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The Impact of Psychological Distress on Weight Regain in Post-Bariatric Patients during the COVID-19 Pandemic: A Latent Profile Analysis

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Introduction

Since the last days of 2019, the entire world has faced the Coronavirus Disease 2019 (COVID-19) pandemic that has caused a global health crisis disrupting healthcare delivery, including care of people with severe obesity who have undergone bariatric surgery for weight loss [1]. Governmental attempts to control the pandemic (e.g., unprecedented large-scale 'lockdowns' and quarantining) are also associated with a wide range of significant life events such as home confinement, forced lifestyle changes and disruptions, loss of employment, debt, social distancing, and isolation [2]. These negative stressors have had an unprecedented impact on people's mental health [3], with a higher prevalence of psychological distress such as anxiety, depression, stress-related disorders, substance abuse, and sleep problems in the general population and people with pre-existing medical conditions [4–8].

Increases in psychological distress associated with the COVID-19 pandemic and mandatory lockdowns additionally negatively affected eating behaviors [9]. Home confinement by itself promotes an obesogenic environment by forcing sedentary lifestyles, enhancing food consumption, and, finally, inducing weight gain [10]. A study carried out during the first Italian lockdown highlighted that nearly 40% of people from the general population reported higher food consumption and more opportunities to eat, while people with obesity ate more unhealthy foods than people with normal BMI [11]. The heightened psychological distress in response to the mandatory stay-at-home order might further trigger the occurrence of dysfunctional eating patterns in at-risk groups [12], ultimately leading to weight gain. Given the well-established link between eating in response to heightened psychological distress or stressful life situations (i.e., emotional eating) in bariatric patients [13], this population might be particularly vulnerable to the adverse effects of the mandatory COVID-19 lockdown. Qualitative studies conducted on bariatric patients' during the initial phase of the pandemic indicated they reported high psychological distress, which, in turn, impacted their weight self-management abilities [14,15]. In particular, some patients reported cooking during the forced home confinement as a trigger for emotional eating, while others reported isolation, fears, and

insecurities over the pandemic to be related to shopping for large amounts and unnecessary foods [15]. For all of these reasons, the purpose of the present study was to examine the role of psychological distress during the COVID-19 pandemic in predicting post-operative weight outcomes in patients that received bariatric surgery for weight loss 12–18 months before the first Italian mandatory COVID-19 lockdown. Data from this study might inform interventions mitigating psychological distress and obesogenic behaviors, during post-COVID times as well as during future pandemics, in vulnerable post-bariatric patients reporting high psychological distress.

Obesity and Post-Bariatric Outcomes

Obesity is one of the most serious public health problems and is associated with high treatment costs for health systems [16]. It is defined as a body mass index of >30 kg/m^2 and is a chronic metabolic disease characterized by an increase of body fat stores [17]. In the last fifty years, obesity has been declared a pandemic by the World Health Organization as it affects 650 million adults worldwide [18]. Obesity rates have tripled between 1975 and 2016 and are estimated to reach 1.1 billion adults by 2030 [19]. Obesity is one of the leading causes of disability and early death [20]. It is universally recognized as a risk factor for many health complications, such as type 2 diabetes, cardiovascular disease, hypertension, sleep apnea, osteoarthritis, and certain forms of cancer [21]. People with obesity are also at an increased risk of experiencing severe illness, complicated clinical courses, poor outcomes from the SARS-CoV-2 infection, worse prognosis, and increased COVID-19 mortality [22].

Bariatric surgery is the most common treatment for patients with severe obesity (i.e., BMI ≥ 40 kg/m^2 or BMI ≥ 35 kg/m^2 who also suffer from obesity-related comorbidities) who did not respond to nutrition and diets, physical activity, and behavioral interventions focused on the adoption of healthy lifestyles [23]. In this context, it proved to be the most effective treatment option for severe obesity [24], even if there is a concerning variability in terms of long-term weight loss outcomes and comorbidities recurrence [24,25]. Research has highlighted that after a “honeymoon” period of 12–18 months post-surgery in which drastic and rapid weight reduction is achieved independently from

