

Weight gain and obesity in general adult psychiatric inpatients: a longitudinal and cross-sectional study

Aumento di peso e obesità nella popolazione adulta in ospedali psichiatrici: uno studio longitudinale e trasversale

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SUMMARY. Background. Weight gain and obesity are significantly linked to mental illness. There have been different theories trying to explain weight gain to psychiatric inpatients, such as physical inactivity and lifestyle, the effect of psychotropic drugs, increased food intake triggered by depression, and comorbidity between mental illness and obesity. The current research is a longitudinal and cross-sectional study collecting the electronic records of weight of psychiatric inpatients in a period spanning from one to ten years to address these theories. **Methods.** We collected the electronic records relative to weight measurement that are conducted weekly and relative to 240 non-forensic psychiatric inpatients (124 males and 116 females) and for a period from 1 to 10 years. Mean ages for males was 39.65 years (SD=±11.66) and females 40.88 years (SD=±13.73). They accessed a psychiatric inpatient service in the United Kingdom. The coefficient of determination R² calculated the time variation in bodyweight in the period span, while the Chi-square statistic evaluated the differences in outcomes. **Results.** Our longitudinal study shows that R²=0.17 (95% CI=0.14-0.20) for males and 0.27 (95% CI=0.20-0.34) for females. There was a statistically significant difference between the R² (χ^2 : p<.05) for both genders. The average Body Mass Index (BMI) for male psychiatric inpatients was 27.05 (SD=±5.92), corresponding to WHO Overweight Class. The average BMI for female psychiatric inpatients was instead 31.21 (SD=±7.73), corresponding to WHO Obesity Class I. The difference in BMI was statistically significant for both genders (χ^2 : p<.001). **Discussion.** In our study, only 27% of the difference in body weight in females and 17% in males was explainable by the time variable with a small to moderate effect size. Our findings appear to support the theory that overweight and morbid obesity might be comorbid with psychiatric illnesses and independent from the therapeutic regimen. Overall, females' BMI is more pathological. **Conclusion.** During lengthy admissions, only modest changes in body weight were observed in our research. Our findings would suggest that metabolic syndrome and therefore elevated BMI, overweight, and obesity might be comorbid with psychiatric illnesses and might be independent of the length of admissions.

KEY WORDS: obesity, weight gain, psychiatry, inpatients, Body Mass Index.

RIASSUNTO. Scopi. L'aumento di peso e l'obesità sono significativamente legati alle malattie mentali. Ci sono state diverse teorie che cercano di spiegare l'aumento di peso nei pazienti psichiatrici come l'inattività fisica e lo stile di vita, l'effetto dei farmaci psicotropi, l'aumento dell'assunzione di cibo innescato dalla depressione e la comorbidità tra malattia mentale e obesità. La ricerca in corso è uno studio longitudinale e trasversale che raccoglie le registrazioni elettroniche del peso dei pazienti psichiatrici in un periodo che si estende da uno a dieci anni. **Metodi.** Abbiamo raccolto le registrazioni elettroniche relative alla misurazione del peso che vengono condotte settimanalmente e relative a 240 pazienti ricoverati psichiatrici non forensici (124 maschi e 116 femmine) e per un periodo da 1 a 10 anni. L'età media dei maschi era di 39,65 anni (DS=±11,66) e delle femmine di 40,88 anni (DS=±13,73). Tali pazienti hanno avuto accesso a un servizio di degenza psichiatrica nel Regno Unito. Il coefficiente di determinazione R² ha calcolato la variazione nel tempo del peso corporeo nell'intervallo di tempo, mentre la statistica del test Chi-quadrato ha valutato le differenze nei risultati. **Risultati.** Il nostro studio longitudinale mostra che R²=0,17 (95% CI=0,14-0,20) per i maschi e 0,27 (95% CI=0,20-0,34) per le femmine. Non vi era alcuna differenza statisticamente significativa tra R² (χ^2 : p<0,05) in entrambi i sessi. L'indice di massa corporea medio (IMC) per i pazienti psichiatrici maschi era di 27,05 (SD=±5,92), corrispondente alla classe di sovrappeso dell'OMS. L'IMC medio per i pazienti psichiatrici femminili era invece di 31,21 (SD=±7,73), corrispondente alla classe di obesità dell'OMS I. La differenza di IMC è stata statisticamente significativa per entrambi i sessi (χ^2 : p<0,001). **Discussione.** Nel nostro studio, solo il 27% della differenza nel peso corporeo nelle femmine e il 17% nei maschi era spiegabile dalla variabile di tempo con una minima dimensione effetto. Pertanto i risultati della ricerca sembrano confermare la teoria che l'obesità sovrappeso e morbosa potrebbe essere comorbile con malattie psichiatriche e indipendenti dal regime terapeutico o dallo stile di vita. In generale, l'IMS nelle pazienti femmine è quello più patologico. **Conclusione.** Durante lunghe ammissioni, nella nostra ricerca sono stati osservati solo modesti cambiamenti sostanziali nel peso corporeo. I nostri risultati suggerirebbero che la sindrome metabolica e quindi l'IMC elevato, il sovrappeso e l'obesità sono in comorbidità con malattie psichiatriche e sono indipendenti dalla durata delle ammissioni.

