Personality as a Predictor of Weight Loss Maintenance after Surgery for Morbid Obesity

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Abstract

LARSEN, JUNILLA K., RINIE GEENEN, CORA MAAS, PIETER DE WIT, TINY VAN ANTWERPEN, NICO BRAND, AND BERT VAN RAMSHORST. Personality as a predictor of weight loss maintenance after surgery for morbid obesity. *Obes Res.* 2004;12:1828–1834.

Objective: Personality characteristics are assumed to underlie health behaviors and, thus, a variety of health outcomes. Our aim was to examine prospectively whether personality traits predict short- and long-term weight loss after laparoscopic adjustable gastric banding.

Research Methods and Procedures: Of patients undergoing laparoscopic adjustable gastric banding, 168 (143 women, 25 men, 18 to 58 years old, mean 37 years, preoperative BMI 45.9 ± 5.6 kg/m^2) completed the Dutch Personality Questionnaire on average 1.5 years before the operation. The relationship between preoperative personality and short- and long-term postoperative weight loss was determined using multilevel regression analysis.

Results: The average weight loss of patients progressively increased to 10 BMI points until 18 months after surgery and stabilized thereafter. A lower baseline BMI, being a man, and a higher educational level were associated with a lower weight loss. None of the personality variables was associated with weight outcome at short-term follow-up. Six of seven personality variables did not predict long-term weight outcome. Egoism was associated with less weight loss in the long-term postoperative period. The effect sizes of the significant predictions were small.

Discussion: None of the personality variables predicted short-term weight outcome, and only one variable showed a small and unexpected association with long-term weight outcome that needs confirmation. This suggests that personality assessment as intake psychological screening is of little use for the prediction of a poor or successful weight outcome after bariatric surgery.

Key words: gastric banding, multilevel modeling, gender, education, weight outcome

Introduction

Obesity is a prevalent health problem in Western societies (1). Surgery is considered the treatment of choice in morbid obesity (2). The outcome of bariatric surgery, although usually favorable in the short term, is variable, and weight regain may occur in the long-term postoperative period (3). Surgical success is dependent not only on the technical adequacy of the surgical procedure but also on the patients' motivation and ability to make enduring changes in health behaviors, such as eating behavior and physical activity.

Modern theories in health psychology emphasize the importance of both individual and environmental factors in predicting health behaviors (4). Personality characteristics are assumed to underlie individual factors, such as personal goals and self-efficacy beliefs, and to affect and be affected by environmental factors, such as social support and reinforcement (5–7). Without explicit consideration of these multiple individual and environmental factors or mediating health behaviors, our study focuses on the possible role of personality as a predictor of weight loss after bariatric surgery.

Although some studies have observed that personality is not a predictor of weight loss after surgery (8,11,12), others have found that a self-defensive attitude, rigidity (13), psychopathic deviancy (14), somatization, hostility (15), and

Received for review June 27, 2003.
Accepted in final form August 23, 2004.
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hypochondriasis (16) predict less weight loss after surgery. We hypothesized that neuroticism, dominance, hostility, and social anxiety predict a poor weight outcome after bariatric surgery. Neuroticism, dominance, and hostility are implicated in ineffective coping strategies (7), poor health habits (6), and a poor outcome in several diseases (9). Social anxiety and hostility are associated with disturbed social relationships, whereas social support and reinforcement are important for maintaining health behaviors (10).

Most studies on personality variables as predictors for surgical success have relied on a short-term follow-up up to 1 year after surgery (8,11,13,14). Just after the operation, nearly all patients lose a great deal of weight, experience improved psychological well-being, and are praised and encouraged, which is important for maintaining health behaviors (17). About 2 years postoperatively, weight stabilizes or even increases (3), and the amount of psychosocial reinforcement decreases (17). We expected that personality traits would be more important in the prediction of weight outcome in this weight stabilization period than in the first period after surgery when favorable weight and psychosocial changes occur.

The purpose of our study was to examine prospectively whether personality traits predict short-term weight loss and, specifically, long-term weight loss maintenance after laparoscopic adjustable gastric banding (LAGB).[1]

