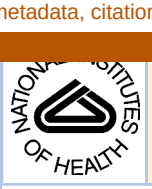

Published in final edited form as:

Gen Hosp Psychiatry. 2009 ; 31(1): 1–7. doi:10.1016/j.genhosppsych.2008.09.012.

The Impact of Obesity on Health Care Costs among Persons with Schizophrenia

Lydia A. Chwastiak, MD, MPH[1], **Robert A. Rosenheck, MD**[1], **Joseph P. McEvoy, MD**[2], **T. Scott Stroup, MD, MPH**[3], **Marvin S. Swartz, MD**[2], **Sonia M. Davis, DrPH**[4], and **Jeffrey A. Lieberman, MD**[5]

1 *Department of Psychiatry, Yale School of Medicine, New Haven CT*

2*Department of Psychiatry and Behavioral Sciences, Duke University School of Medicine, Durham NC*

3*Department of Psychiatry, University of North Carolina School of Medicine, Chapel Hill NC*

4*Department of Biostatistics, University of North Carolina, Chapel Hill NC*

5*Department of Psychiatry, Columbia University College of Physicians and Surgeons, New York NY*

Abstract

Background—Obesity is the second leading cause of preventable death in the US, and is twice as common among individuals with schizophrenia as the general population.

Methods—Data from the Clinical Antipsychotic Trials of Intervention Effectiveness, a multi-site trial of antipsychotic pharmacotherapy in 1400 patients with schizophrenia was used to examine the relationships between body mass index (BMI) and medical costs.

Results—ANCOVA analyses found significant increases in both psychiatric and non-psychiatric medication costs associated with increasing BMI, and a significant, but smaller, difference in costs of outpatient medical-surgical service utilization: $41 per month for morbidly obese patients compared to $26 per month for patients of normal weight (F=2.4, p = 0.04). In multivariable logistic regression analyses, morbid obesity was associated with significantly increased odds of any outpatient medical-surgical service costs. When compared to observations of BMI>35, BMI observations within the normal range (18.5–24.9) were half as likely to be associated with any outpatient medical-surgical costs (OR 0.53, 95% CI 0.45, 0.63).

Conclusions—In this large sample of persons with schizophrenia, obesity was associated with increased outpatient general medical service and medication costs even after controlling for demographic characteristics and medical co-morbidity, but the absolute dollar amount was small.

Keywords

obesity; schizophrenia; cost

Corresponding author: Lydia A Chwastiak, MD, MPH, Yale New Haven Psychiatric Hosptial, 184 Liberty Street, LV-119, New Haven, CT 06519, phone (203) 688-9707, fax (203) 688-9709, lydia.chwastiak@yale.edu.

Background

Obesity is the second leading cause of preventable death in the United States and a major cause of morbidity and mortality (1). The costs attributable to overweight and obesity for the entire US population have been estimated to be $92.6 billion, or 9% of total health care costs (2). The effects of obesity on health care costs exceed those of smoking or problem drinking (3). Obesity is a risk factor for diabetes (4), hypertension (5), stroke (6), and cardiovascular disease (7). Obese patients have been shown to have higher health care costs than normal weight controls, including more hospitalizations, more outpatient visits, and greater pharmacy costs (8). In one study, after controlling for age, gender, and chronic disease, a person with a body mass index (BMI) of 40 kg/m^2 consumed $115 more in health care costs per year compared with a person with a BMI of 25 kg/m^2 (9).

The prevalence of obesity among individuals with schizophrenia is 1.5–2.0 times higher than the general population (10): compared to a prevalence of 30% in the general population (11), patients with schizophrenia have rates of greater than 40% (10). Among persons with schizophrenia, obesity is associated with co-morbid hypertension and diabetes and reduced health-related functioning (12). The life expectancy of persons with schizophrenia is 20% shorter than that of the general population (13), and their mortality rate appears to be increasing (14). Cardiovascular disease and other obesity-related medical conditions play an important role in this increasing mortality rate (15).

