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Relationship between Cumulative BMI and Symptomatic, Psychosocial, and Medical Outcomes in Patients with Borderline Personality Disorder

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Abstract

We examined the relationship between cumulative body mass index (BMI) and symptomatic, psychosocial, and medical outcomes in patients with borderline personality disorder (BPD). Two hundred female borderline patients were weighed and measured during their index admission. They were subsequently interviewed at six, eight, and 10 years intervals. Over 10 years of prospective follow-up, increases in cumulative BMI were significantly associated with self-mutilation and dissociation (but not suicide attempts). Increases in cumulative BMI were also significantly associated with having no life partner, a poor work or school history, being on disability, being rated with a GAF score in the fair or poor range, and having a low income. In addition, increases in BMI were related to having two or more obesity-related medical conditions and using costly forms of health care. Increases in cumulative BMI may be a marker for adverse symptomatic, functional, and medical outcomes in patients with BPD.

Body mass index (BMI) (kilograms/meters squared) is the anthropometric measure widely used as an indicator of healthy body weight. Because it takes height into account, it is a more informative measure than weight alone. A BMI of 30 or more is commonly used as an indicator of obesity (NIH, 1998).

Previous research has shown links between obesity and adverse social and economic consequences. Puhl and Brownell (2001) documented widespread discrimination against the obese. Gortmaker, Must, Perrin, Sobol, and Dietz (1993) found that women who had been overweight in adolescence completed fewer years of school, were less likely to be married, and had lower household incomes than women who had not been overweight.

The medical consequences of obesity have been well described (NIH, 1998). Studies also document increased health expenditures among the obese beginning in childhood (Trasande, 2009) and progressing through adulthood (Arterburn, Maciejewski, & Tsevat, 2005).

In previous studies, we have examined the prevalence, risk factors, and consequences of obesity in borderline patients (Frankenburg & Zanarini, 2004; Frankenburg & Zanarini, 2006). In these earlier studies, we used cross-sectional data from female subjects meeting criteria for BPD six years after their index admission.

We now report on our subjects six, eight, and 10 years after their index admission and use prospective and cumulative rather than cross-sectional data. Cumulative BMI (cBMI) is a continuous measure that reflects changes, both increase and decreases, in BMI over time.

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The use of cBMI allows us to examine the relationship between BMI in individuals in a way that partially controls for time.

In terms of symptomatic outcome, we chose to examine three key aspects of borderline psychopathology on which we have previously published longitudinal data: self-mutilation, suicide attempts, and severity of dissociation (Zanarini, Frankenburg, Jager-Hyman, Reich, & Fitzmaurice, 2008; Zanarini, Frankenburg, Reich, Fitzmaurice, Weinberg & Gunderson, 2008) and which have not previously been examined with respect to BMI. In terms of functional outcome, we chose to examine five outcomes: having a life partner, work/school history, receiving disability payments, Global Assessment of Functioning (GAF) score, and income.

In terms of medical outcome, we recorded how many of our subjects suffered from two or more weight-related medical conditions and the number of emergency room visits and medical hospitalizations.

We hypothesized that the BPD subjects who were gaining weight, as measured by increasing cBMI, would be less likely than other BPD subjects to be making progress in terms of symptoms and functioning, and to have more medical issues.

Method

Participants

The current study is part of a multifaceted longitudinal study of the course of borderline personality disorder--the McLean Study of Adult Development (MSAD). The methodology of this study has been described in detail elsewhere (Zanarini, Frankenburg, Hennen & Silk, 2003). Briefly, our subjects had initially been inpatients at McLean Hospital in Belmont, Massachusetts. Each patient was screened to determine that he or she: 1) was between the ages of 18-35; 2) had a known or estimated IQ of 71 or higher; 3) had no history or current symptomatology of schizophrenia, schizoaffective disorder, bipolar I disorder, or an organic condition that could cause psychiatric symptoms; and 4) was fluent in English.