PAROLE CHIAVE: obesità, aumento di peso, psichiatria, pazienti ricoverati, indice di massa corporeo.

INTRODUCTION

Obesity is associated significantly with mental health illnesses¹. In psychiatric-hospital patients, the rate of overweight and obesity hits 66%, with the tendency for female patients to raise their weight during their admissions instead of males who normally enter a stable state^{2,3}. In the population detained inside mental health protected units, obesity and overweight (with rates of up to 80 percent reported) are more common than in the general population (about 60 percent), and patients tend to be at risk of weight gain while detained⁴. The UK National Obesity Observatory suggests a bidirectional aspect of the problem, where obesity can cause psychiatric illnesses or where mental health illnesses can cause obesity⁵. Theories that link obesity to mental illnesses can be summarized into four major clusters. The first hypothesis suggests that psychiatric patients' physical inactivity and lifestyle explain their elevated BMI (Body Mass Index)^{6,7}. The second theory hypothesizes that psychotropic drugs are accountable for weight gain, especially SSRI (Serotonin System Reuptake Inhibitor) antidepressants, and antipsychotics^{8,9}. Some authors suggest a mixture of these aspects, where patients decrease physical activity, and via psychotropic medicines and augmented appetite, gain more weight due to some preference for carbohydrates¹⁰. The third hypothesis suggests that some form of diet is accountable for psychological disorders, which may lead to depression, in particular, elevated intake of fast food and baked goods¹¹. Studies in mice show a neuroinflammatory effect of a high-fat diet¹². The fourth theory postulates that pathological weights are comorbid, particularly in female patients, with psychiatric diseases^{13,14}. The prevalence of women with the diagnosis of borderline personality disorder in the general adult inpatient population¹⁵, and the correlation between borderline personality disorder and obesity¹⁶, can partly elucidate why morbid weight is mostly discovered in the female psychiatric population with borderline personality disorder¹⁷. Besides, a general association has been discovered between psychiatric illnesses, metabolic syndrome, and overweight¹⁸. Research shows that augmented BMI is related to reduced brain size with axonal/myelin irregularities in the white matter, with a decrease in the grey matter and consequent damage to neurons¹⁹. Preliminary experiments in mice indicate that high-fat diets change the mice's intestinal microbiome while interfering with their neuro-biology, including elevated anxiety, erratic behavior, and diminished memory¹². One proposal to overcome these effects is to use non-steroidal anti-inflammatory drugs and omega-3 fatty acids to stimulate the development of beneficial intestinal bacteria in patients at risk of high BMI and psychiatric disorders²⁰, thus having beneficial effects on mental health²¹. Research that has examined the impact of obesity on the brain proposes that increased body weight is linked to a reduced brain size of the hippocampus, parietal, and frontal lobes²². Compared to a healthy population, persons with obesity show reduced volumes of the grey substance (frontal, temporal gyri, thalamus, and hippocampus) and white substance (internal capsule and optic radiation)²³.

Research involving 896 patients showed that obesity was associated with reduced cognitive functioning relative to non-obese patients, while patients with obesity and schizophrenia had poorer scores²⁴. One systematic review

found that the most affected cognitive abilities in obesity are psychomotor performance, speed, and time underestimation²⁵. Another study supports the co-occurrence of causes that increase body weight in psychiatric hospital patients, such as extended sleep hours, alcohol, incorrect diets, antipsychotics; however, a link between weight change and admission period was not identified in the same research²⁶. While diet instruction, sports syllabi, health awareness groups, open gym, hikes, and outdoor cycling are the most embraced interventions to counteract weight gain in psychiatric hospital patients, one study found that these initiatives were only relatively successful in 55 percent and unsuccessful in 25 percent of cases²⁷.