Multiple factors contribute to obesity among persons with schizophrenia, including sedentary lifestyle, poverty, lack of healthy food options, and impaired ability to participate in medical care. Treatment with first- and second-generation antipsychotic medications can also contribute to weight gain (16). In randomized controlled trials, the estimated average weight gain at 10 weeks of active drug treatment has ranged from 0.5–5.0 kg (17). Treatment with atypical antipsychotic medications can cause a rapid increase in body weight in the first few months of therapy that may not reach a plateau even after one year of treatment (16).

Schizophrenia is a very costly disease in the US adult population, and chronic medical conditions increase the annual healthcare costs of patients with schizophrenia. For example, data from the Medical Expenditure Panel Surveys show that patients with schizophrenia and hypertension spend on average $3913 per year to treat both chronic conditions, 46% more than the $2675 they spend on schizophrenia alone (18). The relationship between obesity and health care costs has not been examined among persons with schizophrenia. The specific aim of this exploratory study was to examine the extent to which obesity contributes to health care costs (including costs of inpatient and outpatient psychiatric and medical-surgical services and medication costs) among persons with schizophrenia, after controlling for severity of medical illness and physical health status. The study utilized baseline and follow-up data from the Clinical Antipsychotic Trials of Intervention Effectiveness (CATIE) trial, an NIMH-funded, multi-site trial of antipsychotic pharmacotherapy, which involved over 1400 patients with schizophrenia at 57 sites in the US between 2001–2003 (19).

Methods

Study Design

This cross-sectional correlation analysis utilized baseline and follow-up data from the CATIE trial to examine the association between obesity and health care costs among persons with schizophrenia. Using the BMI categories adopted by the National Institutes of Health (NHLBI) and the World Health Organization (WHO), observations were classified as normal weight, overweight, obese and morbidly obese. Inpatient, outpatient and emergency room service utilization was documented at each monthly visit over the 18-month study period. ANCOVA

and multivariable logistic regression analyses were used to examine the relationships between the categories of BMI and the cost categories over all study time points (adjusting for potential confounding covariates) (20). A range of potential demographic and clinical confounders of the relationship between obesity and health care costs were examined, including age, race, gender, educational level, physical health status and (self-reported) medical co-morbidity.

Sample

The CATIE study was initiated by NIMH to compare the effectiveness of antipsychotic medications. Subjects were adult patients (age 18 to 65 years old) with a diagnosis of schizophrenia. Patients or their guardians provided written informed consent for the randomized clinical trial. Potential subjects were excluded if they had a diagnosis of schizoaffective disorder, mental retardation or other cognitive disorders; first episode of schizophrenia; past adverse reaction to a proposed treatment; treatment-resistant schizophrenia; an unstable or serious medical condition; or if they were pregnant or breastfeeding. The study was conducted from January 2001 through December 2004. The CATIE study was approved by the institutional review boards (IRB) at each of the 57 sites. The current study was approved by the IRB of the VA Connecticut Healthcare System.

Definition of terms

Body Mass Index (BMI)

Study analyses evaluated the association between BMI category and health care costs. The units used in the a nalyses were BMI observations. Baseline BMI was calculated from the baseline height and weight data, and follow-up BMI was calculated for every time point that weight data was collected during the 18-month study period (months 1, 3, 6, 9, 12, 15, and 18). Using the BMI categories adopted by the NHLBI and WHO (21–22), BMI levels were categorized as normal weight (BMI 18.5–24.9); overweight (BMI 25.0–29.9); obese (BMI 30.0–35.0), and morbidly obese (BMI >35.0).

Health care costs

These analyses evaluated direct health care costs, including costs of medication and of psychiatric and medical-surgical services. The following categories of health care costs were evaluated: outpatient mental health services, inpatient psychiatric services, outpatient medical-surgical services, inpatient medical-surgical services, study-associated (antipsychotic) medications, ancillary medications, and the total of all of these costs. Indirect costs, such as lost productivity (employment earnings) were not evaluated.