Procedures

After the study procedures were explained at baseline, written informed consent was obtained. Each patient then met with a masters-level interviewer blind to the patient's clinical diagnoses. Three semistructured diagnostic interviews were administered: 1) the Structured Clinical Interview for DSM-III-R Axis I Disorders (SCID-I) (Spitzer, Williams, Gibbon, & First, 1992), 2) the Revised Diagnostic Interview for Borderlines (DIB-R) (Zanarini, Gunderson, Frankenburg, & Chauncey, 1989)**,** and 3) the Diagnostic Interview for DSM-III-R Personality Disorders (DIPD-R) (Zanarini, Frankenburg, Chauncey, & Gunderson, 1987). Good-excellent levels of interrater and test-retest reliability were achieved at baseline for both axis I and II disorders (Zanarini & Frankenburg, 2001; Zanarini, Frankenburg, & Vujanovic, 2002).

At each follow-up wave, separated by 24 months, diagnostic information was assessed via interview methods similar to the baseline procedures by staff members blind to baseline diagnoses. After informed consent was obtained, the MSAD diagnostic battery was re-administered, consisting of a change version of the SCID-I, the DIB-R, and the DIPD-R. The follow-up interrater reliability (within one generation of follow-up raters) and follow-up longitudinal reliability (from one generation of raters to the next) of these three measures have also been found to be good-excellent (Zanarini & Frankenburg, 2001; Zanarini, Frankenburg, & Vujanovic, 2002).

At each of the follow-up periods in this sub-study, we also administered the Revised Borderline Follow-up Interview (BFI-R), which assesses psychosocial functioning over the past two years and which has good-excellent levels of interrater and test-retest reliability (Zanarini, Frankenburg, Hennen, Reich, & Silk, 2005). In addition, we administered the Lifetime Self-destructiveness Scale: Follow-up Version (LSDS), which assesses the number of episodes of self-harm and number of suicide attempts in a two-year follow-up period (Zanarini, Frankenburg, Ridolfi, Jager-Hyman, Hennen, & Gunderson, 2006). We also administered the Dissociative Experiences Scale (DES), a 28-item self-report measure (Bernstein & Putnam, 1986).

At the six, eight, and 10-year follow-up, the Medical History and Services Utilization Interview (MHSUI) was administered to all patients. The MHSUI, developed by the authors of this article, assesses the health of the patients, lifestyle issues related to physical health, and health care utilization. Medical diagnoses were recorded only if the patient had been informed by a physician that they had that specific illness. We inquired specifically about disorders generally considered to be related to overweight and obesity: diabetes, hypertension, osteoarthritis, chronic back pain, carpal tunnel syndrome, urinary incontinence, gastroesophageal reflux disorder, gall stones, and asthma (Frankenburg & Zanarini, 2006). We also gathered data about medically related emergency room visits and medical hospitalizations. Medical services related to pregnancy were not included in the estimates of health care utilization. Good-excellent levels of interrater and test-retest reliability were also found for medical variables (Frankenburg & Zanarini, 2004).

BMI was computed for each subject using her measured height and weight from her index admission and her self-reported height and weight at six-year, eight-year, and 10-year follow-up. BMI was calculated by dividing the weight in kilograms by the square of the height in meters. Cumulative BMI (cBMI) was calculated by averaging the values of BMI from baseline to that of each of the relevant follow-up periods. For example, cBMI at year six was calculated by adding baseline and six-year values of BMI and dividing by two (the number of time periods); cBMI at year eight was calculated by adding baseline, six-year, and eight-year values of BMI and dividing by three, etc. Looked at another way, cBMI is a "running average" of BMI and can increase or decrease reflecting changes in BMI over the course of the study. As a one point increase or decrease is so small that it is difficult to grasp clinically, we divided the cBMI by five and thus, our results pertain to each increase (or decrease) of five BMI units over the six years of follow-up (from the end of four-year follow-up to the end of the 10-year follow-up).

Data Analysis

To properly account for the correlation among the three repeated measures of symptomatic, psychosocial, and medical outcomes at years six, eight, and 10, generalized estimating equations (GEE), with cumulative BMI and time as main effects, were used in longitudinal analyses of the prevalence of the adverse symptomatic, functional, and medical outcome data. All outcomes were binary and the analyses modeled the log prevalence of each binary outcome, yielding a relative risk ratio (RRR) and 95% confidence interval (95%CI) for cumulative BMI and time. Estimated effects of time are not reported in the material which follows as it was included in the analysis to adjust for changes in the outcome that were unrelated to changes in BMI and was not the subject of our inquiries. Alpha was set at 0.05, two-tailed.