Research Methods and Procedures

From November 1995 until May 2001, 232 consecutive patients were subjected to a LAGB procedure in the St. Antonius Hospital in Nieuwegein (The Netherlands) using the Lap-Band system (INAMED Health, Santa Barbara, CA). The Dutch Personality Questionnaire (18) was completed about 1.5 years before the operation as a fixed part of the intake psychological screening. Personality questionnaires were tracked down in files of 185 patients. The questionnaires of four patients were incomplete, and no postoperative weight follow-up was known of 13 patients, leaving 168 evaluable patients (143 women, 25 men), mean age 37.3 ± 8.7 (range 18 to 58) years, mean preoperative weight 131.1 ± 17.4 (range 99.0 to 190.0) kg, mean preoperative BMI 45.9 ± 5.6 (range 36.2 to 69.1) kg/m^2. 9.5% of the patients completed primary education, 38.1% lower secondary education, 42.8% higher secondary education, and 9.6% tertiary education. Age, gender, and preoperative weight showed no differences between the 168 evaluable patients and the remainder of the 232 ($p > 0.10$). All patients underwent surgery after screening by a team consisting of a bariatric surgeon, an internist, a psychologist, and a dietitian. Surgical indications were BMI ≥40 or a BMI between 35 and 40 with serious comorbidity. In cases of obesity-related psychopathology, acceptance of psychological treatment was a condition for acceptance for surgery. The operation was performed according to the techniques described by Belachew and coworkers (19).

The postoperative development in weight was assessed every 3 months for the first 2 postoperative years and every 6 months from 2 years after surgery. There were 1337 weight observations of 168 patients. Long-term postoperative weight at 24 or more months after surgery was known for 138 of the 168 patients. Weight observations from four years after surgery were excluded from the analyses because the sample sizes were too small.

Instruments

The Dutch Personality Questionnaire is a validated personality questionnaire derived from the California Psychological Inventory (20). It consists of seven scales: neuroticism, social anxiety, rigidity, hostility, egoism, dominance, and self-esteem. Norm scores of a general Dutch population were used ($n = 8826$); for the scales rigidity, hostility, and egoism, distinct norms are provided for low vs. high educational level. For the scales neuroticism and dominance, norms are gender-specific (18).

Statistical Analyses

To compare the personality scores of our research group with the general Dutch population norm group ($n = 8826$) (18), mean scores of the appropriate gender or educational level norm group were subtracted from the patients' scores, after which Student's t tests were used to test whether these adjusted scores deviated from the norm.

Multilevel regression modeling, as implemented in the program MLwiN (21), was used to determine the relationship between preoperative personality assessments and postoperative weight outcome. Weight outcome was defined as BMI change (preoperative BMI minus postoperative BMI), with a higher score reflecting more weight loss. BMI change was normally distributed (skewness = 0.42, minimum = −4.69, maximum = 26.67). The term "multilevel" refers to multiple levels of nesting. In our study, there were two levels of nesting. The repeated postoperative measurements of BMI change ($n = 1337$) at the within-subjects level were nested within the patients ($n = 168$) at the between-subject level.

Preceding multilevel regression modeling, the predictor variable year and the demographic and personality variables were centered on their grand mean (i.e., the overall mean was subtracted from the values of a variable). The significance of the effects was determined with the Wald test: Z = estimate/SE of estimate, where Z is referred to the standard normal distribution (22). An α level of 0.05 was used for all statistical tests.

The adequacy of distinguishing the two levels of analyses (between- and within-subject level) was examined in a first

[1] Nonstandard abbreviation: LAGB, laparoscopic adjustable gastric banding.

Table 1. Personality scores of the study population before surgery ($n = 168$) compared with the norm group (means and SD)

	Patients		Norm		t	p
Neuroticism						
Men	12.0	(8.9)	9.7	(7.6)	3.5	0.001
Women	15.8	(9.9)	13.1	(8.3)		
Social anxiety	12.1	(8.6)	10.4	(7.0)	2.6	0.009
Rigidity						
Low education	29.0	(7.5)	29.1	(7.5)	−0.8	NS
High education	24.6	(7.7)	25.4	(7.8)		
Hostility						
Low education	18.7	(7.0)	19.0	(7.0)	0.6	NS
High education	17.0	(8.1)	16.1	(6.8)		
Egoism						
Low education	12.5	(5.0)	13.9	(5.1)	−2.5	0.014
High education	10.2	(4.5)	10.7	(4.9)		
Dominance						
Men	13.2	(6.7)	15.8	(6.1)	1.4	NS
Women	13.8	(6.3)	12.5	(5.7)		
Self-esteem	25.1	(7.2)	27.9	(5.9)	−5.1	0.000

For rigidity, hostility, and egoism, distinct norms are provided for people with low vs. high educational level, and for inadequacy and dominance, gender-specific norms are available. To arrive at a Student's t value that is similar to the t values of the other personality variables, after subtracting the appropriate gender or educational level norm group means from the patients' scores, we examined whether these scores deviated from zero.

step by testing an empty model without any explanatory variables included (Model 1). There has to be enough variance present at both the between- and within-subject level. In a second step, the trend of weight loss across the postoperative years was examined (Model 2), after which the effects of the explanatory demographic and personality variables were tested (Model 3). Finally, interaction effects between personality and postoperative time were tested (Model 4). These interactions reflect whether the amount of weight loss is different in the short- and long-term after surgery for patients with low and high scores at a specific personality characteristic.