Service use was documented every month through a self-report questionnaire that recorded four kinds of inpatient hospital days (medical, surgical, psychiatric and substance abuse) across six different types of facilities (state mental hospitals, private psychiatric hospitals, VA hospitals, non-federal general hospitals, community mental health centers, and detoxification facilities). Use of 16 types of outpatient mental health services, including psychiatric and psychosocial rehabilitation services were recorded, along with eight different types of medical outpatient visits and the use of both psychiatric and medical emergency room services (20).

Costs of service utilization were estimated by multiplying the number of units of each type of health service received by the estimated local unit cost of each service, and then summing the products to reflect the total health care costs. Unit costs were estimated from published data and analysis of insurance claims files, and administrative data. Unit costs estimated for each type of service were derived from published sources from each of the 24 states in which CATIE sites were geographically located. Where only national unit cost estimates were available, they were adjusted for state wage rates (23). Cost estimates were derived from published sources

documenting inpatient costs in the various sectors in each state (24), and substance abuse treatment costs (25). Unit costs of some services were estimated using claims data from the 2002 MarketScan® dataset (26), a compilation of all mental health and medical insurance claims from over 500,000 private sector mental health service users, classified by diagnosis and CPT code. Some unit cost estimates were derived from VA administrative files (27–29). Unit costs estimated form published reports and public databases were not specific to the agencies delivering the services at each site. Estimates of service use were based on self-report and could not be independently evaluated. Faulty recall of service use, however, was minimized by frequent assessments and by probing on many different types of service.

There were two categories of medication costs in the CATIE study: study-associated antipsychotic medications which were controlled by study enrollment, and ancillary (all other) medications which were not controlled by the study. Costs of the ancillary non-psychiatric medications were based on average daily medication costs for specific agents in the 2002 MarketScan® dataset. Subjects did not incur costs from monthly study visits or study-associated laboratory assessments.

Medical Co-morbidity

The medical co-morbidity variable used for analyses was a simple count of self-reported medical diagnoses. Medical disorders reported by participants during the baseline interview were categorized into medical diagnoses according to the Medical Dictionary for Regulatory Activities (MedDRA). MedDRA is an international medical terminology which classifies medical information; it is used extensively throughout the development and regulatory cycles of pharmaceutical products and biomedical devices (30).

Physical Health Status

Physical health status was measured by the Physical Component Summary Scale (PCS) of the SF-12, the12-item questionnaire from the Medical Outcomes Study (31). Scores on the SF-12 can range from 0–100, with higher scores reflecting better physical health status. These scores have been standardized for the general population, such that a score of 50 reflects an average level of physical health, and each 10-point change in score reflects one standard deviation (31).

Analyses

The analyses for this exploratory study were conducted in three stages. The first stage involved the examination of bivariate correlations both between BMI category and demographic and clinical characteristics, and also between BMI category and the categories of health care costs over the previous month.

Second, ANCOVA was used to examine the relationships among the categories of BMI and the cost categories over all time points in which BMI was obtained (weight was measured). As the aim of this study was to generate, not test, hypotheses, a value of ($p<0.05$) was used for statistical significance, with no adjustment for multiple comparisons. As medication costs were normally distributed, mean monthly costs were evaluated. Costs of inpatient service use were highly skewed, but showed an approximately log-normal distribution. Consequently, statistical comparisons of inpatient (and therefore total) cost date were performed using a log transformation of observed cost data.

Only 28.6% of the BMI observations were associated with any outpatient medical-surgical costs—i.e., for 71.4% of observations, there were no outpatient medical-surgical costs in the previous month. Therefore, the third analysis was a logistic regression analysis evaluate whether overweight and obesity (BMI > 25) were associated with an increased likelihood of

outpatient medical-surgical costs. For the ANCOVA and logistic regression analyses, adjustment was made for potentially confounding covariates: demographic characteristics (age, race, gender); medical co-morbidity (a count of medical conditions); and physical health status (SF-12 PCS). All data analyses were conducted using the SAS software version 9.1 (SAS Institute Inc., Cary NC).

