The Economic Burden of Schizophrenia in the United States in 2002

Eric Q. Wu, Ph.D.; Howard G. Birnbaum, Ph.D.;
Lizheng Shi, Ph.D.; Daniel E. Ball, M.B.A.; Ronald C. Kessler, Ph.D.;
Matthew Moulis, B.A.; and Jyoti Aggarwal, M.H.S.

Objective: This study quantifies excess annual costs associated with schizophrenia patients in the United States in 2002 from a societal perspective.

Method: Annual direct medical costs associated with schizophrenia were estimated separately for privately (N = 1090) and publicly (Medicaid; N = 14,074) insured patients based on administrative claims data, including a large private claims database and the California Medicaid program (Medi-Cal) database, and compared separately to demographically/geographically matched control samples (1 case:3 controls). Medicare costs of patients over age 65 years were imputed using the Medicare/Medi-Cal dual-eligible patients (N = 1491) and published statistics. Excess annual direct non–health care costs were estimated for law enforcement, homeless shelters, and research/training related to schizophrenia. Excess annual indirect costs were estimated for 4 components of productivity loss: unemployment, reduced workplace productivity, premature mortality from suicide, and family caregiving using a human capital approach based on market wages. All costs were adjusted to 2002 dollars using the Medical Care Consumer Price Index and were based on the reported prevalence in the National Comorbidity Survey Replication.

Results: The overall U.S. 2002 cost of schizophrenia was estimated to be $62.7 billion, with $22.7 billion excess direct health care cost ($7.0 billion outpatient, $5.0 billion drugs, $2.8 billion inpatient, $8.0 billion long-term care). The total direct non–health care excess costs, including living cost offsets, were estimated to be $7.6 billion. The total indirect excess costs were estimated to be $32.4 billion.

Conclusion: Schizophrenia is a debilitating illness resulting in significant costs. The indirect excess cost due to unemployment is the largest component of overall schizophrenia excess annual costs.

(J Clin Psychiatry 2005;66:1122–1129)

The American Psychiatric Association (APA) Guidelines[1] define schizophrenia as a chronic and debilitating mental illness in which patients often have a diminished capacity for learning, working, self-care, interpersonal relationships, and maintaining general living skills. Crown et al.[2] estimate that 40% to 60% of schizophrenia patients are likely to suffer from lifelong impairments. Kessler et al.[3] state that schizophrenia affects a minimum of 0.5% (range, 0.3%–1.6%) of the U.S. population, although they note that this survey-based prevalence estimate is a lower bound due to the underrepresentation of schizophrenia patients in epidemiologic surveys.

Previous U.S. cost-of-illness studies have documented that schizophrenia is a costly disease. Cost-of-schizophrenia studies in the early 1990s by Wyatt et al.[4] and Rice and Miller[5] estimated the annual costs of schizophrenia to be $65 billion and $33 billion, respectively. These estimates should be considered as measures of the economic impact of the disease to society, i.e., excess costs of patients with schizophrenia compared to their costs had they never had schizophrenia. The 2 studies' estimates of total direct costs were similar, in the range of $18 billion to $19 billion. The discrepancy between their total cost estimates arises mainly from differences in estimated indirect costs due to inclusion of different cost components, application of different methodologies, and use of different data sources. For example, to estimate lost earnings from premature mortality, Wyatt et al.[4] applied a steady-state methodology, whereas Rice and Miller[5] projected the earnings for the duration of the patient's life, had that person not committed suicide, and discounted the results to 1990 values.

Furthermore, Wyatt et al.[4] considered both the lost income and the lost productivity of unpaid work, nonmonetary production, and homemaking due to schizophrenia, while Rice and Miller[5] accounted only for lost income. Additionally, Wyatt et al.[4] used annual prevalence for the calculation of direct health care costs and lifetime prevalence for the calculation of all other cost components, whereas Rice and Miller[5] used annual prevalence for all cost estimates.

The research presented in this article draws on aspects of both the Wyatt et al.[4] and Rice and Miller[5] studies, as described below. In addition to reconciling these studies' estimates by selectively combining both estimation approaches, it is important to update the Wyatt et al.[4] and Rice and Miller[5] studies because the empirical data underlying their analyses are obsolete. Over the past decade, a new generation of antipsychotic drugs, generally referred to as atypical antipsychotics, has entered the market. Compared with conventional antipsychotics, the atypical antipsychotics have been effective at treating positive and negative symptoms with fewer side effects in the extrapyramidal system and may reduce the risk of relapse, as suggested by the APA guidelines.[1] These advances may have changed treatment patterns and potentially altered the associated resource utilization and cost profile of patients with schizophrenia.

On the basis of the above considerations, the objective of this study is to provide current estimates of the excess costs of patients with schizophrenia in the United States compared to the general population. This information is critical to improve awareness of this devastating disease and to help guide decision makers as they allocate resources for mental health services.

