informa
healthcare

A Retrospective Study of Weight Changes and the Contributing Factors in Short Term Adult Psychiatric Inpatients

JAMES L. MEGNA, MD, PhD, and ARUN RAJ KUNWAR, MD

Department of Psychiatry, SUNY-Upstate Medical University, Syracuse, NY, USA

MICHAEL J. WADE, MS

VA Medical Center, Syracuse, NY, USA

Introduction. The authors endeavored to determine if there is significant weight gain during acute psychiatric inpatient hospitalization for adults and, if so, what are the contributing factors.
Methods. A retrospective chart review was conducted of all patients admitted to the psychiatric inpatient unit of a University Hospital in the year 2001. The study was approved by the Institutional Review Board.
Results. Out of 535 charts reviewed, 96 patients met the inclusion criteria. The group on average gained 3.9 ± 13.3 lbs. (P = 0.005; 95% CI = 1.2, 6.6). Lower admission body weight was associated with more weight gain. Patients with diagnoses of bipolar disorder and schizophrenia gained more compared to those diagnosed with major depressive disorder. Patients who were prescribed atypical antipsychotics gained more compared to those who were not prescribed such medications. Smokers gained more weight than nonsmokers, and males gained more than females. Weight at the time of the admission (inverse relationship) and Axis I diagnosis were the strongest predictors of weight gain.
Conclusions. This study demonstrates that significant numbers of patients are at risk of gaining weight when they are admitted to a psychiatric inpatient unit. Patients with lesser degrees of overweight at the time of admission, patients with diagnoses of bipolar disorder and schizophrenia, and those receiving atypical antipsychotics may be more vulnerable to such effects.

Keywords Psychiatric inpatients, Weight gain, Contributing factors

INTRODUCTION

Weight gain has become a major public health problem in the United States. The prevalence of obesity (defined by a body mass index (BMI) of >30.0) and overweight (defined by a BMI >25.0) is rising markedly (1). For example, obesity has increased from 14.5%, as recorded in the National Health and Nutrition Examination Survey (NHANES) II (1976–1980), to

22.5% in the NHANES III (1988–1994) (2). Moreover, the combined prevalence of obesity and overweight amongst adults is now 61% (3). This increase is of concern because even small amounts of weight gain can lead to significant increases in the risk of type II diabetes, coronary artery disease, hypertension, gallbladder disease and, in some women, breast cancer (1,4).

Whether certain psychiatric disorders predispose a person to overweight or obesity is not fully understood at this time. Some data suggest that the psychiatric patient population may be at increased risk for these problems (4–9). Most of the antipsychotics, as well as mood stabilizers and some antidepressants, are frequently associated with weight gain (3,10,11,12). These factors likely place psychiatric patients at greater risk for this problem.

There are limited data regarding weight gain during psychiatric inpatient hospitalization. One study that looked at such effects in children and adolescents found a significant outcome. The actual mean increase was roughly 3.5 times greater than that predicted by growth charts for the age groups studied (13). One other study, that used a retrospective chart review (also done in children and adolescents), found clinically significant weight gains (>7% weight increase from baseline) in 78% of inpatients treated with risperidone as compared with 24% of those in the non-risperidone comparison group, over the course of six months (14). Lastly, a prospective study of adolescent, male, inpatients diagnosed with schizophrenia, who were matched for age, duration of current hospitalization, or accumulated lifetime hospitalization, demonstrated a significant increase in BMI in the olanzapine treated group but not in those receiving haloperidol, over a four week period (15). Most of the studies in adult psychiatric populations have focused on specific drug effects in weight gain and have been conducted in outpatient settings. In our literature review we found only one that assessed weight gain amongst inpatients. This study was conducted at a state psychiatric hospital with a substantial average length of stay (11). Furthermore, only the effects on weight gain of three mood stabilizers (lithium, valproate, and topiramate) were assessed. Not surprisingly, lithium and valproate were associated with weight gain while topiramate was found to be associated with weight loss.

It remains unknown, however, if significant weight gain develops amongst psychiatric inpatients who are hospitalized for shorter time periods in general medical/surgical hospitals. Furthermore, whether other factors, such as gender, diagnosis, physical activity level, and smoking status, as well as psychotropic medication class, play a contributory role during such admissions is also unknown. We, therefore, undertook this pilot study to investigate if significant weight gain develops amongst psychiatric inpatients at a university hospital and, if so, what are the contributing factors.