Results

The demographic characteristics of the CATIE sample, presented in Table 1, have been described previously (32). The sample of 1,460 subjects had a mean age of 40.6 (s.d. +/− 11.1),and was 74% male and 35% African-American. Subjects had, on average a mean of 2.2 (s.d. +/− 2.4) medical conditions. The mean physical functioning score on the SF-12 (PCS) for the sample was 48.6 (s.d. +/− 10.1), which is lower than 50, the normative mean for the general population (27). Mean BMI (at baseline) was 30.4 kg/m^2 (s.d. +/−7.0), with a range of 15.6 – 65.8. kg/m^2).

Mean monthly total health care costs over the 18-month study period were $1726 per month (Table 2). Bivariate analyses revealed that total health care costs were statistically significantly correlated with BMI category (rho =0.04, p =0.0003), and that outpatient medical-surgical costs also increased with increasing BMI category (rho= .08, p<0.0001). While statistically significant, the magnitude of these correlations was small. Other covariates significantly associated with higher BMI category included (female) gender, (black and Hispanic) race, increased medical co-morbidity, and poor physical health status,.

In ANCOVA analyses, after adjusting for demographic and clinical characteristics that were significant in bivariate analyses (including medical co-morbidity), higher BMI category was significantly associated with mean monthly costs of both study and ancillary medications, and of outpatient medical-surgical service use (Table 2). Higher BMI was associated with increased dose (number of capsules) of study (antipsychotic medication) (data not shown). Given the relatively low monthly outpatient medical-surgical costs of the study sample, the dollar amount of the differences was small: $41.38 per month for morbidly obese patients compared to $25.78 per month for subjects of normal weight (F=2.4, p = 0.04). Mean monthly costs of inpatient service utilization and total health care costs were not significantly associated with BMI category. Log-transformed inpatient and total costs were statistically significantly associated with BMI category, but there was not a monotonic linear trend of increasing cost with increasing BMI category in either case. There was no statistically significant difference in mean monthly costs of outpatient or inpatient mental health services.

Only 28.6% of the BMI observations were associated with any outpatient medical-surgical service utilization. A multivariable logistic regression analysis was conducted to evaluate whether obesity was associated with increased odds of any medical-surgical service use, controlling for age, gender, race, medical co-morbidity, and physical health status. In this analysis, morbid obesity (BMI >35) was associated with an increased likelihood of any outpatient medical-surgical service costs. When compared to observations of BMI > 35, BMI observations within the normal range (18.5–24.9) were half as likely to be associated with any outpatient medical-surgical costs (OR 0.53, 95% CI 0.45, 0.63). Similarly, BMI observations in the other two categories (overweight and obese) also had statistically significantly lower odds of any outpatient medical-surgical costs, when compared to observations of BMI >35. The odds ratio for overweight (BMI 25.0–29.9) was 0.62 (95% CI 0.54, 0.72); and the odds ratio for obesity (BMI 30–35.0) was 0.72 (95% CI 0.62, 0.83), when compared to observations of morbid obesity (BMI >35).

Discussion

In this large sample of persons with schizophrenia, obesity was associated with increased health care costs even after controlling for medical co-morbidity. The most significant differences in health care costs across BMI categories were in costs of medications, both study-associated (antipsychotic) medications and ancillary medications, including those used to treat chronic medical conditions. The difference in the costs of these ancillary medications for morbidly obese subjects compared to normal weight subjects was about $700 per year (mean monthly costs of $105 compared to $47). These findings are consistent with previous literature demonstrating that, over relatively short time frames (such as the 18-month CATIE study period), the increased costs of medical care are primarily due to medication costs (9). While it might be expected that costs of non-psychiatric medication would be higher among overweight and obese patients, it is a bit surprising that the costs of study-associated antipsychotic medications were also higher. Further analyses revealed that the mean dose of study medication increased with increasing BMI category, but these analyses cannot determine the direction of the relationship. It is possible that either obese subjects received higher doses of (antipsychotic) medications, or that subjects receiving higher doses gained more weight.