Results

The subjects in this study were the female subjects who met both DIB-R and DSM-III-R criteria for BPD at baseline. We gathered data from 213 subjects at baseline and six-year

follow-up, 205 at eight-year follow-up, and 200 at 10-year follow-up. At baseline, the mean age of these subjects was 27.1 (SD=5.9), their mean socioeconomic status was 3.3 (SD=1.5) (where 1=highest and 5=lowest), and their mean GAF was 39.4 (SD=7.8) (indicating major impairment in several areas, such as work or school, family relations, judgment, thinking, or mood). In addition, 86.4% (N=184) were white.

Figure 1 shows the percentage of borderline patients at each of the four study periods of interest who were underweight, normal weight, overweight, and obese. As can be seen, being underweight declined from 17% to 4%, while being normal weight declined from 51% to 45%. Being overweight was stable at 17-18%, while being obese increased from 17% to 34%.

Table 1 details our 11 outcomes and their relationship to cBMI over three time periods. With respect to key symptomatic outcomes, there was a significant increase in risk with each five-unit increase of cBMI for self-mutilation (12%) and a DES score of 30 or higher (43%) but not suicide attempts (11%).

With respect to functional outcome, there was a significant increase in risk with each five-unit increase of cBMI for each of the five psychosocial outcomes studied. More specifically, the following increased risks were found: having no partner/spouse (23%), having a poor work or school history (14%), receiving disability benefits (55%), having a GAF score of 60 or less (43%), and having an income of less than $10,000 (27%).

With respect to medical outcome, there was a significant increase in risk with each five-unit increase of cBMI for each of the three outcomes studied. More specifically, the following increased risks were found: having two or more medical conditions related to weight (60%), having an emergency room visit (27%), and having a medical hospitalization (35%).

Discussion

Obesity and overweight are increasingly a topic of concern for patients with severe mental illness (McElroy, 2009). In this study, we prospectively examined change in BMI using a continuous measure, cBMI, and its effects in female subjects with BPD.

Three main findings have emerged from this study. The first finding concerns core psychological symptoms of BPD. In previous reports, we have shown that overall our subjects have become less symptomatic over time (Zanarini, Frankenburg, Reich, & silk, Hudson, & McSweeney, 2007), and this is apparent in the prevalence figures we found. But a different picture emerges when we examined the relationship with BMI. We found that there was a significant relationship between changes in cBMI and subjects reporting self-mutilation and high levels of dissociation (but not suicide attempts).

The significant relationship between change in cBMI and adverse psychological outcomes represents a new finding. It may be that those patients with BPD with more severe and more chronic symptoms are more likely to be gaining weight due to being less active and taking multiple psychiatric medications (Frankenburg & Zanarini, 2006). It may also be that they are more likely to have a family history of obesity in first-degree relatives (Frankenburg & Zanarini, 2006). Whether this family history of obesity represents a biological vulnerability, social learning, or some combination of the two is an open question. A possible confounding factor is the effect of childhood adversity. It is possible that weight gain for some of our subjects is a way of protecting oneself from others (Frankenburg & Zanarini, 2006).

The second finding concerns the relationship between cBMI and functional outcome. In previous reports, we have shown that overall the psychosocial functioning of our subjects

has improved somewhat over time, particularly in those subjects who experienced a symptomatic remission (Zanarini, Frankenburg, Hennen, Reich, & Silk, 2005). We now show the relationship between psychosocial functioning and changes in cBMI. As noted above, there was a significant relationship between increases in cBMI and subjects reporting having no partner. Just under half of our subjects reported having no partner, illustrating the difficulty our subjects have in initiating or maintaining intimate relationships. The chances of forming an intimate relationship were lower with increasing cBMI. This is consistent with findings in the general population, where researchers have found that obese women are less likely to marry than are women of normal weight (Enzi, 1994).

Our subjects with increasing BMI are more at risk of reporting a poor school or work history, receiving disability, receiving a GAF score of 60 or less, and reporting a low income.