Previous findings by the current study investigators indicate a prevalence of women with borderline personality disorder in adult psychiatric hospital patients, proposing that this demographic group could be the one with the largest number of extreme overweight and obesity findings^{15,17}. The theory indicating that regulating impulsive feeding problems could be responsible for obesity in psychiatric hospitals appears to be verified in one study²⁸. Concerning age, one study found no association between weight gain and age in patients who showed an association of hypertension and diabetes with psychotropic medication²⁹. It is understood that psychotropic medications raise the weight, although certain drugs are also responsible for an increased incidence of type 2 diabetes and hypertension, such as olanzapine²⁹. Second-generation antipsychotics (SGAs), particularly olanzapine and clozapine, have been linked with adverse metabolic syndrome and, most importantly, type 2 diabetes³⁰. However, one theory indicates that glucose metabolism dysfunction and clozapine and olanzapine hyperinsulinemia are both associated with augmented antipsychotic action; thus, it is speculated that the therapeutic and metabolic actions of clozapine and olanzapine may be compatible while functioning on insulin brain receptors³¹. Obesity itself is correlated, from a wider viewpoint, with a higher incidence of hospitalizations in studies documenting prevalence in various countries and a comparable prevalence in general medical wards and psychiatric wards, with a mean BMI of 25.4 kg/m² for males and females³². Patients at higher risk are female psychiatric patients with bipolar disorder or unipolar depression^{33,34}.

However, the same incidence of obesity impacting the same catchment area population may be present in psychiatric inpatients. A National Health Service study in the UK shows that 58% of women and 68% of men were overweight or obese in 2015, while two out of three admissions had a primary diagnosis of obesity and 74% were female³⁵. Our new study reveals a prevalence of admissions of females of white ethnic origin with borderline personality disorder in general adult psychiatric wards¹⁷. The prevalence of extreme obesity in these patients also is high³⁶. In 26.9% of the obese population, a US report found a prevalence of borderline personality disorder that ties personality disorder to compulsive eating¹⁶. Research shows that child abuse in women is linked later in life with obesity³⁷. Studies also correlate depression with obesity. For example, obese teenagers have a greater prevalence of neurological and psychological disorders than teenagers with a stable BMI, including bad academic records, decreased self-esteem, depression, and higher suicide risk³⁸. In general, major depressive disorder is associated with a greater risk of obesity and is likely to be associated with ele-

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vated appetite and sleep³⁹. The relation between obesity and chronic depression has been linked to reduced hippocampus volume⁴⁰. Metabolism and weight problems arise separately from psychotropic treatment in subjects with psychosis⁴¹.

In comparison, depression and obesity can already be conducive to brain modifications in the early stages of psychosis⁴². The theory is that high BMI in schizophrenia induces alterations of the cerebral white matter by disrupting neurotransmission in the cortico-limbic networks that play a key role in schizophrenia for neurocognition, impulses, and mental wellbeing⁴³. A connection between obesity and bipolar disorder sharing the same causes, along with the obesogenic activity of mood stabilizers, has also been identified in research⁴⁴. Another research showed that increased BMI in adolescents with bipolar disorder is related to the volume of the frontal cortical lobes⁴⁵. The overall study indicates that obesity is linked with schizoaffective disorder, marked by a history of major depressive disorder and suicidal attempts⁴⁶.

OBJECTIVES

There are no general and longitudinal studies to show if weight gain is already present when patients access psychiatric services or if, instead, it could be attributed to the theories mentioned above, mainly the effect of psychotropic medication, altered diet, and reduced physical activity. In the United Kingdom, data relative to psychiatric patients, including body weight, are commonly recorded on an electronic database. Consequently, longitudinal data collection using electronic support can improve research outcomes⁴⁷. Electronic medical records (EMR) offer a chance for useful and extensive scientific research in psychiatry⁴⁸. The research hypothesis is to verify if weight gain is linked to the time factor. The research objective was to collect longitudinal data of the non-forensic psychiatric population for a period spanning between one to ten years, corresponding to the creation of electronic data in participating clinical centers.

