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Weight Gain is Not Associated with Antipsychotic Medication, Sociodemographic Factors, or Diagnosis in a Welsh Secure Mental Health Unit

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ABSTRACT

Many people treated in secure inpatient services have a serious mental illness and are obese. This study aimed to assess the predictive power of demographic, clinical and pharmacological factors on secure inpatient weight gain during the initial stages of treatment. Retrospective data pertaining to body weight, sex, diagnosis, and prescribed medication was collected for 209 secure psychiatric inpatients. Lower admission bodyweight and non-antipsychotic medication with a low risk of inducing weight gain were the only significant predictors of weight gain ($R^2 = .050$). Clinical implications of these findings are discussed.

KEYWORDS

weight gain; forensic psychiatry; medication

Introduction

A recent review of Welsh secure services has highlighted that the average Body Mass Index (BMI) of individuals accessing inpatient services is 32.7 kg/m² for males and 33.9 kg/m² for females (Mills & Davies, 2022). These statistics mirror clinical data from Public Health England (Day & Johnson, 2017) and reflect rising rates of obesity in the Welsh population more broadly (Public Health Wales, 2019). Physical health outcomes of people detained in secure inpatient settings remain poor; people with serious mental illness have an increased risk of premature death and die up to 14.5 years earlier than the general population (Hjorthøj et al., 2017). Many of the leading causes of death in this population are associated with obesity and its co-morbidities such as metabolic syndrome, heart disease and type two diabetes (Hilton et al., 2022; Hennekens et al., 2005; Laursen et al., 2012; Subashini et al., 2011; Zareifopoulos et al., 2018; Zolezzi et al., 2017).

The first 12 wk following admission into an inpatient setting is a period that is characterized by rapid weight gain (Wetterling, 2001; Shin et al., 2012; Long et al., 2014; Levitt et al., 2017), however the risk of weight gain may continue past this initial 12-week

period, (Hilton et al., 2015). Paradoxically, individuals who have an underweight BMI classification on admission typically experience the greatest weight change (De Leon et al., 2007; Engelke et al., 2018; Sušilová et al., 2017). Increases in body weight may arise from improved nutrition but may also reflect medication side effects and reduced engagement in physical activity (Davies et al., 2023). Sušilová et al. (2017) reviewed patient weight at discharge from secure services and found that even patients that were underweight at admission had BMIs that were classified as overweight when leaving the service. Weight gain trends show that if patients are overweight or obese at the start of their inpatient treatment, they still gain weight but that this increase is more gradual than their underweight counterparts (Shin et al., 2012; Every-Palmer et al., 2018; Hilton et al., 2015; Huthwaite et al., 2017; Mat et al., 2015).

Weight gain in psychiatric populations has often been characterized as an adverse effect of antipsychotic medication. Whilst most antipsychotic medications are associated with some level of weight gain, the atypical antipsychotic drugs clozapine and olanzapine are associated with the most rapid weight gain (Leucht et al., 2013). For example, individuals who

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have been prescribed clozapine experience an average weight change of up to 17 kg in the first year of treatment (Foley & Morley, 2011), whilst for olanzapine this is 11 kg (Perez-Iglesias et al., 2008). Clozapine and olanzapine are prescribed for regular oral use to over 50% of patients being treated in secure services (Farrell & Brink, 2020). Weight gain associated with these medications is likely caused by two mechanisms; the medications raise levels of the hormone ghrelin which makes individuals feel hungrier (Murashita et al., 2005) but also have a sedative effect which reduces motivation to be physically active (Leucht et al., 2009). Antipsychotic medications also have adverse effects on the metabolic and cardiovascular systems, which include increased cholesterol, arterial hypertension, and impaired glucose metabolism (De Hert et al., 2011).