METHOD

This study examined total excess societal costs (consisting of direct health care costs, direct non–health care costs, and indirect costs) associated with patients with schizophrenia in the United States in 2002. A prevalence-based approach is used to quantify the costs associated with this illness. The prevalence rate was estimated based on the Kessler et al.[3] analysis of the National Comorbidity Survey Replication data and epidemiologic literature. The midpoint of the range estimated by Kessler et al.[3] was used to estimate prevalence. Costs were estimated based on primary retrospective data analysis whenever possible. When it was necessary to incorporate estimates from previous publications in the core analysis, a mean or weighted mean of previous estimates was adopted if more than one source of secondary data was identified.

Direct Health Care Costs

Schizophrenia patients are covered by a variety of insurance plans (i.e., private insurance, Medicaid, Medicare). The discussion below describes the approach used here to estimate the direct health care costs (i.e., drugs and medical services) of schizophrenia patients using retrospective analyses of private insurance claims data and the paid claims data of the California Medicaid program (Medi-Cal), as measured by the actual amount paid to the health care providers. In addition, there is discussion of the direct costs of schizophrenia patients without insurance coverage. The private claims database used for this purpose contains detailed administrative information for approximately 3 million beneficiaries (employees, retirees, spouses, and dependents) from 17 large companies with national operations in the United States from 1999 to 2003. The companies operate in a broad array of industries and occupations and include a broad range of types of insurance (i.e., preferred provider organization, health maintenance organization, managed fee-for-service) and many plans that encompass a wide array of mental health coverage. While the database may not be exactly representative of the entire employed U.S. population, it is very diverse and has been used in a variety of cost-of-illness analyses in the mental health area.[6,7] The direct cost analyses using these data were restricted to beneficiaries less than age 65 years, because medical services are primarily covered by Medicare beyond this threshold.

The Medicaid administrative claims data used in this analysis consisted of a 20% random sample from the Medi-Cal paid claims database from 2000 to 2003. This database includes approximately 2 million beneficiaries. Both the private and Medicaid claims data contain information on diagnoses, procedures, prescription drugs, physician visits, hospitalizations, long-term care services, and patient demographics. In addition, the Medi-Cal database includes information about Medicare copayment and deductible amounts for patients covered by both Medicare and Medicaid (i.e., dual-eligible patients). Because the Medicaid benefit was calculated based on Medicare copayment and deductible amounts, these data should yield reliable information on Medicare paid amounts. All costs were adjusted to 2002 dollars using the Medical Care Consumer Price Index.

Patients were identified from the private and Medi-Cal data as individual enrollees with at least 1 diagnosis of schizophrenia (ICD-9 code: 295.xx). In both data sources, the study samples were limited to schizophrenia patients who were continuously eligible for health insurance benefits for a minimum of 12 months after their first observed schizophrenia diagnosis in the database (i.e., the index date). The index diagnosis can be either from an inpatient claim or from an outpatient claim. Both the employed and Medi-Cal databases include monthly enrollment information, so the algorithm on which the patient-selection method was based relied on measures of positive enrollment.

Schizophrenia patients (N = 1090) were matched to nonschizophrenia beneficiaries based on available demo-

graphic information (i.e., age, sex, and geographic region) using the private claims database. The Medi-Cal schizophrenia patients (N = 14,074) were similarly matched based on age, sex, Medicare status, and zip code. The matched nonschizophrenia sample was randomly selected using a 1 case:3 controls matching ratio. Barnett el al.[8] applied a similar approach in previous research.

Health care costs were estimated from a societal perspective and were calculated based on insurance payments for medical service (i.e., outpatient, inpatient, long-term care, etc.), prescription drugs, and patient out-of-pocket costs (i.e., deductible and copayments).Per-patient annual health care costs were calculated based on a 12-month period after the index date. The 6-week period following the index date was excluded from the cost estimates a priori to avoid an upward bias in costs due to an increase in health care utilization associated with the index date event. Patients' week-by-week mean direct health care costs were plotted for a visual inspection of the cost varying over time. An inspection of the direct health care cost variation over time of the study sample showed that the mean health care cost increased significantly around the index date and reduced to a stable level after week 6. Therefore, paired t tests were further conducted to assess the existence of cost difference between week 6 and week 7 and week 7 and week 8. For the study sample of the private insurance plan, there were no significant differences in the mean direct health care costs between week 6 and week 7 (p = .23) or between week 7 and week 8 (p = .54). The test results for the Medi-Cal patient sample were similar. Therefore, the 6-week washout period was determined to be sufficient to avoid an upward cost estimate bias at the beginning of the treatment episode. Costs for the remaining 12-month period were annualized.