eating habits, a stabilization period occurs where post-bariatric patients need cognitive, emotional, and behavioral effort to manage their weight [26]. Many studies indicate that post-bariatric patients are at increased risk for weight regain starting from the end of the "honeymoon" period [26,27] with a recent systematic review highlighting the incidence and prevalence of weight regain increased with time after surgery [28]. Another study underlined that more than three-quarters of patients regained some weight at the 5-year follow-up [29]. In addition to time after surgery, psychological distress in post-bariatric patients has been related to unsuccessful bariatric surgery [28]. The literature indicates that psychological distress and associated life stressors, dysfunctional eating behaviors, physical inactivity, and lower social support are related to weight regain after surgery [25,30].

To our knowledge, no research has examined the role of psychological distress during the COVID-19 lockdown in predicting post-operative outcomes in patients reaching the end of the "honeymoon period" (i.e., the 12–18 months follow-up) during the COVID-19 lockdown. This particular follow-up corresponds to a stabilization period in which the psychological distress induced by the COVID-19 lockdown might trigger poorer weight outcomes in at-risk post-bariatric patients. Furthermore, most of the studies conducted during the COVID-19 pandemic focused on how average psychological distress impacted post-bariatric outcomes [31–33] rather than examining how possible individual differences in psychological distress affected weight outcomes. A person-centered rather than a variable-centered approach [34] that identifies the at-risk group of post-bariatric patients with high psychological distress would, in our opinion, provide more robust conclusions. Hence, this study aimed to identify groups of post-bariatric patients with different profiles of psychological distress. We hypothesized that compared to patients with low psychological distress, patients with high psychological distress will be increasingly at risk of poorer weight outcomes. Targeting post-bariatric patients at risk for weight regain is paramount in order to deliver interventions mitigating the adverse health effects of the COVID-19 pandemic and lockdown on this vulnerable population.

Methods

Participants and Procedures

Patients who underwent bariatric surgery between November 1st, 2018 and March 10th, 2019 at the Surgery of the Alimentary Tract Unit and were followed up at the Division of Endocrinology and Diabetes Prevention and Care, of the IRCCS Azienda Ospedaliero-Universitaria of Bologna in Italy were included in this study. Patients' anthropometric data were gathered from medical records, while weight at the end of the lockdown was collected by phone interviews conducted within four weeks of the end of the mandatory stay-at-home orders (i.e., May 4th, 2020). Patients additionally completed an online questionnaire in which they provided written informed consent and responded to self-report measures assessing psychological distress. The study was approved by the ethical review committees of the University and the Hospital involved. All patients were informed about the study aims and the voluntary nature of their participation.

Measures

Anthropometric Data and Physical Activity During COVID-19 Lockdown

Weight (in kg) before the lockdown was collected through electronic medical records of the last face-to-face follow-up visit, while weight at the end of the lockdown was assessed through phone interviews. Weight changes (ΔWeight) was calculated by subtracting the weight at the last follow-up from the weight at the end of the COVID-19 lockdown. Assuming a variation of at least 5% of body weight as cut-off, weight changes were further categorized into maintained (≥ -5% e ≤ +5%), increased (≥ +5%), and decreased (≤ -5%). Patients' self-reported physical activity during the COVID-19 lockdown was classified as present or absent.

Psychological Distress

The following three outcomes were used to operationalize psychological distress during the COVID-19 lockdown: anxiety symptoms, depressive symptoms, and sleep disturbances.

Anxiety and depressive symptoms. Anxiety and depressive symptoms were evaluated with the Italian validated version [35] of The Hospital Anxiety and Depression Scale (HADS) [36]. The HADS is a widely used self-report measure assessing the presence of anxiety (HADS-Anxiety; HADS-A) and depressive (HADS-Depression; HADS-D) symptoms in the last two weeks in medical

practice [36], including bariatric patients (e.g.,[37]). The scale is composed of two 7-item subscales (i.e., the HADS-A for anxiety and the HADS-D for depression) rated on a 4-point scale (0=*not present* to 3=*considerably*). Both subscales are summed (range 0–21), with higher scores indicating higher anxiety or depression levels. Normative data indicate that a cut-off value of 8 or higher could be used to identify possible clinical anxiety or depressive symptoms [38]. The HADS has good psychometric properties in primary care patients and community settings [38].