An alternative explanation for the significant levels of weight gain documented in secure psychiatric settings is that overeating is driven by cognitive impairments associated with serious mental illness. Mental health diagnoses such as schizophrenia and personality disorders are common within secure services (Mills & Davies, 2022) and are routinely treated with antipsychotic medication (Sahpolat & Ari, 2021; Sansone & Sansone, 2013). Both diagnoses are characterized by central deficits in inhibitory control (Ethridge et al., 2014; Kelly et al., 2020; Orellana & Slachevsky, 2013) which are likely to impact all aspects of behavior, including food consumption (Lavagnino et al., 2016). Harvey and Strassnig (2019) have argued that unhealthy eating patterns documented in those with schizophrenia are likely to be driven by functional impairments that impede ability to cook healthy meals. The higher incidence of binge eating within psychiatric settings is also likely to reflect the rewarding qualities of foods being used as a coping mechanism to help people manage their feelings of distress (Pack, 2009; Tuncer & Çetinkaya Duman, 2020). This is prudent, given the amount of distress patients feel when they are involuntarily admitted to psychiatric inpatient services (see review by Seed et al., 2016).

A propensity to overeat in patients admitted to secure services may also reflect over-eating's relationship with other addictive behaviors. Many patients have co-existing substance use disorders (Eagle et al., 2019). These disorders arise due to a biological sensitivity to the reinforcing properties of psychoactive substances (Koob & Volkow, 2016). As these reward pathways are the same as those which are triggered when consuming palatable foods, it is likely that over-eating reflects reward sensitivity. Research has shown

that substance users have reduced density of dopamine D2 receptors in the brain (as a cause or consequence of substance misuse), the net result is that individuals need to consume more food to receive the desired level of reward (Benton & Young, 2016; Blum et al., 2014; Carter et al., 2016). This may explain why individuals with substance misuse problems gain considerable amounts of weight when they are admitted into inpatient services, where their ability to access substances is significantly reduced but access to food is less restricted (Hodgkins et al., 2004).

Whilst patient characteristics are an important factor to consider with regards to predictors of weight gain, it is important to consider the obesogenic nature of the secure environment, with restrictions inherent in secure services impacting patients' ability to engage in regular exercise (Davies et al., 2023; Every-Palmer et al., 2018; Rogers et al., 2021). In their qualitative study with staff members in secure services, Davies et al. (2023) found that inpatient weight gain is largely the result of the restrictive nature of the secure inpatient environment, which impacts the accessibility of regular exercise for some patients, as well as a lack of resources or specialist knowledge on how to engage patients in healthier behaviors. Rogers et al.'s (2021) qualitative study with secure inpatients supports these findings, whereby patients felt that environmental restrictions in secure services, such as limited ward leave, promote sedentary behavior. Patients highlight the impact that these environmental restrictions have on motivation to engage in exercise, which feeds into a sedentary culture within secure services.

The literature reviewed above makes a clear case for the likely involvement of both pharmacological and clinical factors driving weight gain in secure care. Improved understanding of the mechanisms that contribute to weight gain in secure settings must be established if services are going to meet equitable healthcare targets (Davies et al., 2023; National Health Service, 2014; Welsh Government, 2020) and to promote general health. The current study was designed to assess the relative predictive power of demographic, pharmacological and clinical factors (sex, medication, psychiatric diagnosis, and prior substance misuse) for secure inpatient weight gain during the first 12 wk of inpatient treatment in South Wales.

Materials and methods

This study was approved by NHS Wales Research and Development department as a clinical audit and therefore did not require participants to provide consent.

The current study used a retrospective cohort-regression design. The target population were inpatients from Welsh medium and low secure inpatient services. Data was collected from clinical documentation in patient medical records.

A total of 298 patient records were reviewed which represented all patients treated in one medium and one low secure psychiatric service in South Wales between 2004 and 2019. Only records that included all required demographic, pharmacological and clinical data were collated and included in the study analysis ($N=209$). Reasons for exclusion were incomplete pharmacological data ($N=27$), clinical data ($N=14$) and recording of admission bodyweight weight ($N=48$). Demographic and clinical information for the sample is summarized in Table 1. Most patients (76%) were male, ages ranged from 18 to 77 years old with a mean age 35.4 ± 11.98 years old.