Excess annual health care costs of patients with schizophrenia were estimated as the difference in mean annual costs between schizophrenia patients and their matched controls. Excess annual health care costs of patients with schizophrenia were estimated separately for privately and publicly insured patients (i.e., Medicaid and Medicare). The direct health care costs of uninsured schizophrenia patients were difficult to estimate due to lack of data. Under the hypothesis that these patients visit health care providers much less frequently than insured patients, we assumed for the core analysis that uninsured patients with schizophrenia incurred no excess direct health care costs.

Private insurance and Medicaid costs for patients less than age 65 years were estimated directly from the private and Medi-Cal databases. Direct health care costs of Medicare patients over age 65 years were estimated based on the medical claims of Medicare/Medicaid dual-eligible patients in the Medi-Cal database (N = 1491). Actual Medicare claims files were not used for this analysis; instead, we imputed Medicare costs as follows. For Medi-

care Part A services, Medicare paid amounts were estimated using ICD-9–specific mean cost statistics published by the Centers for Medicare & Medicaid Services.[9] For Medicare Part B payments, an algorithm was developed to impute the Medicare paid amount based on Medicare copayments and the published Medicare Part B reimbursement schedule. The total direct health care costs of Medicare/Medicaid dual-eligible patients were estimated as the combination of Medicare paid amounts, Medicaid paid amounts, and patient out-of-pocket costs and were used as a proxy for the direct health care costs of all schizophrenia patients with Medicare coverage.

Direct health care costs of Medicare patients under age 65 years cannot be reliably estimated since their Medicare eligibility (i.e., disability status) may be the result of having schizophrenia. More specifically, schizophrenia patients under age 65 years who were eligible for Medicare due to disability may not have been eligible for Medicare coverage had they not had schizophrenia. Therefore, the nonschizophrenia under age 65 years Medicare population may not be a representative control group. Instead, the mean excess costs of Medicare patients over age 65 years were used to impute the excess cost for an average Medicare beneficiary under age 65 years. While this may create some degree of age-related upward bias, it is more likely an underestimate given that Medicare patients under age 65 years are more typically disabled and costly patients.

Since they were not nationally representative, California Medicare and Medicaid costs were adjusted to represent national mean costs by using state-specific mean per-enrollee costs published by the Centers for Medicare & Medicaid Services.[9]

Direct Non–Health Care Costs

Direct excess non–health care costs were estimated for law enforcement, homeless shelters, and research and training related to schizophrenia. Law enforcement–related statistics and costs were obtained primarily through the U.S. Bureau of Justice Statistics[10] and the Criminal Justice Institute, Inc.[11] Research and training-related statistics were available from the National Institute of Mental Health.[12] Information available through these institutions was supplemented with data extracted from the literature. This review of secondary data sources allowed for the estimation of nonmedical direct costs in the schizophrenia population.

To calculate direct non–health care costs, we assumed, as stated by Wyatt et al.,[4] that a proportion of the direct nonmedical costs within the schizophrenia population would have occurred regardless of their schizophrenia status. This assumption was adjusted by calculating the excess costs of schizophrenia. For example, the rate of homelessness in the nonschizophrenia population was subtracted from the rate of homelessness in the schizophrenia population in order to obtain an excess rate of

homelessness in the schizophrenia population. This process involved combining data from a variety of sources.

Direct Cost Offsets

The schizophrenia population in inpatient programs, nursing homes, shelters, jails, and prisons would still incur basic living costs such as food, clothing, and lodging if they had not been in these settings. Therefore, Wyatt et al.[4] deducted an estimated cost-of-living amount from total excess direct costs. This approach was used in this analysis. The cost offsets for cost of living were estimated using the 2002 poverty level for an individual less than age 65 years as reported by the U.S. Census Bureau.[13] The mean cost of shelter stay is generally lower than the poverty level, and shelter residents are typically otherwise homeless with nominal expense. Basic living costs for individuals staying in homeless shelters were therefore assumed to be zero in this analysis, which implies zero direct cost offsets of living for these patients.

Indirect Costs

Excess indirect annual costs resulting from schizophrenia were estimated separately for 4 distinct components of productivity loss: increased unemployment, reduced workplace productivity, premature mortality from suicide, and family member caregiving time. Indirect costs due to schizophrenia were estimated following a human capital approach, which assumes productivity to be valued at individuals' market earnings.