Sleep disturbances. Sleep disturbances were assessed with the Italian validated version [39] of the Pittsburgh Sleep Quality Index (PSQI) [40]. The PSQI is the most commonly used questionnaire assessing sleep disturbances over the past month. It is composed of 19 items examining seven sub-components of sleep (i.e., quality, duration, latency, efficacy, disturbances, use of medications, daytime dysfunction) on a 4-point rating scale, ranging from 0=*none* to 3 =≥*3 times per week*. Items are combined to form a score for each of the seven components of sleep, each of which has a range of 0–3. The seven component scores are then summed to yield one global score (range 0–21), with higher scores representing higher sleep disturbances [40]. Normative data indicate a cut-off score of 5 or higher identifies possible clinical sleep disturbances [41].

Data Analysis Approach

Preliminary analyses (i.e., descriptive statistics and correlations among study variables) were conducted in IBM SPSS 24. The overall percentage of missing data was 1%. Little's [42] Missing Completely at Random test on the variables of interest yielded a normed χ^2 (χ^2/df) of 0.9. According to guidelines by Bollen [43], this index, which can be used to correct for sensitivity of the χ^2 for large samples, is low and suggests that data are missing completely at random.

Latent Profile Analyses (LPAs) [44] on observed values of anxiety and depressive symptoms, and sleep quality were carried out in *Mplus* 8.3 with the robust maximum likelihood estimator (MLR) [45]. LPA is a mixed modeling approach designed to probabilistically assign each participant to a profile that shares strong similarities on a set of variables, with the aim of finding the smallest number of profiles or classes that capture most of the variance among participants. A parsimonious number

of classes is identified by evaluating the: (a) Sample Size Adjusted Bayesian Information Criterium (SSA-BIC), with the optimal model represented by the lowest SSA-BIC; (b) entropy, which is an index of classification accuracy to assign a participant to a class, with values >.80 representing clarity of classification [46]; (c) adjusted Lo-Mendell-Rubin Likelihood Ration Test (LMR-LRT), with a non-significant result indicating that adding an extra class does not significantly improve the model; (d) content, interpretability and theoretical meaningfulness of each class in the various solutions, preferring the most parsimonious solution; (e) presence in each class of a meaningful number of cases for interpretation and further analysis. As in all Latent Variable Model (LVM) analyses, there is no pre-determined minimum sample size in LPA. The sample size is contingent on many study circumstances, including the number of indicators in the model, how well the indicators differentiate each class, and how well-separated the classes are. To date, there are no fixed guidelines on the sample size for LCA models, and a sample size as small as 30 has been used in simple LCA models with a pair of well-separated classes [47].

Finally, according to the identified psychological distress profiles, an analysis of variance was conducted in which the psychological distress profiles were set as the independent variable and weight changes from the last follow-up visit till the end of the COVID-19 lockdown as the dependent variable. As the number of family members and the presence of physical activities during the COVID-19 were the only sociodemographic or bariatric surgery or the COVID-19 lockdown variables significantly correlated with changes in weight, we controlled for them in the analyses. We also controlled for currently working and low education as these variables are theoretically important confounding variables. Following the recommendation from Ellis [48], effect size was assessed by using eta squared (η^2), considering an η^2 around .40 as large, .25 as medium, and .10 as small.

Results

Preliminary Analyses

Sample Characteristics. A total of 87 post-bariatric patients satisfied inclusion criteria: of these, four were excluded due to incomplete data at post-surgery follow-ups, twelve because they

did not answer the phone interview, and four because they did not give their consent to participate. The final sample included 67 patients. There were no significant differences in baseline socio-demographics (i.e., gender, age, and pre-surgery weight) between the final sample (n=67) and those that did not participate in the study (n=20). Table 1 depicts the characteristics of the final sample which was composed of 71% female patients, with an age range of 20–69 (M=45.9 years, SD=11.7). The age range in males was 20–67 (M=48.1 years, SD=13.7), while in females was 20–69 (M=45.1 years, SD=10.9). There were no significant differences in age between males and females, $F(1,66)=0.35$, $p=0.35$.