All data were documented retrospectively from patient's medical record. Medical records were either physical documents which were kept in a secure filing room on site, or, electronic and kept on a secure health board or company intranet service. Medical records were examined to collect objective clinical data (i.e., admission date, age on admission, sex, primary and secondary psychiatric diagnoses, substance misuse history and contact time with mental health services prior to admission date). If a patient had repeated admissions to the inpatient service only the first admission period was included in the database to avoid duplication of participants as a source of bias. Participant nursing notes were used to document patient's weight on admission and weight 12 wk post admission. If weight was not recorded at 12 wk, the weight recording for one week previous or later was used instead. If weight records were not available for

this timeframe, the patients' data was excluded from the study. Medical charts were used to determine what type of anti-psychotic and non-antipsychotic medications they were prescribed.

The following objective measures were obtained from patient medical records: Placement security was categorized as medium or low security. Patients age at admission was recorded in number of full years since first birthday. Antipsychotic medication risk was recorded as a categorical variable with levels high, moderate, and low risk of weight gain. Categorisations were based on the Maudsley Prescribing Guidelines in Psychiatric (13th ed: Taylor et al., 2018). Non-antipsychotic medication risk was also a categorical variable with levels high and low risk of weight gain based on categorisations established by Grootens et al. (2018), Kyle and Kuehl (2020) and Saunders et al. (2016). Patient's most recent primary psychiatric diagnosis was collected from medical records and was categorized in line with the International Classification of Diseases (ICD-10; World Health Organization, 2016). Primary psychiatric diagnosis was categorized as 1) schizophrenia, which included other psychosis derived disorders as outlined by ICD-10, 2) personality disorder, or 3) mood disorder. Comorbid substance misuse disorder, or history of a substance misuse disorder, was also documented in this study and categorized as either 1) having a substance misuse history prior to admission, or 2) not having a substance misuse history prior to admission. Patient height had not been recorded routinely in the majority of medical records, therefore patient's weight at admission was compared to the mean BMI of the UK population based on age and sex (Stewart, 2022). This enabled patients' weight to be categorized as either underweight (bottom 40%), normal weight (41-59%) or overweight (top 40%). Body weight at 12 wk post admission was categorized using the same approach.

Table 1. Frequency of participant demographic and clinical characteristics.

Demographic and clinical characteristics	Frequency
Patient sex	Male = 159 (76%) Female = 50 (24%)
Patient age	Mean = 35 years old (SD = 11.98) Range = 18 – 77 years old
Placement security	Medium = 135 (65%) Low = 74 (35%)
Primary psychiatric diagnosis	Schizophrenia = 139 (67%) Personality Disorder = 50 (24%) Mood Disorder = 20 (10%)
Substance misuse history	Yes = 125 (60%) No = 84 (40%)
Antipsychotic weight gain risk	High Risk = 113 (54%) Moderate Risk = 32 (15%) Low Risk = 64 (31%)
Non-antipsychotic weight gain risk	High Risk = 96 (46%) Low Risk = 113 (54%)

Note. Percentages are rounded to the nearest whole number.

Data analysis

All analyses for this study were conducted in SPSS (version 26; IBM Corp, 2019). First the descriptive statistics were generated to examine mean and standard deviation scores for each measure. A repeated measures t-test was conducted to assess the difference in weight in kilograms on admission and weight in kilograms 12 wk post admission. A one-way Analysis of Variance (ANOVA) was also conducted, to explore weight differences over the 12-week study period between individuals who were underweight, normal weight or overweight on admission. Furthermore, a

multiple linear regression was conducted with patient sex, primary psychiatric diagnosis, substance misuse history, prescribed antipsychotic medication weight gain risk, prescribed non-antipsychotic medication weight gain risk, and admission body weight category as predictor variables. The outcome variable in this analysis was weight difference in kilograms from admission to 12 wk post admission.

Results

Most patients in this study had a primary diagnosis of schizophrenia (66.5%) and history of a substance misuse disorder (59.8%). Most patients had been prescribed antipsychotics medication that was categorized as high risk of weight gain (54.1%). The majority of patients (65%) in the current study were inpatients from a medium secure service.