With log transformation, total health care costs were associated with BMI, but there was not a monotonic linear trend of increasing costs with increasing BMI. This suggests a fairly weak effect of obesity on total health care costs among patients with schizophrenia. There are a number of factors that determine health care costs in this clinically complex population, but in this study, total costs were driven mainly by inpatient psychiatric service utilization. It is important, though, that increasing BMI was statistically significantly associated with increased outpatient medical-surgical service utilization costs, even after controlling for demographic characteristics and medical co-morbidity. The percentage increase in costs (25%) is consistent with previous published reports of costs of obesity in the general population (33), but the absolute dollar amount in this study was quite small, dwarfed by the costs attributable to medications and inpatient psychiatric service utilization.

The lack of a larger effect of BMI on medical-surgical service utilization costs may reflect some limitations of this study. First, the time frame of the CATIE study was 18 months, which may not be long enough to capture the medical costs associated with obesity, in particular inpatient medical costs. Second, in order to evaluate an independent association between obesity and costs, analyses controlled for medical co-morbidity. The method of evaluating co-morbidity (a count of self-reported illnesses) has limitations, as self-report may be particularly problematic among persons with schizophrenia, and a simple count of diagnoses may not perform as well as other more complex indices. Moreover, controlling for medical co-morbidity may underestimate the true relationship between obesity and medical costs, as a large proportion of medical costs are attributable to obesity-related conditions, such as diabetes. In one large study of the costs associated with obesity, five obesity-related diseases (hypertension, dyslipidemia, diabetes, coronary artery disease, and stroke) accounted for approximately 85% of the economic burden of obesity (9). This was not the case in this sample. To address this question, the ANCOVA analysis of outpatient medical –surgical costs was repeated without controlling for medical co-morbidity. While the difference between morbid obesity and the other BMI categories was more robust ($F=15.36$, $p<0.0001$), the magnitude of differences in the costs was not large (normal weight $21 per month; morbid obesity $34 per month).

Finally, and perhaps most importantly, it may be difficult to see a large effect of obesity on outpatient medical-surgical costs because these costs were small among CATIE subjects. Subjects in the CATIE study were relatively young (mean age 40.6), and the findings of an association between obesity and health care costs may have been more robust in an older sample. Also, subjects in the CATIE study had frequent (monthly) study visits, which may

have decreased their utilization of medical services, in particular emergency room services. Moreover, despite intense efforts to include a broad range of subjects in the CATIE trial, some individuals who may have had particularly high health care costs were excluded form the study: those with serious or unstable medical conditions, cognitive disorders, or treatment-resistant schizophrenia.

These small costs of outpatient medical-surgical service utilization, however, do not appear to be explained by a lack of need for medical care, as subjects had, on average, more than two chronic medical conditions. It is more likely that this reflects an under-utilization of necessary medical care by persons with serious mental illness, as has been reported by previous studies (34). The current study identified an association between obesity and increasing costs associated with chronic medical illness (medications and outpatient medical-surgical service use) among persons with schizophrenia, which were small in magnitude. Future research should examine health care costs over longer time periods, and the indirect costs of obesity in this population.