Patients reported an average family size of 2.7 members (SD=1.3). Approximately half of the sample (54%) were married, 16% were living with a partner, while the remainder were single, widowed, or divorced. More than half of the sample (58%) had a high school diploma, 13% had a bachelor's degree, and the remainder completed secondary school. Most patients (70%) were employed, with the most represented jobs being laborers (n=12) and clerks (n=12). Seven patients were unemployed (10%), with one reporting to have been dismissed due to the COVID-19 lockdown. The majority of patients (88%) were of Italian ethnicity and nationality, while eight participants were foreign, of East-European (n=4), Hispanic (n=3), or North African (n=1) ethnicity.

The most performed bariatric surgery technique was Sleeve Gastrectomy (SG) (93%), while 6% and 1% of patients underwent One Anastomosis Gastric Bypass (OAGB) or Roux-en-Y Gastric Bypass (RYGB), respectively. Bariatric surgery procedures promote weight loss and improvement in comorbidities and have traditionally been classified into restrictive or hybrid approaches, which are a combination of restriction and malabsorption [49]. Restrictive approaches, such as SG, limit the amount of food consumed by reducing the size of the stomach, whereas hybrid surgeries, such as OAGB and RYGB, limit the absorption of nutrients by bypassing portions of the intestine in addition to the stomach restriction. Even though hybrid approaches have been shown to induce greater weight loss than restrictive approaches, many variables are involved in the risk-benefit ratio and the choice of a given bariatric procedure (i.e., the complexity and reversibility of the procedure, the patient's

general health, the nature of obesity-associated comorbidity and risk factors related to high perioperative morbidity and mortality) [50]. Bariatric surgery was performed for each patient between 12–18 months before the COVID-19 lockdown, with a mean follow-up time at the end of the lockdown of 15.3 months (*SD*=1.3). Specifically, 46% of the sample underwent surgery between 12–15 months before lockdown and 54% between 16–18 months. All bariatric patients who displayed hypertension as obesity-related comorbidity were essential hypertensives while none of the patients declared current or past SARS-CoV-2 infection.

Descriptive Statistics and Correlations among Study Variables. Descriptive statistics and Pearson's correlations for all study variables are displayed in Table 2. Weight changes from the last follow-up visit until the end of lockdown displayed a significant and moderate positive correlation with depressive symptoms (r=0.41, p<0.001). Weight changes were also negatively associated with the number of family members (r=-0.26, p=0.02).

The average weight changes from the last follow-up visit until the end of the COVID-19 lockdown was 0.1 kg (*SD*=3.8). Most post-bariatric patients (75%) reported weight decrease, while 13% reported stable weight, and 12% increased weight. More than one-third (39%) of patients reported the presence of physical activity during the COVID-19 lockdown. The average scores for anxiety and depressive symptoms were 7.2 (*SD*=4.9) and 5.5 (*SD*=4.1), with 43% and 34% of the post-bariatric patients reporting clinically significant anxiety and depressive symptoms, respectively. The average score for sleep disturbances was 6.7 (*SD*=4.3), with 60% of patients reporting clinically significant disturbed sleep.

Psychological Distress Profiles

We conducted LPAs extracting one, two, and three classes. As reported in Table 3, the fit indices indicated that the two-class solution was the most parsimonious. It was better than the single-classs solution (lower SSA BIC) and, although the SSA BIC was lower in the three-class solution, adding another class was not theoretically meaningful, since the third class was a slight variation of one class of the two-class solution. Furthermore, when a third class was extracted, a

class with a small number of cases appeared (9%), decreasing its interpretability and meaningfulness. Hence, the two-class solution was selected because it displayed satisfactory entropy (0.82), indicating appropriate levels of clarity in the classification associated with it.