METHODS

All patients admitted to the psychiatric inpatient unit at a University Hospital in New York state in the year 2001 were eligible for study inclusion. The ward is a locked unit and patients are confined to the immediate area where the unit is located. Some of the patients can have off ward pass privileges, which are usually one to six times a day for a maximum of 20 minutes each. However, some patients are granted off grounds passes, which allow for up to several hours of activity. Patients, when admitted, are consulted by a nutritionist for their dietary preferences and are provided three meals a day. They can ask for second helpings without restrictions. In addition, patients can order snacks in between meals and have free access to the unit pantry, which provides juices, ginger ale, and crackers.

The following information was collected, retrospectively, by means of chart review: age, sex, education level, length of stay, medications, DSM-IV diagnosis, height at the time of admission, weight at the time of admission and at the time of discharge, smoking status and physical activity level (off ground pass vs. no off ground pass). Patients with diagnoses of eating disorders, diabetes mellitus, hypothyroidism, and patients needing medical intervention requiring intravenous fluids, were excluded. Also excluded were patients taking psychostimulants or topiramate as part of their treatment (since these medications are associated with weight loss and our aim was to ascertain those factors which contribute to weight gain). Patients whose records lacked information regarding height and weight at the time of admission and/or weight at the time of discharge were similarly excluded. The Institutional Review Board of the medical school approved the study.

Statistical Analysis

Descriptive statistical parameters were calculated for demographic and clinical characteristics noting mean ± standard deviation for continuous variables and frequency/percentage for non-continuous variables. A two-tailed t-test of the mean weight change during hospitalization was conducted with a p value < .05 required for statistical significance.

Analysis of covariance (ANCOVA) was used to compare changes in weight from hospital admission to discharge among various subgroups of patients. Change in weight was defined as the dependent variable and compared via the between subjects factor (e.g., gender). Since baseline weight was correlated with the change in weight, we utilized ANCOVA to adjust the weight changes within each subgroup, thereby washing out any potential confounding effect associated with weight at hospital admission. Our first round of analyses on any one variable did not consider potential effects from the remaining factors.

Since many of our variables were interrelated, we chose to conduct a multivariate ANCOVA that separated the true predictors of weight gain from the spurious variables. Baseline weight remained in the model, and a backward selection method was used to remove the variables that did not significantly (p < 0.10) predict weight gain. A type I error less than 0.10 was selected to define statistical significance since adequate power was not attained (< 80%) to detect weight gain values in the 3–5 lbs. range. Accordingly, and since this is a pilot study, we were liberal in setting the threshold for statistical significance so that a clinically meaningful 3–5 lb. weight gain could be substantiated through statistical analysis. To preserve the experiment-wise type I error rate, post-hoc analyses on Axis I subgroups were applied using Tukey's method. All tests of statistical significance were two-tailed and conducted using the SAS software version 9.0.

RESULTS

A total of 535 patients were admitted and discharged in 2001 at our University Hospital psychiatric unit. Ninety-six

Table 1 Clinical and Demographic Characteristics of Psychiatric Inpatients at a University Hospital

Weight	
Baseline	179.4 ± 51.6 lbs.
Discharge	183.3 ± 49.1 lbs.
BMI	
Baseline	28.2 ± 7.5
Discharge	28.8 ± 7.2
Length of Stay	17.2 ± 18.2 days
Age	39.5 ± 15.3 years
Axis V (n = 95)	52.4 ± 9.2
Gender (n = 95)	
Male	53 (56)
Female	42 (44)
Education (n = 92)	
< High school	19 (21)
High School	36 (39)
< Bachelor's degree	30 (33)
≥ Bachelor's degree	7 (7)
Smoker (n = 83)	54 (65)
Axis I Diagnosis	
Major Depressive Disorder	37 (39)
Schizophrenia	29 (30)
Bipolar Disorder	13 (14)
Psychotic Disorder NOS	13 (14)
Cognitive Disorder NOS	3 (3)
Adjustment Disorder	1 (1)
Pass privileges	64 (67)
Atypical Antipsychotic medication	(n = 94)
None	29 (31)
Olanzapine	29 (31)
Risperidone	16 (17)
Quetiapine	16 (17)
Ziprasidone	2 (2)
Olanzapine/Risperidone	1 (1)
Olanzapine/Clozapine	1 (1)
Mood Stabilizer	
None	68 (71)
Divalporex sodium	14 (15)
Lithium	6 (6)
Carbamazepine	4 (4)
Gabapentin	3 (3)
Carbamazepine/ Gabapentin	1 (1)

