There was missing data on number of days with sick leave for some patients who stated they *were* employed (14 patients at baseline and 17patients at follow-up). One patient reported being employed but having 365 days of sick leave. This was truncated to 260 days, the maximum possible number of working days.

	Before operation			5 years after operation			*P*-value
	Mean/ count	SD/ (%)	Quartiles	Mean/ count	SD/ (%)	Quartiles	
Employed (yes/no), count	122	(54%)	–	130	(58%)	–	0.34
Full-time equivalent, mean*	0.46	0.46		0.49	0.46		0.54
Days with sick leave per year†							
Patients employed at both baseline and follow-up (paired *t*-test, *n* = 75), mean	56	61	2; 40; 86.5	28	46	0; 5; 39	0.002
Patients employed at at least one time point (*n* = 108 at baseline, *n* = 113 at follow-up), mean	63	73	1.5; 36; 108	26	45	0; 4; 35	–

1   * The fraction of full-time employment, e.g. 0 = unemployed, 0.5 = working half time, 1 = working full time.

2   † There was missing data on number of days with sick leave for some patients who stated they *were* employed (14 patients at baseline and

3   17 patients at follow-up). One patient reported being employed but having 365 days of sick leave. This was truncated to 260 days, the

4   maximum possible number of working days.

Table 3 a and b . Logistic regression for the risk of not being employed five years after obesity surgery

1   Table 3a. Logistic regression for the risk of not being employed five years after obesity surgery
2   (*n* = 211).

	Unadjusted model				Adjusted model			
	OR*	95% CI		*P*-value	OR*	95% CI		*P*-value
Age (years)†	1.04	1.01 to	1.07	0.01	1.05	1.01 to	1.10	0.02
Sex				< 0.01				0.003
Female (ref.)	1	– to	–	–	1	– to	–	–
Male	0.34	0.18 to	0.61	< 0.01	0.31	0.13 to	0.68	0.003
Married/cohabitation	0.94	0.54 to	1.64	0.83	0.83	0.38 to	1.79	0.63
Education				< 0.001				< 0.001
University/college (ref.)	1	– to	–	–	1	– to	–	–
High school	1.64	0.79 to	3.55	0.20	1.13	0.45 to	2.90	0.80
Primary school	8.40	3.65 to	20.56	< 0.001	6.98	2.41 to	21.73	< 0.001
BMI (kg/m²)†	1.01	0.97 to	1.04	0.74	1.03	0.98 to	1.08	0.30
Disability pension before surgery	10.56	5.39 to	21.84	< 0.001	4.05	1.68 to	10.07	0.002
Not working before surgery	9.84	5.29 to	18.96	< 0.001	6.40	2.85 to	15.05	< 0.001
Treatment‡				1.00				0.25
Biliopancreatic diversion with duodenal switch	1	– to	–	–	1	– to	–	–
Sleeve gastrectomy	0.98	0.51 to	1.89	0.96	1.59	0.63 to	4.11	0.33
Revisions	0.98	0.31 to	2.97	0.98	0.38	0.06 to	1.94	0.26

4   Table 3b. Logistic regression for the risk of not being employed five years after obesity surgery
5   for patients not receiving any disability pension before surgery (*n* = 144).

	Unadjusted model				Adjusted model			
	OR*	95% CI		*P*-value	OR*	95% CI		*P*-value
Age (years)	1.01	0.97 to	1.06	0.49	1.05	1.00 to	1.10	0.05
Sex				0.11				0.02
Female (ref.)	1	– to	–	–	1	– to	–	–
Male	0.54	0.25 to	1.15	0.11	0.33	0.12 to	0.82	0.02
Married/cohabitation	0.91	0.43 to	1.94	0.81	0.96	0.38 to	2.46	0.94
Education				0.001				0.001
University/college (ref.)	1	– to	–	–	1	– to	–	–
High school	1.20	0.46 to	3.41	0.72	0.90	0.29 to	2.89	0.85
Primary school	5.39	1.88 to	16.84	0.002	5.47	1.66 to	19.92	0.007
BMI (kg/m²)†	1.04	0.99 to	1.09	0.14	1.04	0.97 to	1.10	0.26
Not working before surgery	4.24	1.94 to	9.48	< 0.001	5.01	1.96 to	13.59	< 0.001
Treatment‡				0.70				0.52
Biliopancreatic diversion with duodenal switch	1	– to	–	–	1	– to	–	–
Sleeve gastrectomy	0.87	0.35 to	2.03	0.75	1.35	0.46 to	3.88	0.57
Revisions	0.43	0.02 to	2.70	0.45	0.35	0.01 to	3.30	0.43

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12   * OR > 1 means increased risk for *not being employed* in paid work five years after obesity surgery.
13   † Age and BMI were also included as non-linear terms (second-degree polynomials), with no notable changes in any estimated effects or *p*-
14   values. We therefore only report the estimated linear effect.
15   ‡ It was not possible to reliably estimate the effect of gastric bypass, as only 3 (out of 5) patients had complete follow-up data (all of them were
16   employed at follow-up). The gastric bypass patients are therefore excluded from the models.