Assessing weight difference in kilograms over 12 wk

Table 2 shows patients body weight in kilograms, bodyweight category and bodyweight by psychiatric diagnosis, on admission and 12 wk post admission. On admission, 70% of patients were overweight, 8% were normal weight and 22% were underweight. By week 12 of treatment, 78% were overweight, 6% were normal weight and 16% were underweight. Most patients (67%) had experienced weight gain, whilst 28% lost weight and only 3% had maintained their bodyweight. Table 3 shows the direction of bodyweight changes after 12 wk of treatment.

A repeated measures t-test indicated that, for the sample as a whole, there was a significant increase in body weight between admission and 12 week follow

up (3.8 kg, 95% CI [2.716, 4.857]), $t(208) = 6.974$, $p < .001$, $d = 0.48$). A one-way ANOVA was conducted to determine if weight difference at 12 wk was dependent on classification of admission body weight category. Participants were classified into three groups: underweight ($n = 46$), normal weight ($n = 17$) and overweight ($n = 146$). There was an effect of baseline weight category on weight change at 12 wk ($F(2, 206) = 3.641$, $p = .028$, $\eta^2 = .034$). The pattern of weight gain was different between the three groups; with the underweight group gaining more weight ($M = 6.4$ kg, $SD = 7.9$) compared to normal weight ($M = 4.4$ kg, $SD = 6.6$) and overweight participants ($M = 2.9$ kg, $SD = 7.8$). Tukey post hoc analysis showed that there was a significant mean difference in weight gain between the underweight and overweight groups (3.5 kg, 95% CI [0.41, 6.60], $p < .05$). No other group differences were statistically significant.

Predicting weight gain over the first 12 wk of treatment

A multiple linear regression was run to assess whether (1) patient sex, (2) prescribed antipsychotic

Table 3. Prevalence and direction of weight category change over 12 wk.

Weight category on admission	Weight category at 12 wk N (%)
Underweight N = 46	Underweight = 30 (65.2) Normal weight = 8 (17.4) Overweight = 8 (17.4)
Normal weight N = 17	Underweight = 1 (5.9) Normal weight = 5 (29.4) Overweight = 11 (64.7)
Overweight N = 146	Underweight = 2 (1.4) Normal weight = 0 Overweight = 144 (98.6)

Note. Percentage is based on total percentage of weight category on admission.

Table 2. Weight data for sample.

	Admission	12 wk post admission
Body weight	Mean = 95.4kg (SD = 22.6) Range = 43–155.2kg	Mean = 99.2kg (SD = 22.5) Range = 53.9–180.6kg
Weight category		
Underweight	N = 46 (22%) 67.9kg (SD = 8.9) Range = 43–80.5kg	N = 33 (16%) 74.3kg (SD = 10.5) Range = 53.9–96.8kg
Normal weight	N = 17 (8%) 83.1kg (SD = 1.8) Range = 80–96.6kg	N = 10 (5%) 87.5kg (SD = 5.9) Range = 74.6–99.9kg
Overweight	N = 146 (70%) 105.5kg (SD = 18.6) Range = 67.4–155.2kg	N = 163 (78%) 108.4kg (SD = 19.8) Range = 59.3–180.6kg
Psychiatric diagnosis		
Schizophrenia (N = 141)	95.1kg (SD = 21.8) Range = 51.7–149.9kg	98.9kg (SD = 22.1) Range = 53.9–180.6kg
Personality disorder (N = 89)	94.3kg (SD = 23.7) Range = 43–149.1kg	97.8kg (SD = 22.5) Range = 57.0–146.9kg
Mood disorder (N = 43)	100.5kg (SD = 25.2) Range = 60.3–155.2kg	104.6kg (SD = 25.7) Range = 60.3–156kg

Table 4. Multiple regression results for weight difference over 12 wk.