In Models 3 and 4, separate multilevel analyses were performed for each personality variable. This was done because covariance among these variables might result in spurious findings. In all tests, p values <0.05 were considered significant, but p values in tests of personality variables were set to the conservative Bonferroni criterion of $p = 0.007$, i.e., the normal α of 0.05 divided by the number of analyzed personality variables. To examine the magnitude of significant results, effect sizes were computed (23): the difference between two means divided by the (pooled) SD. Effect sizes between 0.2 and 0.5 reflect a small effect, between 0.5 and 0.8 a moderate effect, and above 0.8 a large effect (23).

Results

Preoperative Personality Scores

Table 1 shows the mean preoperative personality scores of our research group compared with those of the appropriate norm population. The scores on self-esteem ($t = -5.1$, $p < 0.001$) and egoism ($t = -2.5$, $p < 0.05$) were significantly lower, whereas the scores on neuroticism ($t = 3.5$, $p < 0.01$) and social anxiety ($t = 2.6$, $p < 0.01$) were significantly higher than the norm. No significant differences compared with the Dutch norm scores were observed for rigidity, hostility, and dominance. All deviations were small (effect sizes between 0.2 and 0.5).

Confirmation of the Two-Level Model (Model 1)

The amount of variance at the between- and within-subject level was highly significant (Model 1, Table 2), justifying the specification of a two-level model with patients at a between-subject level and the repeated weight loss measurements at a within-subject level.

Table 2 Fixed and random predictors (SEs) of weight change

	Estimate + (SE)			
Fixed effects	**Model 1†**	**Model 2‡**	**Model 3§**	**Model 4¶**
Intercept	8.106 (0.280)*	10.097 (0.284)*	10.368 (0.294)*	10.380 (0.293)*
Year		1.035 (0.240)*	1.036 (0.240)*	1.054 (0.239)*
Year^2		−2.909 (0.231)*	−2.906 (0.231)*	−2.888 (0.229)*
Period		−0.377 (0.303)	−0.379 (0.303)	−0.410 (0.301)
Period × year^2		2.212 (0.312)*	2.210 (0.312)*	2.185 (0.310)*
Baseline BMI			0.092 (0.046)*	0.087 (0.046)
Gender			−1.728 (0.739)*	−1.698 (0.744)*
Educational level			−0.545 (0.208)*	−0.634 (0.215)*
Egoism				−0.036 (0.057)
Egoism × period				−0.130 (0.034)*
Random effects	Variance			
Between subjects	11.630 (1.431)	11.493 (1.337)	10.399 (1.219)	10.339 (1.212)
Within subjects	10.503 (0.434)	5.339 (0.221)	5.341 (0.221)	5.274 (0.218)
Goodness of fit	7312.242	6509.583	6494.250	6478.404

For all models: 1337 BMI assessments, 168 subjects; all variables were centered with the exception of the nominal variables period and gender.

* $p < 0.05$.

† Model 1, estimation of variance at the between- and within-subject level.

‡ Model 2, prediction of the time course.

§ Model 3, demographic and personality variables were added; only the significant variables were included.

¶ Model 4, personality × period interactions were added to the model to test whether personality was a better predictor of weight change in the period long term after surgery; only the significant interactions were included.

Length of Postoperative Follow-Up Period (Model 2)

To account for a change of trend about 2 years postoperatively when weight loss stabilizes, an independent variable named period was added to the model, with value 0 for the first 2 years after surgery and value 1 for the 3rd and 4th years after surgery. Interaction terms between period on the one hand and year and year^2 on the other hand were calculated, to examine the specific weight loss trends in the short- and long-term periods after surgery. The nonsignificant interaction effect period × year was removed from the model. The interaction effect period × year^2 was significant. This reflected that weight loss more than 2 years after surgery was characterized by a less steep decrease. The fitting of average weight loss trends had caused a 49.2% reduction of the within-subjects variance from 10.503 to 5.339. The accompanying regression equation was the following:

$$BMI\ change = 10.097 + 1.035\ year - 2.909\ year^2 - 0.377\ period + 2.212\ period \times year_2$$

Because the variable year was centered (the mean year value was 1.4609), the value year − 1.4609 must be filled out for year to fit this regression equation to the data. The estimated BMI change values of this equation give an adequate reflection of the progressive weight loss until ~18 months after surgery and the stabilization thereafter (Figure 1).