The first profile was composed of 50% of the sample reporting low levels of anxiety symptoms (*M*=3.4, *SD*=0.7), depressive symptoms (*M*=2.2, *SD*=0.6), and sleep disturbances (*M*=4.2 *SD*=0.6). It was labeled "low psychological distress profile" as it exhibited psychological distress values that were below the normative clinical cut-offs for probable anxiety and depressive symptoms (i.e., ≥8) and sleep disturbances (i.e., ≥5). The second profile was composed of the remaining 50% of the sample reporting high levels of anxiety symptoms (*M*=10.7, *SD*=0.9), depressive symptoms (*M*=8.5, *SD*=0.7), and sleep disturbances (*M*=8.9, *SD*=0.9). It was labeled "high psychological distress profile" as it displayed psychological distress values above the normative clinical cut-offs. A graphic representation of the two profiles is depicted in Figure 1.

Weight Changes from the Last Follow-up to the End of COVID-19 Lockdown Based on the Psychological Distress Profiles

Analysis of variance was used to assess whether the high psychological distress group of post-bariatric patients displayed higher weight regain during the COVID-19 lockdown compared to the low psychological distressed group. Results indicated a significant difference between the high and low psychological distressed group in weight regain, $F(1,58)=5.2$, $p<0.001$, $\eta^2=0.3$. As displayed in Table 4, post-bariatric patients in the high psychological distressed group regained a mean of 1.4 kg (95% CI = 1.0, 2.6), while patients in the low psychological distressed group lost a mean of 1.1 kg (95% CI = -2.3, 0.2).

Discussion

This study examined the role of psychological distress during the first Italian COVID-19 lockdown in predicting post-operative outcomes in post-bariatric patients reaching the 12–18 months follow-up assessment at the end of the mandatory stay-at-home orders. This particular follow-up corresponds to the end of the "honeymoon" period in which the psychological distress exacerbated

by the COVID-19 lockdown might trigger poorer weight outcomes in at-risk post-bariatric patients. By using a person-centered approach, we identified two groups of post-bariatric patients with high and low psychological distress during the COVID-19 lockdown. Compared to post-bariatric patients with low psychological distress, post-bariatric patients with high psychological distress were more at risk of poorer weight outcomes at the end of the Italian mandatory COVID-19 lockdown. After controlling for the number of family members, the presence of physical activity during the lockdown, currently working, and low education, there were significant differences in the two groups in weight changes from the last follow-up visit to the end of the lockdown. Specifically, results indicated that post-bariatric patients in the high psychological distressed group regained weight while patients in the low psychological distressed group kept losing weight. Findings correspond to a medium effect size.

The results of this study further expand the literature on the detrimental impact of the COVID-19 lockdown and associated psychological distress in at-risk post-bariatric patients. Noteworthy, this study is the first to highlight a significant association between high psychological distress during the COVID-19 lockdown and weight regain in post-bariatric patients reaching the end of the "honeymoon period" during the mandatory stay-at-home orders. Previous studies on post-bariatric patients reaching heterogeneous follow-up assessments during the COVID-19 lockdown revealed an increase in psychological distress and dysfunctional eating behaviors in post-bariatric patients during the COVID-19 restrictions [31,33,51–55] but did not underline a relationship between psychological distress during the stay-at-home orders and weight regain. A longitudinal study comparing patients that reached the post-bariatric 3-year follow-up assessment before the pandemic began (n=66) compared to patients that reached the same follow-up time during the COVID-19 lockdown (n=35), highlighted that the latter experienced higher dysfunctional eating patterns and weight regain [32]. Finally, we found only one research examining post-bariatric patients reaching the same follow-up assessment (i.e., the end of the "honeymoon period") as the one used in our study [33]. It was conducted in Portugal on a group of post-bariatric patients (n=75) and underlined a relationship

between moderate to high psychological distress and increased consumption of junk food [33]. However, a relationship between high psychological distress and increased weight did not emerge as it did in our study, probably as the focus was on average psychological distress and not on group differences.