Table 2 Categorical Assessment of Weight Gain

Weight Gain	Frequency (%)	95% CI on the Proportion
>0 lbs	52 (54.2)	44.2–64.1
≥7% of body weight	16 (16.7)	9.2–24.1

patients met the study inclusion criteria (18%). Over 90% of the subjects excluded were those individuals for whom the medical record lacked information regarding height and weight at admission and/or weight at discharge. Table 1 lists the clinical and demographic characteristics of the study population (n = 96 unless otherwise indicated). Noteworthy is that, as a group, our patients were quite overweight at admission (BMI = 28.2 + 7.5), yet gained an average of 3.9 + 13.3 lbs. (95% confidence interval: 1.2–6.6; p = .005) during a relatively short hospital stay (17.2 ± 18.2 days). Furthermore, Table 2 indicates that 54.2% of them gained some weight during hospitalization, while 16.7% gained at least 7% of their baseline bodyweights (i.e., 12.6 lbs.). There were 5 patients excluded on topiramate and one on methylphenidate. As a group they lost 4.24 lbs.

Including them in the statistical analysis would have resulted in a lesser, overall mean weight gain of 3.4 lbs.

The first round of analysis (univariate ANCOVA) produced the following significant predictors of weight gain: gender (males more likely than females; p = .035), atypical antipsychotic (more likely if prescribed; p = .016), and Axis I diagnosis (more likely with a more severe illness; p = .001; schizophrenia and bipolar diagnoses more likely than major depressive disorder in post-hoc analyses using Tukey's method; p < .05). However, since the potential predictors of weight gain are interrelated, confounding becomes an important effect for which to control. Therefore, a second round of analysis was conducted via multivariate ANCOVA. (It is important to note that two patients [both female] were receiving two atypical antpsychotics [see Table 1]. One gained 1.9 lbs. and the other 2.8 lbs. The latter female was not included in this analysis since her smoking status was unknown.) This revealed that baseline weight was the most significant predictor of weight gain (p < .001), with a manifest inverse relationship (r = -0.317). An inverse relationship was found for BMI as well (r = −0.322, p = 0.00l). Those patients who gained weight had a lower mean baseline BMI (26.4 vs. 28.2 for the group as a whole). Nevertheless, they were quite overweight at admission. The breakdown of average weight gain per BMI group was as follows: <25.0 (6.0 ± 14.2 lbs.), 25–30 (3.1 ± 15.8 lbs.), and >30 (0.3 ± 16.5 lbs). Although gender, antipsychotic medication class, Axis I diagnosis, and smoking status were controlled for, no significant difference was found amongst the BMI groups. Axis I diagnosis was the other significant predictor (p = .016) with more serious illness associated with weight gain. Post-hoc analyses (Tukey's method) revealed that bipolar disorder patients were more likely to gain weight than those with major depressive disorder (p < .05): 9.9 ± 12.2 lbs. vs. −2.6 ± 12.1 lbs (weight loss), respectively. Approaching statistical significance were the following factors: atypical antipsychotic medication, being a smoker prior to admission, and male gender (see Table 3). A trend was observed amongst the atypical antipsychotics. Those patients receiving olanzapine gained the most weight (9.1 ± 14.5 lbs.), followed by quetiapine (4.8 ± 15.0 lbs.) and risperidone (1.1 ± 14.6 lbs.). Interestingly, we also found that there was a near significant interaction between smoking status and antipsychotic medication class, viz. smokers who were prescribed atypical antipsychotics gained the most weight while nonsmokers receiving typical agents actually lost weight. Baseline weight, gender and Axis I diagnosis were controlled for in this subanalysis

Table 3 Multivariate ANCOVA Results

	N	Change in Weight (lbs)	DF	F-statistic	P-value
Baseline weight			1	20.4	<0.001
Gender			1	2.9	0.094
Males	46	4.9 ± 13.3			
Females	37	0.1 ± 14.5			
Atypical Antipsychotic			1	3.4	0.069
Yes	58	5.6 ± 12.5			
No	25	−0.4 ± 14.5			
Axis I			3	3.7	0.016
Bipolar Disorder	13	9.9 ± 12.2			
Schizophrenia	25	3.3 ± 12.7			
Major Depressive Disorder	33	−2.6 ± 12.1			
Psychotic Disorder NOS	12	−0.3 ± 13.7			
Smoking			1	3.4	0.070
Yes	54	5.1 ± 14.3			
No	29	0.1 ± 13.1			

Each significant ($p < 0.10$) factor is adjusted for the remaining variables in the model. Per the definition of factor levels and due to small cell counts, 4 patients (3 with Cognitive Disorder NOS and 1 with Adjustment Disorder) were not included in this analysis. Smoking status was unknown for 6 patients, gender unknown for 1, and atypical medications for 2, thereby producing a final sample of 83 analyzable patients.