Acknowledgements

This article was based on results from the Clinical Antipsychotic Trials of Intervention Effectiveness project, supported by the National Institute of Mental Health (NO1 MH90001). The aim of this project is to examine the comparative effectiveness of antipsychotic drugs in conditions for which their use is clinically indicated, including schizophrenia and Alzheimer's disease. The project was carried out by principal investigators from the University of North Carolina, Duke University, the University of Southern California, the University of Rochester,and Yale University in association with Quintiles, Inc.; the program staff of the Division of Interventions and Services Research of the NIMH; and investigators from 56 sites in the United States (CATIE Study Investigators Group). AstraZeneca Pharmaceuticals LP, Bristol-Myers Squibb Company, Forest Pharmaceuticals, Inc., Janssen Pharmaceutica Products, L.P., Eli Lilly and Company, Otsuka Pharmaceutical Co., Ltd., Pfizer Inc., and Zenith Goldline Pharmaceuticals, Inc., provided medications for the studies. The Foundation of Hope of Raleigh, NC also supported this work.

Abbreviations used in text

CATIE
: Clinical Antipsychotic Trials of Intervention Effectiveness

BMI
: body mass index

ANCOVA
: analysis of covariance

References

1. Must A, Sandano J, Coakley EH, Field AE, Colditz G, Dietz WH. The disease burden associated with overweight and obesity. JAMA 1999;282:1523–1529. [PubMed: 10546691]
2. Finkelstein EA, Fiebelkorn IC, Wang G. National medical spending attributable to overweight and obesity: how much, and who's paying? Health Aff 2003;22:219–226.
3. Sturm R. The effects of obesity, smoking and drinking on medical problems and costs. Health Aff 2002;21:245–254.
4. Colditz GA, Willett WC, Rotnitzky A, Manson JE. Weight gain as a risk factor for clinical diabetes in women. Ann Intern Med 1995;122:481–486. [PubMed: 7872581]
5. Huang Z, Willett WC, Manson JE, Rosner B, Stampfer MJ, Speizer FE, Colditz GA. Body weight change and risk for hypertension in women. Ann Intern Med 1998;128:81–88. [PubMed: 9441586]
6. Rexrode KM, Hennekens CH, Willett WC, Colditz GA, Stampfer M, Rich-Edwards JW, Speizer FE, Manson JE. A prospective study of body mass index, weight change, and risk of stroke in women. JAMA 1997;277:1539–1545. [PubMed: 9153368]