Weight difference (kg)	<i>B</i>	95% CI for <i>B</i>		<i>t</i>	<i>SE B</i>	β
		LL	UL			
Constant	9.080*	2.642	15.518	2.781	3.264	
Sex	.304	−2.079	2.687	.252	1.208	.019
Primary psychiatric diagnosis	.674	−.882	2.230	.854	.789	.066
Substance use history	−.281	−2.286	1.723	−.277	1.016	−.020
Anti-psychotic weight gain risk	.313	−.837	1.463	.537	.583	.041
Non-anti-psychotic weight gain risk	−2.673*	−4.653	−.694	−2.664	1.004	−.194
Admission bodyweight category	−1.388*	−2.558	−.219	−2.341	.593	−.169

Note. Model = "Enter" method in SPSS statistics; *B* = unstandardized regression coefficient; CI = confidence interval; LL = lower limit; UL = upper limit; *t* = *t* value; *SE B* = standard error of the coefficient; β = standardized coefficient.

* $p < .01$.

** $p < .001$.

medication weight gain risk, (3) prescribed non-anti-psychotic medication weight gain risk, (4) primary psychiatric diagnosis, (5) substance misuse history, and (6) admission body weight category, predicted weight gain (in kilograms) over the first 12 wk of secure inpatient treatment. With regards to pretest assumptions for a linear regression; seven outliers were identified as studentized deleted residuals greater than ± 3 standard deviations and were therefore removed.

The resulting pretest assumption analyses showed that there was linearity as assessed by partial regression plots and a plot of studentized residuals against the predicted values. There was independence of residuals, as assessed by a Durbin-Watson statistic of 1.652. There was homoscedasticity, as assessed by visual inspection of a plot of studentized residuals versus unstandardized predicted values. There was no evidence of multicollinearity, as assessed by tolerance values greater than 0.1. There were no studentized deleted residuals greater than ± 3 standard deviations or leverage values greater than 0.2. There were no values for Cook's distance above 1. The assumption of normality was met, as assessed by a Q-Q Plot. The resulting model was a significant predictor of 5.0% of the variance in changed body weight ($F(6, 195) = 2.754$, $p = .014$, adj. $R^2 = .050$). However, body weight category on admission and prescribed non-antipsychotic medication risk were the only significant predictors in the model (see Table 4).

Discussion

The aim of the present study was to evaluate the predictive power of pharmacological, clinical, and demographic variables for weight gain during the initial stages of secure inpatient treatment. Previous literature has suggested that rapid weight gain in psychiatric inpatients occurs in the first 12 wk following admission (Levitt et al., 2017). Rapid weight gain was

also observed in the current study as participants gained 3.8 kg on average over 12 wk. There was substantial variance in the amount of weight gained in this study, with the range in weight gain being -16.3 to 30.7 kg. The majority of patients in this study experienced weight gain over 12 wk (78%), with only 3% of patients maintaining their weight, and 28% losing weight.

In this sample, 70% of participants were overweight on admission. Prevalence of overweight status and obesity in this sample is different to rates documented in other studies (Hilton et al., 2022; Hilton et al., 2015; Huthwaite et al., 2017; Mat et al., 2015). A higher rate of obesity was found in a study Huthwaite et al. (2017) who showed that 90% of their population of secure inpatients in New Zealand were overweight or obese on admission. This may be explained by the fact that the obesity prevalence in Wales (22.6%; PHW, 2019) is less than that of New Zealand (30.9%; Ministry of Health, 2020). Contrarily, Hilton et al. (2022) showed in their study within a Canadian inpatient forensic assessment unit, that 48% of secure inpatients were overweight or obese. It is not clear why there are discrepancies in weight on admission in this sample compared to previously published research, however, our findings support that a large proportion of secure inpatients are overweight.

In this study, the greatest level of weight gain was documented in participants whose body weight on admission was underweight. When weight gain was compared between participants who were underweight on admission and overweight on admission this difference was statistically significant. Underweight participants gained an average of 3.4 kg more bodyweight compared to patients who were overweight on admission. These results suggest that people with lower admission weight are at the greatest risk of acute weight gain during the initial stages of treatment. These findings are consistent with patterns of weight gain documented in the non-secure psychiatric

literature with several studies highlighting that it is patients who are underweight that gain the most weight when commencing psychiatric treatment (De Leon et al., 2007; Engelke et al., 2018; Sušilová et al., 2017).