Table 4 Change in Weight According to Smoking Status and Class of Antipsychotic Medication

	N	Change in Weight (lbs)	DF	F-statistic	P-value
Baseline weight			1	20.4	<0.001
Group			3	2.3	0.085
Nonsmoker/typical	9	−2.2 ± 13.2			
Nonsmoker/atypical	20	2.7 ± 12.1			
Smoker/typical	16	1.8 ± 13.2			
Smoker/atypical	38	8.2 ± 11.7			

(see Table 4). None of the other factors listed in Table 1 (length of stay, education level, pass privileges, nor mood stabilizing medication) was found to be even remotely significant ($p > 0.20$).

DISCUSSION/CONCLUSIONS

This study, to our knowledge, is one of the first to address the issue of weight gain and the contributing factors during a relatively short, inpatient psychiatric hospitalization. Although an average of only about 4 lbs. was gained, this occurred during a 2.5 week period amongst individuals who were already overweight at admission (average BMI of 28.2). This is noteworthy since even small amounts of weight gain can lead to significant increases in the risk for type II diabetes, coronary artery disease, hypertension, gall bladder disease, and, in some women, breast cancer (1,4). Furthermore, it is important to note that many patients are readmitted following discharge and often more than once (16). In our sample, the readmission rate was about one third within 3 months of discharge. This suggests the ominous possibility that weight gain during psychiatric hospitalizations may be cumulative with quite profound effects on the health of our patients.

A number of findings are not surprising, viz. that of an inverse relationship between baseline bodyweight and weight gain, as well as that of more serious mental illness being associated with same (5,6,7). In addition, the association between atypical antipsychotics and weight gain has been noted in a number of other (outpatient) studies, as has the trend for olanzapine to have the greatest weight gain effect (10). Nevertheless, the possibility of a patient gaining over 9 lbs. during a relatively short psychiatric hospitalization, simply due to the taking of olanzapine, should give practitioners much pause for thought.

Less obvious, though not unexpected, was the trend for smokers to gain weight during hospitalization. Although smoking pass privileges were available, the total number of cigarettes smoked per patient (12 per day) was less than any of the patients smoked prior to admission. Consequently, a modified smoking cessation program was effected with expectable elevations in body weight (17). Unanticipated, however, was the trend noted for males to gain weight. Clearly, the role of gender in weight gain requires further study, especially in psychiatric populations.

There are caveats, however. Our study was retrospective and many patients were not included due to incompleteness of the medical records. This was primarily a result of missing information regarding height and weight at admission and/or weight at discharge. Our patient inclusion rate of 18% was almost identical to the percentage of patients (18.6) who had weights recorded in the medical record during a British chart review study of 616 psychiatric inpatients taking antipsychotic medication (18). These low rates suggest that the significance of weight gain during psychiatric hospitalization is not fully appreciated. Nevertheless, the patients excluded from our study (due to incomplete medical records) did not differ significantly on any of the variables found to be important contributors to weight gain. In addition, and as noted in the Methods section, our study was not sufficiently powered to detect a weight gain in the 3–5 lbs. range during the subanalyses of contributing factors (Type II error). However, the results for gender, atypical antipsychotics, and smoking status closely approached statistical significance. Lastly, the study population was drawn from one specific geographic area and hospital. Hence, the results may not be widely generalizeable. At the very least, however, there is great import in these results for the patients studied.

This study demonstrates that psychiatric patients may be at significant risk for weight gain during hospitalization and, furthermore, that exacerbation of this problem may be effected via rehospitalization(s) (a not uncommon event) with profound and deleterious effects on overall medical well being. Accordingly,

there is a need for prospective study of this phenomenon with efforts made to ensure assiduous recording of admission and discharge body weights. This should include following patients through any course of rehospitalization (s).

It appears prudent, therefore, to recommend immediately that the monitoring of bodyweight become routine during psychiatric hospitalization (for all patients), and that monitoring of serum glucose and lipids be implemented at least for patients who are overweight at admission. Some effort should be made to provide dietary management education and, perhaps, information on how light physical activity can be utilized for overall bodyweight management (for those patients whose medical conditions do not preclude this activity) (19). In addition, for patients in need of atypical antipsychotic medication, selecting an agent with less propensity to produce weight gain, which provides reasonably equivalent clinical benefits, seems reasonable. Such an approach may provide for, at the very least, a diminution of the weight gain that will likely occur in most psychiatric inpatients and a reduction in the risk of obesity related medical sequellae. When results of prospective studies become available, more precise and targeted interventions can be effected for the overall well being of our patients.