The relationship between increasing cBMI and functional outcome as represented by income is well known. Researchers in Finland found that obese women (but not obese men) had significantly lower income than non-obese women (Sarlio-Lähteenkorva, 2004). The relationship is probably complex, bi-directional and self-reinforcing. Our subjects have poor school or work records. This may be caused in part by discrimination against the obese (Puhl & Brownell, 2001). Obesity itself, even among fairly young people, can be associated with medical problems leading to disability (Lakdawalla, 2004). Either of these conditions, doing poorly at work or being on disability, leads to a low income, which in itself can be associated with obesity. One reason for low income leading to obesity may be the easy availability of cheap fast food, which is high in saturated fats and calories and low in satiety value (Pereier et al., 2005).

The third finding is unsurprising. Our subjects who had an increase in their weight over time suffered more medical illnesses. They also had more medical emergency room visits and medical hospitalizations, which represent expensive forms of medical treatment. This finding confirms earlier work (Frankenburg & Zanarini, 2004) and emphasizes the importance of normal weight in maintaining somatic health among the population with borderline personality disorder.

Although a full discussion of the relationship between obesity and affective disorders and stress is beyond the scope of this manuscript, it is important to note that there is a well described but complex connection between mood disorders and obesity, possibly mediated through perturbations of the hypothalamic-pituitary-adrenal axis, which is central to the stress response. Changes in insulin resistance, also a well-known feature of obesity, may activate immune-inflammatory networks involved with both affective symptoms and vascular pathology (McIntyre et al., 2009).

Obesity is of particular importance with respect to women and the risk of developing metabolic syndrome. This syndrome is an ill defined cluster of the following: abdominal obesity, hypertension, insulin resistance, hypertriglyceridemia, low HDL cholesterol, elevated fasting blood glucose, hypercholesterolemia, proinflammatory markers and prothrombotic state. Metabolic syndrome significantly increases the risk of developing diabetes, heart disease, and/or stroke. In young women (but not men) the risk of developing metabolic syndrome doubles coincident with depression (Kinder, Carnethon, Palaniappan, King, & Fortmann, 2004). Women who are treated with atypical antipsychotic medication are at greater risk of developing metabolic syndrome than are men (McEvoy et al., 2005).

Our study has some limitations. First, our data were obtained by self-report. With respect to accurate reporting of weight and height, validation studies have found that overweight subjects may underestimate their weight, while all subjects overestimate their height

(Mokdad et al., 2003). Therefore our results may err on the conservative side when it comes to estimating BMI. However, many studies reporting on BMI in psychiatry use self-reported data (Petry**,** Barry, Pietrzak, & Wagner, 2008).

The second limitation to our study is that we did not use abdominal circumference as a measure of obesity. Excess abdominal adiposity, captured by the waist-to-hip ratio or a measurement of the waist circumference, is in itself a risk factor for metabolic problems (Fox et al., 2007) and depression (Lee, Kim, Beck, Lee, & Oh, 2005). However, in practice, obtaining a valid abdominal circumference can be difficult, and many epidemiological studies continue to rely on the BMI.

The third limitation is that all BPD subjects were inpatients at baseline and people with BPD who have never been hospitalized may differ from these subjects in their BMI, their outcomes, or both.

The fourth limitation is that for some of our subjects who were underweight at their index admission, an increase in cBMI is actually a marker of health. However, obesity is more common in our subjects than is underweight. Therefore our findings are conservative, and if they err, they err by underestimating the seriousness of increasing BMI in female borderline subjects who were not underweight at the beginning of this study.

The fifth limitation is that we are only reporting on our female subjects. This is because BMI is perceived quite differently in males than in females. Indeed for males an increase in weight is actually associated with less depression and suicidality (Mukamal, 2007; Palinkas**,** Wingard, & Barrett-Connor, 1996). Moreover, as noted above, the interlocking relationships between psychiatric illnesses, psychotropic medications, and BMI are different in women than they are in men.

Despite these limitations, our study has important clinical implications. Long-term programs to monitor and treat weight gain in this vulnerable population are needed. Mental health providers are well positioned to identify overweight and obese patients and to identify possible modifiable risk factors, such as polypharmacy, unhealthy eating habits, and lack of exercise (Frankenburg & Zanarini, 2006). For some patients excessive body weight may play a protective role, albeit one that comes at a high cost.

More studies that assess changes in BMI in borderline patients (female and male) are needed. Examination of the roles that psychotropic medications, stress, severity of affective disturbance, and level of physical activity play in the maintenance of body weight will be helpful. The medical consequences and costs of excess weight in BPD will be important to follow. As our subjects move into middle age, we suspect that the contribution of excess weight to medical illnesses will increase.