However, most underweight patients (65% of those classified as underweight on admission) remained within this body weight category at 12 wk post admission. This suggests that there is a smaller subgroup of patients who are at risk of gaining excess weight. Further research could look to differentiate underweight individuals who are at risk of gaining excess weight so that their weight gain can be negated or managed more effectively. However, regardless of whether patients body weight category changed, rapid weight gain is of significant concern because it is associated with an increased risk of cardiovascular incidents, regardless of whether individuals are obese or not (Li et al., 2021). It may also be prudent to note, that weight gain does not stop at 12 wk, with some studies suggesting weight gain continues for at least six months of psychiatric treatment (Meltzer et al., 2003). It may be that underweight patient's weight continues to increase as their length of stay increases (Hilton et al., 2022).

The findings from the current study also suggest that secure inpatients with a bodyweight that is within the healthy range are also at risk of gaining weight on admission. Patients in the current study gained on average 4.4 kg (SD = 6.6) over the 12-week study period. These findings are consistent with research conducted by De Leon et al. (2007), found that patients who had a BMI within the healthy range at the start of psychiatric treatment gained up to 4 kg of weight over a 16-week period. It may be that those who are normal weight on admission are of the greatest concern because the majority of normal weight patients (65%) in the current study became overweight after 12 wk of treatment.

Findings from the current study also indicated that patient's bodyweight on admission significantly predicted weight gain (in kilograms) over a 12-week period. This finding is not surprising given that a lower bodyweight on admission was associated with greater weight gain over the 12-week period. This is also consistent with broader psychiatric literature that has explored patient weight after commencing psychiatric treatment (De Leon et al., 2007; Engelke et al., 2018; Sušilová et al., 2017). Paradoxically, results of the regression analysis in this study indicated that being prescribed non-antipsychotic medication that is associated with a low risk of weight gain, was a

significant predictor of weight gain over 12 wk. This result may be a product of the interaction with more powerful predictors of weight gain in this population and further research should look to explore this in greater detail.

Contradicting our own initial predictions, no other pharmacological or clinical factors were predictive of weight change. This finding challenges many studies that have suggested antipsychotic medications, such as clozapine and olanzapine, are significantly associated with excessive weight gain (Leucht et al., 2013). These findings may reflect the limited variability in the sample regarding diagnosis and type of medication that was prescribed to patients. This sample's clinical characteristics and medication profiles were homogenous in that most patients had a diagnosis of schizophrenia and were prescribed high risk antipsychotic medication. However, research that highlights the predictive power of antipsychotics on weight gain are not conducted within secure psychiatric environments. It is plausible that the nature of the secure psychiatric inpatient environment, given that it is highly restrictive and under stimulating (Davies et al., 2023), has a greater impact on weight gain than the use of certain antipsychotic medications.

Despite the high levels of weight gain documented in individuals who had a diagnosis of schizophrenia, personality or mood disorder, the current study found that clinical diagnoses were not reliable predictors of patient weight gain during the initial stages of treatment. Many of the participants in the current study (60%) had a history of substance misuse and this again did not predict weight gain. This conflicts with literature that suggested that patients who are admitted to inpatient services with a history of substance misuse experience rapid weight gain (Hodgkins et al., 2004). These findings, as well as the low predictive value of the regression model, suggests that there are other important factors that influence body weight in secure psychiatric inpatient settings that were otherwise not captured in the design of the current study. Given the complex psychosocial history of patients within secure psychiatric inpatient settings, it is plausible that weight gain is the result of a complex interplay between psychological and cognitive factors, as well as the restrictive nature of the secure inpatient environment (Davies et al., 2023).

Limitations, implications and future research

The current study has several limitations to consider. In particular, the study utilized data from medical

records which had varying degrees of detail, and which had been structured differently over the 6-year period. It may be that the inconsistent nature of record taking impacted on the reliability of the patient data collected. This limitation is largely due to the retrospective collection of the study data. Future research should look to explore the role that demographic, clinical, and pharmacological factors have on secure inpatient weight using prospective cohort data, to negate this issue.