Demographic and Personality Factors (Model 3)

Baseline BMI, gender, and educational level, but none of the personality variables, were significant predictors of weight loss (Table 2). The reduction in the between-subjects variance was from 11.493 to 10.399 (9.5%) and reflects the amount of explained variance. A higher baseline BMI, being a woman, and a lower educational level were associated with a larger weight loss. Patients with a baseline BMI of ~50 (+1 SD) lost, on average, 1 BMI point more than patients with a starting BMI of ~40 (−1 SD). Women lost, on average, 1.7 BMI points more than men. Patients with only primary education or lower secondary education lost 1.4 BMI points more than patients with higher secondary or tertiary education. In terms of effects sizes, taking the mean ± SD of 4.4 kg/m^2 BMI of the 1337 weight obser-

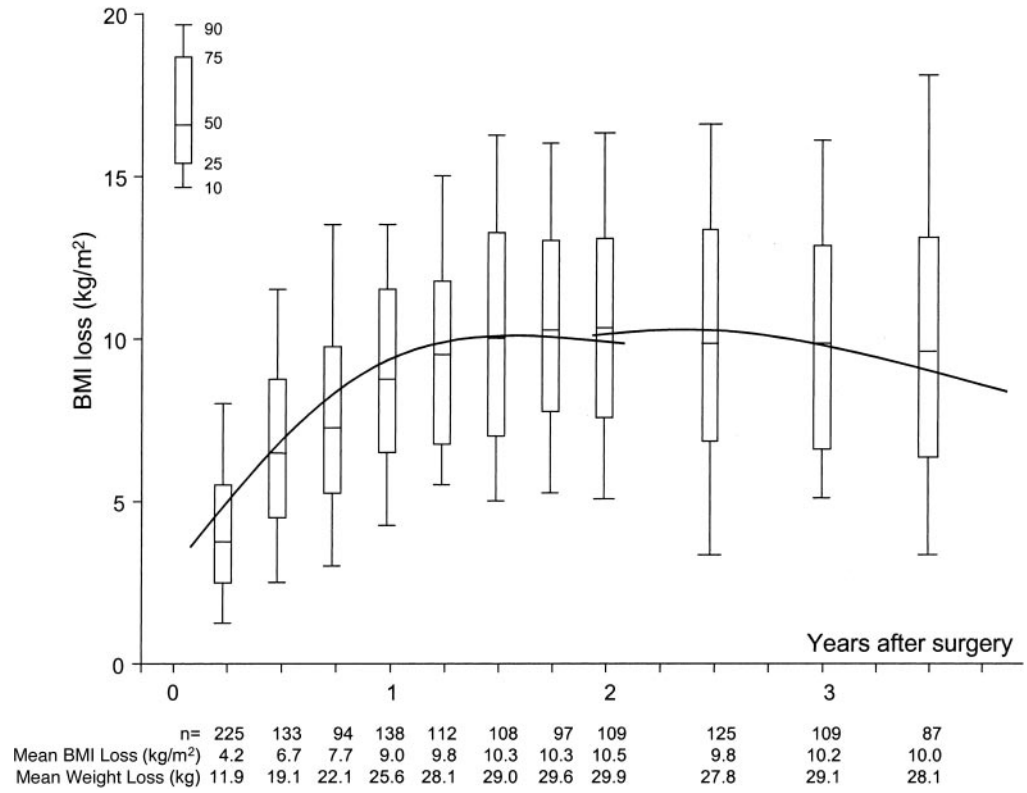

Figure 1: Observed and predicted weight loss (BMI). The box plots show scores at percentiles 10, 25, 50, 75, and 90, respectively. The curves reflect the estimated weight loss according to Model 2.

vations as a criterion, differences in BMI of 1.7, 1.4, and 1 correspond with effect sizes of 0.38, 0.32, and 0.23, respectively. These effects sizes reflect a small difference.

Short- and Long-Term Prediction by Personality (Model 4)

Five of seven personality variables did not show a significant interaction with period (the 1st and 2nd vs. the 3rd and 4th postoperative years). Without Bonferroni correction for multiple tests, dominance (estimate = 0.059, SE = 0.027) showed a significant interaction with period, reflecting that persons with higher preoperative dominance scores tended to lose less weight in the long-term interval. Egoism (estimate = −0.130, SE = 0.034) remained significant after Bonferroni correction (Table 2, Model 4). In the first period after surgery, weight loss was about equal for persons low and high in egoism, but less egoism was associated with a larger weight loss of ~1.6 BMI points in the later period after surgery. The effect size of this difference was 0.36, thus, small. The reduction of between-subjects variance from 10.399 to 10.339 showed that egoism explained a small amount of 0.6% additional variance of the individual differences in weight loss.