7. Manson JE, Colditz GA, Stampfer MJ, Willett WC, Rosner B, Monson RR, Speizer FE, Hennekens CH. A prospective study of obesity and risk of coronary heart disease in women. N Engl J Med 1990;322:882–889. [PubMed: 2314422]
8. Flegal KM, Graubard BI, Williamson DF, Gail MH. Excess deaths associated with underweight, overweight, and obesity. JAMA 2005;293:1861–1867. [PubMed: 15840860]
9. Raebel MA, Malone DC, Conner DA, Xu S, Porter JA, Lanty FA. Health services use and health care costs of obese and nonobese individuals. Arch Intern Med 2004;117:738–746.
10. Allison DB, Fontaine KR, Heo M, Mentore JL, Cappelleri JC, Chandler LP, Weiden PJ, Chesin LJ. The distribution of body mass index among individuals with and without schizophrenia. J Clin Psychiatry 1999;60:215–220. [PubMed: 10221280]
11. Flegal KM, Carroll MD, Ogden CL, Johnson CL. Prevalence and trends in obesity among US adults 1999–2000. JAMA 2002;288:1723–1727. [PubMed: 12365955]
12. Dickerson FB, Brown CH, Kreyenbuhl JA, Fan GL, Goldberg RW, Wolheiter K, Dixon LB. Obesity among individuals with serious mental illness. Acta Psychiatr Scand 2006;113:306–313. [PubMed: 16638075]
13. Newman SC, Bland RC. Mortality in a cohort of patients with schizophrenia: a record linkage study. Can J Psychiatry 1991;36:239–245. [PubMed: 1868416]
14. Goff DC, Cather C, Evins AE, Henderson DC, Freudenreich O, Copeland PM, Bierer M, Duckworth K, Sachs FM. Medical morbidity and mortality in schizophrenia: guidelines for psychiatrists. J Clin Psychiatry 2005;66:183–94. [PubMed: 15705003]
15. Goff DC, Sullivan LM, McEvoy JP, Meyer JM, Nasrallah HA, Daumit GL, Lamberti S, D'Agostino RB, Stroup TS, Davis S, Lieberman JA. A comparison of ten-year cardiac risk estimates in schizophrenia patients from the CATIE study and matched controls. Schizophrenia Research 2005;80:45–53. [PubMed: 16198088]
16. Allison DB, Mentore JL, Heo M, Chandler LP, Cappelleri JC, Infante MC, Weiser PJ. Antipsychotic-induced weight gain: a comprehensive research synthesis. Am J Psychiatry 1999;156:1686–1696. [PubMed: 10553730]
17. Allison DB, Casey DE. Antipsychotic-induced weight gain: a review of the literature. J Clin Psychiatry 2001;62 (Suppl 7):22–31. [PubMed: 11346192]
18. McDonald M, Hertz RP, Lusik MB, Unger AN. Healthcare spending among community-dwelling adults with schizophrenia. Am J Manag Care 2005;11:S242–S247. [PubMed: 16180962]
19. Stroup TS, McEvoy JP, Swartz MS, Byerly MS, Glick ID, Canive JM, McGee MF, Simpson GM, Stevens MC, Liberman JA. The National Institute of Mental Health Clinical Antipsychotic Trials of Intervention Effectiveness (CATIE) project: schizophrenia trial design and protocol development. Schizophr Bull 2003;29:15–31. [PubMed: 12908658]
20. Rosenheck RA, Leslie D, Sindelar J, Miller EA, Lin H, Stroup S, McEvoy J, Davis S, Keefe RSE, Swartz M, Perkins D, Hsiao J, Lieberman JA. Cost-Effectiveness of Second Generation Antipsychotics and Perphenazine in a Randomized Trial of Treatment for Chronic Schizophrenia. American Journal of Psychiatry 2006;163(12):2080–2089. [PubMed: 17151158]
21. NHLBI Expert Panel on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults. Clinical guidelines on the identification, evaluation, and treatment of overweight and obesity in adults—the evidence report. Obes Res 1998;6(suppl2):51S–209S. [PubMed: 9813653]
22. World Health Organization. Physical status: the use and interpretation of anthropometry: report of a WHO Expert Committee. World Health Organ Tech Rep Ser 1995;854:1–452. [PubMed: 8594834]
23. Bureau of Labor Statistics, U.S. Department of Labor. Occupational Outlook Handbook, Bulletin 2540. Vol. 2004–05. Washington, D.C.: U.S. Department of Labor; 2005.
24. National Association of State Mental Health Program Directors. Table 19: SMNHA Mental Health —Controlled Expenditures Per Inpatient Day, All Civil (Voluntary and Involuntary) Patients in State Psychiatric Hospitals Receiving Mental Health Services by Age and State, FY. Alexandria, VA: National Association of State Mental Health Program Directors; 2002.
25. U.S. Department of Health and Human Services. The ADSS Cost Study: Costs of Substance Abuse Treatment in the Specialty Sector. Washington, D.C.: U.S. Department of Health and Human Services; 2004 June 18.

26. Thompson Medstat Group. Marketscan Communical Claims and Encounters Database. Ann Arbor, Michigan: The Thompson Medstat Group; 2002.

27. Barnett PG. Review of methods to determine VA health care costs. Medical Care 1999;37(Suppl Va):AS 9–17.

28. Greenberg, G.; Rosenheck, RA. National Mental Health Program Performance Monitoring System: Fiscal Year 2002 Report. West Haven, CT: Northeast Program Evaluation Center; 2003.