In conclusion, this is the first prospective long-term study of cBMI in well-described female borderline patients in which the relationship with symptomatic, functional, and medical outcomes was studied. The long-term implications of increasing BMI in this group of patients are serious and include disadvantages in all of these areas. The findings show the utility of measures of the duration of risk exposure for both life-course studies of health and tests of cumulative-disadvantage theory.

In this paper we have highlighted the importance of overweight and obesity in the female BPD population. Future work is needed to develop and implement obesity prevention and treatment strategies to determine if these need to be specific to BPD.

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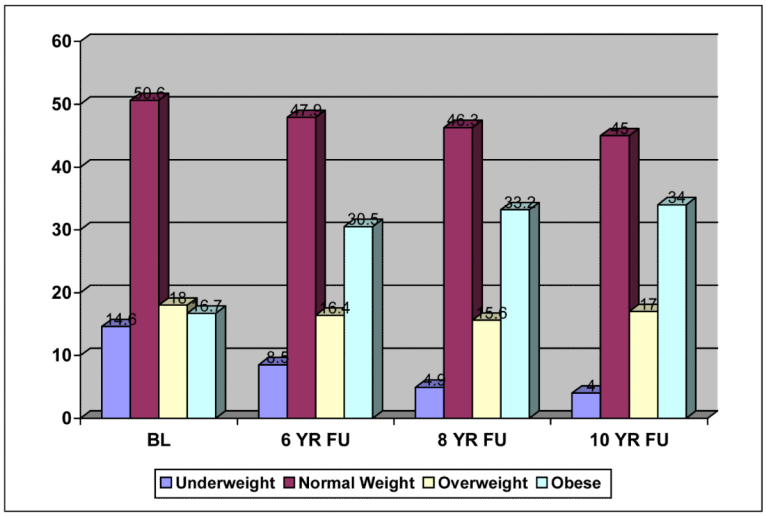

Figure 1.
Weight Classifications Among Female Borderline Patients at Baseline and 6, 8, and 10 Years After Their Index Admission
Underweight = BMI <18.5; Normal weight = 18.5 ≥ BMI ≤ 24.9; Overweight = 25.0 ≥ BMI ≤ 29.9; Obese = ≥ 30

Table 1

Relationship between Cumulative BMI and Symptomatic, Functional, and Medical Outcomes over Time among Women with BPD

	6 YR FU (N=213) %/(n)	8 YR FU (N=205) %/(n)	10 YR FU (N=200) %/(n)	Z-score cBMI	P-value cBMI	RRR cBMI	95%CI cBMI
Symptomatic Outcomes							
Self-mutilation	32.9 (70)	26.3 (54)	21.0 (42)	2.62	0.01	1.12	1.03, 1.23
Suicide Attempts	18.3 (39)	15.1 (31)	14.5 (29)	1.86	0.06	1.11	0.99, 1.24
DES Score of 30 or Higher	10.8 (23)	7.3 (15)	7.5 (15)	5.80	<0.001	1.43	1.26, 1.61
Functional Outcomes							
No Partner	41.8 (89)	43.0 (88)	43.5 (87)	3.10	0.002	1.23	1.08, 1.40
Poor Work/School History	29.6 (63)	30.2 (62)	35.0 (70)	3.30	0.001	1.14	1.05, 1.24
Disability Benefits	13.2 (28)	14.2 (29)	17.0 (34)	5.10	<0.001	1.55	1.30, 1.83
Lower GAF (≤ 60)	67.1 (143)	60.0 (123)	58.5 (117)	4.31	<0.001	1.43	1.22, 1.69
Low Income (<$10,000)	24.9 (53)	21.5 (44)	14.0 (28)	8.68	<0.001	1.27	1.20, 1.34
Medical Outcomes							
Two or More Weight-related Medical Conditions	34.7 (74)	29.8 (61)	33.5 (67)	5.48	<0.001	1.60	1.35, 1.89
ER Visit	24.9 (53)	21.5 (44)	14.0 (28)	8.68	<0.001	1.27	1.20, 1.34
Medical Hospitalization	25.8 (55)	30.7 (63)	23.5 (47)	4.46	<0.001	1.35	1.18, 1.54