REFERENCES

1. Allison DB, Saunders SE: Obesity in North America. An overview. *Med Clin North Am* 2000; 84:305–332
2. Flegal KM, Carroll MD, Kuczmarski RJ, Johnson CL: Overweight and obesity in the United States: prevalence and trends, 1960–1994. *Int J Obes Relat Metab Disord* 1998; 22:39–47
3. Aronne LJ, Segal KR: Weight gain in the treatment of mood disorders. *J Clin Psychiatry* 2003; 64(8, Suppl):22–29
4. Kawachi I: Physical and psychological consequences of weight gain. *J Clin Psychiatry* 1999;60(21, Suppl):5–9
5. Coodin S: Body mass index in persons with schizophrenia. *Can J Psychiatry* 2001; 46:549–555
6. Allison DB, Fontaine KR, Heo M, Mentore JL, Cappelleri JC, Chandler LP, Weiden PJ, Cheskin LJ: The distribution of body mass index among individuals with and without schizophrenia. *J Clin Psychiatry* 1999; 60:215–220
7. Weiser M, Knobler H, Lubin G, Nahon D, Kravitz E, Caspi A, Noy S, Knobler HY, Davidson M: Body mass index and future schizophrenia in Israeli male adolescents. *J Clin Psychiatry* 2004; 65:1546–1549
8. Onyike CU, Crum RM, Lee HB, Lyketsos CG, Eaton WW: Is obesity associated with major depression? Results from the Third National Health and Nutrition Examination Survey. *Am J of Epidemiol* 2003; 158:1139–1147
9. Sansone RA, Wiederman MW, Sansone LA, Monteith D: Obesity and borderline personality symptomatology: comparison of a psychiatric versus primary care sample. *Int J Obes Relat Metab Disord* 2001; 25:299–300
10. Nasrallah H: A review of the effect of atypical antipsychotics on weight. *Psychoneuroendocrinology* 2003; 28(1, Suppl):83–96
11. Chengappa KN, Chalasani L, Brar JS, Parepally H, Houck P, Levine J: Changes in body weight and body mass index among psychiatric patients receiving lithium, valproate, or topiramate: an open-label, nonrandomized chart review. *Clin Ther* 2002; 24:1576–1584
12. Fava M, Judge R, Hoog SL, Nilsson ME, Koke SC: Fluoxetine versus sertraline and paroxetine in major depressive disorder: Changes in weight with long-term treatment. *J Clin Psychiatry* 2000; 61:863–867
13. Putnam D, Williams RA, Weese D, Whitlock K: The effect of inpatient psychiatric hospitalization on weight gain in children and adolescents. *Psychiatr Hosp* 1990; 21:119–123
14. Martin A, Landau J, Leebens P, Ulizio K, Cicchetti D, Scahill L, Leckman JF: Risperidone-associated weight gain in children and adolescents: A retrospective chart review. *J Child Adolesc Psychopharmacol* 2000; 10:259–268
15. Gothelf D, Falk B, Singer P, Kairi M, Phillip M, Zigel L, Poraz I, Frishman S, Constantini N, Zalsman G, Weizman A, Apter A: Weight gain associated with increased food intake and low habitual activity levels in male adolescent schizophrenic inpatients treated with olanzapine. *J Am Acad Child Adolesc Psychiatry* 2002; 41:337–343
16. Thompson EE, Neighbors HW, Munday C, Trierweiler S: Length of stay, referral to aftercare, and rehospitalization among psychiatric inpatients. *Psychiatr Serv* 2003; 54:1271–1276
17. Leischow SJ, Stitzer ML: Effects of smoking cessation on caloric intake and weight gain in an inpatient unit. *Psychopharmacology* 1991; 104:522–526
18. Paton C, Esop R, Young C, Taylor D: Obesity, dyslipidaemias and smoking in an inpatient population treated with antipsychotic drugs. *Acta Psychiatr Scand* 2004; 110:299–305
19. Swinburn BA, Caterson I, Seidell JC, James WP: Diet, nutrition and the prevention of excess weight gain and obesity. *Public Health Nutr* 2004; 7:123–146