In our study, the prevalence of clinically significant anxiety symptoms, depressive symptoms, and sleep problems in post-bariatric patients during the COVID-19 lockdown were 43%, 35%, and 60%, respectively. These percentages are greater than those reported in an Italian study on bariatric patients during the lockdown (i.e., 25% and 29% of anxiety and depressive symptoms) [55], but lower than the rates of anxiety and depressive symptoms evinced in an American similar research (i.e., 73% and 84%, respectively) [56]. These differences might be due to sample size and the specific times since bariatric surgery was conducted (i.e., from before the "honeymoon period" and up to 5 years after surgery), which could modulate the impact on psychological distress. In fact, the literature indicates improvement in psychological distress in post-bariatric patients in the first 24 months after surgery [57]. The prevalence of psychological distress in our sample is, however, higher than those reported in studies on the general population – systematic reviews and meta-analyses reported rates of anxiety symptoms, depressive symptoms, and sleep problems to be 32%, 34%, and 36%, respectively [7].

Rather than using a variable-centered approach based on mean scores, this study employed a person-centered approach, which further revealed that half of post-bariatric patients reaching the 12–18 months follow-up during the first COVID-19 lockdown were included in the high psychological distress group, characterized by mean levels of anxiety symptoms, depressive symptoms, and sleep disturbances during the COVID-19 lockdown above the clinical cut-offs. Results of this study indicate that a notable percentage of post-bariatric patients is at risk of weight regain which, ultimately, predisposes to poorer outcomes in case of SARS-CoV-2 infection and, in the long term, might be associated with worsening of obesity comorbidities [22]. For all of these reasons increased

attention should be placed on post-operative monitoring of psychological distress in post-bariatric patients.

Both pre and post-operative management of post-bariatric patients requires a multidisciplinary approach, including nutrition and dietary interventions, physical activity as well as psychological support focused on promoting adherence to treatment and the adoption of healthy lifestyles over the short and longer-term [58]. During post-operative follow-ups, bariatric patients often feel a sense of isolation, abandonment, and ambivalence towards surgery outcomes [59] which could negatively affect the quality of life, psychological distress, and eating habits [10]. Social distancing and the great stress burden generated by the COVID-19 pandemic might enhance those feelings, increasing psychological distress, undermining healthy lifestyle compliance, and fostering weight regain and comorbidities recurrence in at-risk post-bariatric patients [60]. This study underlined the importance of providing psychological support to at-risk post-bariatric patients within the multidisciplinary team [61].

Given the disruption in healthcare monitoring and management of people who have undergone bariatric surgery during the COVID-19 pandemic [1], the targeted group of post-bariatric patients characterized by high psychological distress during the lockdown might especially benefit from tailored structured interdisciplinary care, including stepped-care psychosocial and psychotherapeutic support [61]. In particular, low-threshold evidenced-based interventions targeting self-regulation skills, stress management, meditation, and physical exercises are needed [62,63]. Telemedicine and emerging web-based interventions might be implemented to mitigate the detrimental impact of the COVID-19 pandemic and lockdowns on weight outcomes in this vulnerable population [60].

The results of this study should be interpreted in light of the following limitations. The generalizability of findings is limited due to a small sample size that depended on the number of patients who underwent bariatric surgery 12–18 months before the COVID-19 lockdown in the Italian hospital carrying out the study. With a large sample size, more than two psychological distress profiles may have been detected, while smaller sample sizes generally only detect classes with high

population prevalence and this limits the generalizability of the findings because only the most commonly occurring profiles could be detected in this study. There is also a bias toward female participants that might limit the generalizability of findings in male patients. Furthermore, weight at the end of the lockdown was self-reported by phone and not directly measured, thus possibly undermining the consistency of the data. Nevertheless, some studies indicate bariatric patients self-report their weight reasonably accurately [64]. In addition, patients' self-reported physical activity during the COVID-19 lockdown was classified as present or absent, and this might not account for varying degrees of physical activity; future studies should include a detailed assessment of physical activity, such as intensity and frequency. Anxiety and depression were also assessed referring to the past two weeks, while sleep disturbances were assessed referring to the past month: future studies should include reporting of psychological distress employing the same time frame. Future studies might also consider other variables related to psychological distress during mandatory lockdowns such as loneliness and perceived social support [65]. Future studies with larger samples might also examine which psychological distress dimension (or combinations) predict weight regain in at-risk post-bariatric patients Finally, the design of the study assessed psychological distress at only one-time point; hence, the causal directions among psychological distress and weight regain remain ambiguous. Future studies with larger sample sizes and longitudinal design should examine the impact of psychological distress [66,67] on at-risk post-bariatric patients.