POPULATION AND METHODS

This current one is a longitudinal and cross-sectional study relative to a period spanning from one to ten years. The sample consisted of 240 non-forensic psychiatric inpatients (124 males and 116 females) from the general adult population with the mean age for males of 39.65 years (SD =±11.66) and females of 40.88 years (SD=±13.73), accessing several psychiatric services in the United Kingdom. Nurses routinely and electronically store data relative to body weight during weekly measurements, relative to each patient. A researcher collected these data on a spreadsheet and relative to a period covering 1 to 10 years for the sample observed. The cross-sectional study averaged the global bodyweights for all patients. The coefficient of determination R² calculated the time variation in bodyweight in the period span, while the Chi-square statistics evaluated the differences in outcomes. R² measures the proportion of variation of the dependent variable (weight gain) justified by the variation of the independent variable or predictor (time)⁴⁹. In our case, R² also has a predictive meaning as it allows for the extrapolation of the correlation curve and makes some estimates on probable future behaviors of the dependent variable (weight). In the current research, patients' weight readings were

collated into a spreadsheet, which automatically converted subsequent readings into R² values. The BMI was calculated by applying the national standards for the height of the male (175.3 cm) and female (161.6 cm) residents in the United Kingdom⁵⁰. Exclusion criteria were patients presenting with less than three weight observations. The software Meta-Excel by EpiGear calculated the statistical significance of χ^2 for the differences between genders given the outcome values and their 95% Confidence Intervals (95% CI)⁵¹. Daniel Soper (2021) online calculator computed the effect sizes (ES) f^2 for R² (www.danielsoper.com). We used the UK National Health Service BMI Calculator for computing the body weights and BMI⁵². BMI is classified according to World Health Organization (WHO) international classification, in 'underweight' BMI less than 18.5, 'healthy weight' BMI between 18.5 and 24.9, 'overweight' BMI between 25 and 29.9, 'obesity class I' BMI between 30 and 34.9, 'obesity class II' BMI between 35 and 39.9, and 'obesity class III' BMI from 40 and over^{53,54}. BMI scores were also condensed in a box-plot. The current research was conducted according to the conventions of the Declaration of Helsinki principles of 1975, as revised in 2008. Data were stored in encrypted files accessible only to the clinicians involved in the research. The anonymity of patients was maintained at all stages of the research.

RESULTS

Global results are shown in Table 1. Our longitudinal study shows that R²=0.17 (95% CI=0.14-0.20) for males and 0.27 (95% CI=0.20-0.34) for females. There was a statistically significant difference between the R² (χ^2 : p<0.05) between both genders (Table 1). The average BMI for male psychiatric inpatients was 27.05 (SD=±5.92), corresponding to WHO Overweight Class. The average BMI for female psychiatric inpatients was instead 31.21 (SD=±7.73), corresponding to WHO Obesity Class I. The difference in BMI was statistically significant for both genders (χ^2 : p<0.001). BMI evenly distributed in all classes for females while concentrating on overweight for males (Table 1, Figure 1). Overall, the female psychiatric population's BMI tends to be higher than the BMI in the male psychiatric population and more dispersed within all BMI categories. When body weights were compared, 44% of males were in the normal weight limits compared to 22% of females who, instead, were obese in 30% of cases and 20% of cases in Obesity Class II. Weight differences between males and females were statistically significant (χ^2 =22.44; p<0.05). Statistically significant differences in WHO bodyweight categories were for Normal Weight, with prevalence of males (44% vs. 22%; p<0.01), and Obesity Class II, with the prevalence of females (20% vs. 5%; p=0.015). BMI in females was more dispersed compared to males (Figure 1). ES f^2 was 0.20 for males and 0.36 for females.

DISCUSSION

In hospitalized psychiatric patients of our study, overweight in males and obesity in females were found. Also, incremental weight gain is more important during admissions in female patients than in male patients, while individual differences were greater in male patients than in female patients. In our study, however, only 27 percent of the difference in body weight in females and 17 percent in

Table 1. Outcomes of the research.