29. Neale, M.; Rosenheck, R.; Martin, A.; Morrissey, J.; Castrodonatti, J. Mental Health Intensive Case Management (MHICM): The Sixth National Performance Monitoring Report: FY 2003. West Haven, CT: Northeast Program Evaluation Center; 2004.

30. MedDRA®, the Medical Dictionary for Regulatory Activities terminology is the international medical terminology developed under the auspices of the International Conference on Harmonization of Technical Requirements for Registration of Pharmaceuticals for Human Use (ICH).

31. Ware, JE.; Kosinski, M.; Keller, SE. How to score the SF-12 Physical and Mental Health Summary Scales. Vol. 3. Lincoln, RI: Quality Metric Inc; 1998.

32. Lieberman JA, Stroup TS, McEvoy JP, Swartz MS, Rosenheck RA, Perkins DO, Keefe RS, Davis SM, Davis CE, Lebowitz BD, Severe J, Hsaio JK. Effectiveness of antipsychotic drugs in patients with chronic schizophrenia. N Engl J Med 2005;353:1209–1223. [PubMed: 16172203]

33. Roux L, Donaldson C. Economics and obesity: costing the problem or evaluating solutions? Obes Res 2004;12:173–179. [PubMed: 14981208]

34. Cradock-O'Leary J, Young AS, Yano EM, Wang M, Lee ML. Use of general medical services by VA patients with psychiatric disorders. Psychiatric Services 2002;53:874–878. [PubMed: 12096172]

Table 1

Baseline Demographic and Clinical Characteristics of CATIE Subjects (n=1460).

Characteristic	Mean +/− standard deviation or Number (%)
Demographics	
Age (years)	40.6 +/− 11.1
Gender –number (%)	
Male	1080 (74)
female	380 (26)
Race—number (%)	
White	874 (60)
Black	513 (35)
Other	71(5)
Spanish, Hispanic, or Latino ethnicity –number (%)	170(12)
Education—years	12.1 +/− 2.3
Marital status—number (%)	
Married	167(11)
Previously married	425(29)
Never married	868 (59)
Unemployed—number (%)[1]	1217 (85)
Clinical characteristics	
Years since first antipsychotic medication prescribed	14.4+/−10.7
Baseline medical diagnoses—number	2.2 +/− 2.4
Specific medical diagnoses--number (%)	154(11)
Diabetes (type 1 or 2)	204(14)
Hyperlipidemia	289(20)
Hypertension	

[1] Percentage based on the number of patients with data available (n=1435)

Table 2

ANCOVA analyses of health care costs across BMI categories (controlling for age, race, gender, medical co-morbidity and physical health status (SF-12 PCS).

Cost category	Mean monthly costs					F	p
	Total (n= 8718 observations)	Normal weight (BMI=18.5–24.9) (n= 1756)	Overweight (BMI 25.0–29.9) (n=2730)	Obese (BMI 30–35) (n=2141)	Morbidly obese (BMI>35) (n=1891)		
Costs of outpatient mental health services	$343	$294	$341	$356	$376	0.71	0.54
Costs of inpatient mental health services	$569	$737	$550	$477	$526	1.07	0.36
Costs of outpatient medical-surgical services	**$31**	**$26**	**$25**	**$32**	**$41**	**2.4**	**0.04**
Costs of inpatient medical services	$118	$142	$74	$108	$171	0.31	0.82
Log-transformed costs of inpatient (psychiatric and medical-surgical) services	**0.72**	**0.94**	**0.73**	**0.58**	**0.64**	**3.75**	**0.0001**
Costs of study drugs	**$478**	**$450**	**$467**	**$479**	**$516**	**5.06**	**<0.001**
Costs of all drugs (study and ancillary)	**$556**	**$497**	**$537**	**$565**	**$621**	**17.65**	**<0.001**
Total health care costs	$1726	$1831	$1691	$1632	$1791	0.69	0.55
Log-transformed total health care costs	**6.75**	**6.76**	**6.69**	**6.71**	**6.84**	**9.79**	**<0.001**