Due to the lack of data on patient height within these medical records, BMI could not be calculated and so the findings could not be discussed in terms of the most common classification of obesity. To negate this issue, we categorized patients as either underweight, normal weight or overweight based age and sex matched UK weight averages (Stewart, 2022). However, even with these categorisations, without height data it cannot be ruled out that weight gain seen in participants within this study was the result of lean body mass increase as opposed to fat increase. This seems unlikely however due to the restricted nature of the secure inpatient environment, with limited access to gym facilities, particularly for those who were prescribed strong doses of psychotropic medications because of their poor mental health, as such activity would be considered risky. Unfortunately, in this study the methodological issues around data extraction could not be overcome because data was collected retrospectively. Further research should include participants height to have an objective measure of obesity, such as BMI. Without height data to calculate BMI, it cannot be ruled out that participants who were underweight were such due to a lower-than-average height and vice versa for those who were overweight.

As well as this, the current study did not consider the impact of imposed lifestyle factors on patient weight gain, despite a literature base showing the impact the restrictive nature of the secure environment can have on patient's ability and motivation to engage in exercise (Davies et al., 2023, Every-Palmer et al., 2018; Rogers et al., 2021). Future research should explore to what extent the secure environment, lack of physical activity, and patient motivation to engage in healthy lifestyle behaviors is associated with weight gain over the first 12 wk of inpatient treatment.

The fact that patient diagnoses in this study were defined by health care professionals and not following use of research diagnostic instruments introduces some limitations of reliability. Psychiatric diagnoses

are generally established by a health care practitioner through clinical interview and by consulting the ICD-10. Ultimately, a psychiatric diagnosis given to a patient through this method is the interpretation of the diagnosing health care professional. Therefore, this method may lack objectivity. However, Jakobsen et al. (2005) explored the reliability of ICD-10 diagnoses by comparing with a standardized diagnostic tool and found strong homogeneity between methods for diagnosing schizophrenia. In any case, it may be prudent in future research to explore use of standardized diagnostic measures completed with patients at the time of study to increase reliability and objectivity.

Despite the limitations identified above, the findings of the current study have important implications for clinical practice. The most at-risk group for weight gain in the current study were patients who were underweight upon admission. Whilst this weight gain may not be clinically significant within the early stages of inpatient treatment, weight gain trajectories can continue throughout the course of rehabilitation (Hilton et al., 2015). This finding highlights the need to closely monitor the weight of patients throughout their inpatient stay. Guidelines have been published for identifying, assessing, and managing obesity (NICE, 2014) and these have been extended for use within secure care (Public Health England, 2021). These guidelines state that weight should be measured on admission and then at regular points during treatment: at a minimum of once per month, however this can be more frequent if patients are more at risk of obesity.

To tackle weight gain and obesity within secure services, service providers should also ensure that appropriate facilities exist to allow patients to maintain a healthy diet and obtain regular exercise, that patients are educated on lifestyle factors associated with poor weight management, that appropriate staff are sufficiently trained to implement this, and that effective weight management programmes are employed (Johnson et al., 2018). Johnson et al. (2018) outlines in their review several weight management programmes that have been implemented within secure services across the UK, however, these have varying degrees of efficacy and lack consideration of potential underlying psychological factors that are implicated in weight gain and obesity. Given the specialist nature of the secure service environment, as well as the population treated within these services having complex psychosocial histories, weight management programmes need to be tailored specifically for use within these settings.

Whilst the current study found that admission weight was a predictor of weight gain over the initial stages of treatment, neither sociodemographic factors, pharmacology nor diagnosis were significant predictors. Furthermore, admission body weight only accounted for 5.0% of the variance in changed body weight. This finding, as well as the complex nature of obesity, would suggest that there are other underlying factors that are implicated in secure inpatient weight gain. For example, there is a literature base that suggests weight gain and obesity can be attributed to mechanisms underlying responses to psychological trauma (Litwin et al., 2017; Roche et al., 2019). Future research should look to explore the role that psychological trauma plays in secure inpatient weight gain, given the high prevalence for psychological trauma within the secure inpatient population (Mills & Davies, 2022).

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Disclosure statement

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