Type of study	Outcome	Subcategories	Males (N=124)	95%CI	Females (N= 16)	95%CI	Significance p of χ^2
Longitudinal:	R2		0.17	0.14-0.20	0.27	0.20-0.34	<.05
Cross-sectional:	BMI		27.1 (\pm 5.92)	26.05-28.14	31.9 (\pm 7.73)	30.49-33.30	<.001
	Body weight	Normal weight	55 (44%)	35%-52%	25 (22%)	14%-29%	<.01
		Over-weight	36 (29%)	21%-37%	34 (30%)	21%-38%	n.s.
		Obesity class I	21 (17%)	10%-23%	16 (14%)	7%-20%	n.s.
		Obesity class II	6 (5%)	1%-8%	22 (20%)	12%-27%	.015
		Obesity class III	6 (5%)	1%-8%	19 (15%)	8%-21%	n.s.
							Total for Body weight: p<.05

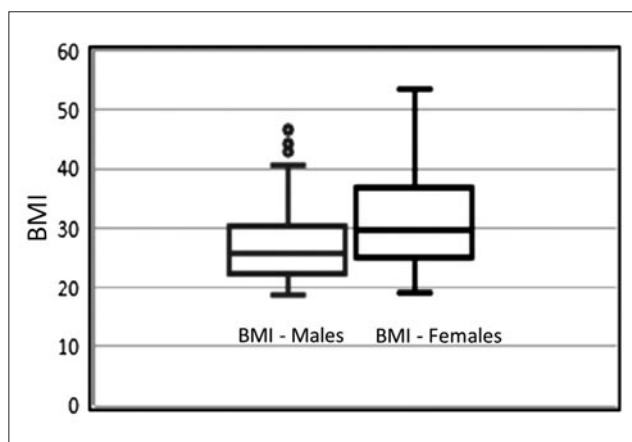


Figure 1. Box-plots for the global BMI of the female psychiatric inpatients shows global higher values than the BMI in the male psychiatric inpatients. In the female population, the average BMI is higher than males' values while the BMI scores are more dispersed than in the male population.

males was explainable by the time variable. The ES of the time variable was small for males and moderate for females. Similarly, meaningful variation was observed in the mean weights for both male and female patients. Therefore, during long admissions, only a small to moderate change in body weight could be observed in our research. Psychiatric hospitals in the UK have been introducing interventions to optimize body weight. For example, with psychotropic drugs' wise procurement, many hospitals have specific strategies to influence body weight. One hypothesis from our research is that metabolic syndrome and elevated BMI, overweight, and obesity might be comorbid with psychiatric diseases and could also be difficult to treat. The theory of the relationship between obesity and mental health, implying a shared effect, would support these observations. In either cases, it is beneficial to reduce the effect of a metabo-

ic syndrome caused by abnormal BMI in the general adult psychiatric community by promoting a dramatic shift in food habits. Besides, while physical fitness policies exist and are facilitated, in psychiatric wards, rare gyms plus small physical spaces make obesity epidemic in psychiatric hospital inpatients. Eventually, to cope with anxieties or heightened drowsiness, often, patients use comfort feeding and energy food, and this activity will make obesity comorbid but not a cause of mental illnesses. The utilization of energy drinks is common in psychiatric inpatients who try to balance the over-sedation from medication. Besides, the findings that relate the current analysis to previous research by the same authors are that the category of psychiatric hospital patients primarily affected by obesity is the borderline female patients. They can use impulsive eating to relieve mental turmoil or as a means of self-harm, often presenting with other types of eating disorders such as anorexia and bulimia. Preliminary research indicates that given the association of high BMI and depression, an improved metabolic state through the normalization of obesity shall also affect the underlying depression⁵⁵. Obesity is correlated with a rise in the risk of mood and anxiety disorders by about 25 percent and a reduction in the probability of substance use disorders by about 25 percent⁵⁶. There is an important and bidirectional link between obesity and depression; for anxiety disorders, the data is modest and insufficient for most medical problems; in these relations, gender seems to be a significant mediator⁵⁷. These data appear to confirm our initial hypothesis that the most affected by morbid obesity are female psychiatric patients with emotionally unstable personality disorder and dysthymia. Nonetheless, as there is an insignificant correlation between weight gain and hospitalization time, the likely hypothesis is that this fringe population suffering from a mood disorder and borderline personality disorder has obesity as a comorbid condition.

The current study shows several limitations. One weakness is that the population's entry and exit weight could have shown higher variations than the longitudinal study. Besides, when first becoming inpatients, the sample might have start-

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ed to assume psychotropic medication that affects body weight and then recorded at the first admission. Therefore, further research is needed to verify if pathogenic factors act individually or consensually in psychiatric inpatients, suggesting a multifactorial cause for pathological weight-gain.

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