Discussion

Although there is little doubt that bariatric surgery is an effective treatment for severe obesity, there is variability in weight outcome that might have to do with personality characteristics. The main finding of our study was that none of the personality variables predicted short-term weight loss, and six of seven personality variables did not predict long-term weight outcome. Before discussing the main results of this article, we reflect on the comparison of personality variables of morbidly obese individuals with the norm.

Although no deviant personality profile has been implicated for obese individuals (16,24,25), lack of self-confidence, neuroticism, and depression (13,26–28) have been reported in obese populations. We found small deviations in the personality variables neuroticism, social anxiety, egoism, and self-esteem, which are mainly suggested to be the result of the obese state, because studies have shown that preoperative depression, anxiety, and low self-esteem virtually disappear after surgical treatment for morbid obesity (28–30). Overall, our data suggest that personality does not meaningfully deviate from the norm.

Our data showed a characteristic pattern of weight loss after surgery. At a group level, patients prospectively lost a significant amount of weight up to 18 months after surgery.

Thereafter, weight stabilized around an average weight loss of 10 BMI points. Thus, in line with previous studies (31,32), our prospective results suggest that LAGB is a long-term solution to morbid obesity with regard to weight outcome.

Being a woman, a higher baseline weight, and a lower educational level were significantly associated with more weight loss in our study. Our gender result is in accordance with previous studies showing that male sex was a significant failure predictor after bariatric surgery (33,34). Our finding that a higher baseline weight is associated with more absolute weight loss is in line with a study showing that the level of BMI reduction after LAGB was higher among superobese patients (BMI $>$ 50), although they had a lower success rate in terms of percentage excess weight loss (33). Our patients with a lower educational level had more weight loss after surgery. Effect analyses showed that the extent to which gender, educational level, and baseline weight predicted weight loss must be considered small.

Our study of personality as a predictor of weight loss differs from other studies in this field by inclusion of a large patient group with both short and long follow-up duration. Studies on personality variables as predictors for short-term surgical success have shown mixed results. Although two studies with small sample sizes observed that personality variables are significant predictors of short-term weight loss (13,14), two other studies with larger sample sizes (8,11) and previous results from our research group (35) showed no relationship between preoperative personality characteristics and short-term weight outcome. Our current study in a large short-term sample confirms that preoperative personality is definitely not a predictor of weight outcome in the short term after surgery.

An incidental study on long-term surgical success found that the preoperative personality variable hypochondriasis, in combination with age, was a significant predictor of weight outcome (16). Preliminary long-term results in a small sample from our research group, examining only the personality traits neuroticism, social anxiety, and hostility, suggested that personality may become important in consolidating weight loss (35). Our hypothesis that especially neuroticism, social anxiety, dominance, and hostility would be important in consolidating weight loss after bariatric surgery was not confirmed by our current analyses in a relatively large long-term sample. Only egoism showed an association with less weight loss in the long-term postoperative period. However, although the finding was significant after Bonferroni correction, the magnitude of the effect was small and the amount of additional explained variance was low. Moreover, the finding was unexpected and, thus, needs confirmation in other studies. The observation that six of seven personality variables did not predict weight loss suggests that personality is not an important predictor of long-term weight outcome.

Our study has some limitations. The population was restricted to patients undergoing LAGB. Because a similar preoperative condition and weight outcome have been reported in studies examining other bariatric surgical procedures (36), we expect similar results in patients undergoing other types of surgery. Our design was restricted to the preoperative measurement of personality characteristics. By definition, personality variables are rather stable characteristics, and even when personality variables interact with life events, such as surgically induced weight loss, the relative position of individuals to each other at a personality variable will not change to a large extent. However, our study did not answer the question of whether possible pre- to postoperative changes in personality predict weight loss and could not confirm a previous finding that an increase in hostility after surgery predicted a poor weight outcome (15). Finally, our study did not examine the predictive value of psychopathology. Personality disorders, major depression, or substance abuse are examples of pathological individual difference variables that are related to but not similar to personality. The predictive value of our study does not generalize beyond normal individual differences in personality characteristics.

In conclusion, men and persons with a higher education lose, on average, less weight. Because effects are small, these findings do not have clinical implications. None of the personality variables predicted short-term weight outcome, and only one variable showed a small and unexpected association with long-term weight outcome that needs confirmation. This suggests that personality assessment as intake psychological screening is of little use for the prediction of a poor or successful weight outcome after bariatric surgery.

Acknowledgment

We thank B. Bliemer for help with data collection. There was no outside support/funding for this study.

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