Conclusion

This study highlighted a significant association between psychological distress and weight regain in post-bariatric patients reaching the end of the "honeymoon" period (i.e., the 12–18 months assessment) during the first COVID-19 lockdown. Because of the heightened psychological distress and obesogenic behaviors during the COVID-19 pandemic, findings have clinical implications regarding the need to closely monitor at-risk post-bariatric patients. Evidence from this study suggests vulnerable post-bariatric patients reporting high psychological distress should be given access to

psychological care in order to alleviate psychological distress and, in turn, prevent weight regain, and metabolic comorbidities recurrence in post-COVID times or during future pandemics.

Data availability statement

Data is available upon reasonable request.

Declaration of Competing Interest

The authors have no competing interests to report.

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Table 1

Sample Characteristics.

	M (*SD*)	*%*
Demographics		
Gender (female)		71
Age	45.9 (11.7)	
Family size	2.7 (1.3)	
Marital status:		
Married		54
Living with a partner		16
Single		27
Widow or divorced		3
Education:		
Secondary school		29
High school diploma		58
Bachelor's degree		13
Currently employed		70
Italian nationality		88
Bariatric surgery data		
Bariatric surgery technique:		
Sleeve Gastrectomy		93
One Anastomosis Gastric Bypass		6
Roux-en-Y Gastric Bypass		1
Time since bariatric surgery:		
12–18 months before lockdown		46
12–15 months before lockdown		54

Table 2

Descriptive Data and Correlations among Study Variables (N = 67).

	M (*SD*)	Range	%	1	2	3	4
1. ΔWeight Lockdown (Kg)	0.11 (3.75)	-9.20–7.70		-			
2. Anxiety symptoms	7.19 (4.91)	0–19		0.21	-		
3. Depressive symptoms	5.53 (4.13)	0–15		0.41***	0.69***		
4. Sleep disturbances	6.66 (4.31)	1–19		0.12	0.65***	0.48***	
5. Number of family members	2.76 (1.29)	1–7		-0.26*	0.17	-0.05	-0.05
6. Physical activity during lockdown			39	-0.24	0.80	-0.02	0.12
7. Currently working			28	0.10	0.40	0.15	0.24
8. Low education			70	-0.06	-0.04	-0.03	-0.12

Notes. $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$. ΔWeight Lockdown = Weight changes from the last follow-up visit till the end of the COVID-19 lockdown. Person's correlation is reported for continuous variables and Spearman's correlations for the presence of physical activity during lockdown, currently working, and low education (0=yes, 1=no).

Table 3

Latent Profile Analysis (LPA) of Psychological Distress in Post-Bariatric Patients During the COVID-19 Lockdown.

Solution	SSA BIC	Entropy	Adj. LMR-LRT	Group prevalence %		
				1	2	3
1-Class solution	1014.583	-	-	100		
2-Class solution	959.009	0.823	55.803**	50	50	
3-Class solution	936.761	0.881	24.410	50	41	9

Notes. ***p*<0.01. SSA BIC=Sample Size Adjusted Bayesian Information Criterium; Adj. LMR-LRT=Adjusted Lo-Mendell-Rubin Likelihood Ration Test. Bold indicates the best fitting solution.

Table 4

Weight Changes from the last follow-up visit till the end of the COVID-19 Lockdown in the High and Low Psychological Distressed Groups of Post-Bariatric Patients.

	Δ Weight Lockdown (kg)	
	M (*SE*)	95 % CI
High Psychological Distress	1.43 (0.61)	0.98, 2.56
Low Psychological Distress	-1.06 (0.61)	-2.29, 0.17

Notes. ΔWeight Lockdown = Weight changes from the last follow-up visit till the end of the COVID-19 lockdown. *M*=adjusted mean, *SE*=standard error, 95% CI=bootstrap for mean 95% confidence interval. The number of family members, physical activities during COVID-19 lockdown, currently studying, and currently working were inserted as confounders in the analysis of variance.

Figure 1

Latent Profiles of Psychological Distress in Post-Bariatric Patients During the COVID-19 Lockdown.