First, on the basis of published studies,[14–16] the employment-to-population ratio of patients with schizophrenia was estimated at 21.3%. This ratio was lower than the employment-to-population ratio for the general population in 2002 (62.7%).[17] The resulting excess productivity loss was estimated as the lost earnings due to excess unemployment of the schizophrenia population using the mean annual wage of 2002 reported by the U.S. Bureau of Labor Statistics[18] for the employed population in the United States. Second, the published productivity weights of schizophrenia patients[19] were used to determine the lost productivity resulting from both work absenteeism and presenteeism for the employed schizophrenia population. Third, the present value of lost earnings due to premature mortality was based on suicide and employment rates reported in the literature, data available through the National Center for Health Statistics,[20] and wage information reported by the U.S. Bureau of Labor Statistics.[18] Projected future earnings lost due to premature mortality among schizophrenia patients were discounted to 2002 values using a 3% discount rate.[21] Finally, caregiver productivity costs were estimated based on family caregivers' reported time providing care to patients with schizophrenia[22] and the mean hourly wage earned by an employed individual in 2002 reported by the U.S. Bureau of Labor Statistics.[18]

In this study, a human capital approach was applied to estimate the indirect cost to society as unemployment and reduced productivity at work associated with schizophrenia. We did not include disability payments, costs of low-income housing support, or any other type of government subsidy in the indirect cost calculation since these transfer payments from the government to the schizophrenia patients did not reflect true cost to society. For example, schizophrenia patients with disability will experience work loss and reduced income that can lead to disability payments and government support for low-income housing. Had they not had schizophrenia, these patients would have worked and received average incomes as the rest of the U.S. population; no government subsidy would have been provided to them. Therefore, the disability and low-income housing cost to society has already been covered by the indirect (i.e., productivity and work loss) cost calculation. Including these payments in addition to the indirect costs would lead to double counting of schizophrenia costs to society.

Sensitivity Analyses

To assess the robustness of the cost estimates from this analysis, sensitivity analyses were conducted on key parameters or parameters with the greatest uncertainty. The values of these parameters were set at the lowest and highest levels reported in the literature, respectively, with other parameters held constant. More specifically, we evaluated the sensitivity of schizophrenia total excess cost estimates to different annual prevalence rates (0.3% and 1.6%) of schizophrenia, alternative discount rates (0% and 5%) of future income, percentages of schizophrenia patients in regular contact with family caregivers (50% and 80%), alternative imputed value of the per-patient direct health care cost (i.e., Medicaid per-patient mean health care costs) for uninsured schizophrenia patients, alternative patient-selection criteria for the samples used to estimate per-patient direct medical costs, and alternative imputed values of the per-patient direct health care costs for the Medicare population under age 65 years. In the last sensitivity analysis, per-patient direct medical costs for the privately insured under age 65 years population were used to estimate the lower bound of costs.

RESULTS

The excess costs associated with schizophrenia in the United States in 2002 were estimated to be $62.7 billion (Table 1).

Direct Health Care Costs

The total excess direct health care costs of individuals suffering from schizophrenia in 2002 were estimated to be about $22.7 billion, or 36% of the total excess costs associated with the disease. Figure 1 illustrates the pro-

Table 1. Excess Costs of Schizophrenia in the United States in 2002[a]

Type of Cost	Cost, $ (in millions)
Direct health care costs	
Drugs	5,043
Outpatient care/professional fees	6,951
Hospital inpatient stays and services	2,764
Long-term care	7,967
Total direct health care costs	22,726
Direct non–health care costs	
Law enforcement	2,637
Research and training	291
Homeless shelters	6,397
Total direct non–health care costs	9,325
Direct cost offsets	(1,739)
Indirect costs	
Unemployment	21,644
Reduced productivity at work	1,734
Premature mortality (suicide)	1,100
Caregiver	7,899
Total indirect costs	32,378
2002 Total excess costs	62,689

[a]Results were calculated using a prevalence rate of 5.1 per 1000 lives in the U.S. population.

Figure 1. Excess Direct Health Care Costs for Patients With Schizophrenia in the United States in 2002 ($22.7 billion)

Table 2. Excess Annual Direct Health Care Costs Per Patient in the United States in 2002

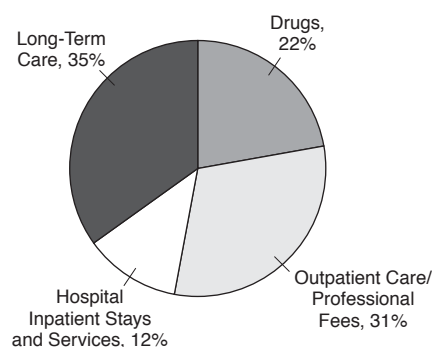| Cost Component	Private Health Insurance, $	Medicaid Only, $	Medicare and Dual Eligible, $	Mean
Drugs	2,357	6,484	4,504	3,432
Outpatient care/ professional fees	2,914	10,529	4,209	4,730
Hospital inpatient stays and services	3,355	3,201	1,516	1,881
Long-term care	121	1,863	21,402	5,422
Total	8,747	22,077	31,631	15,464

portion of excess direct health care costs attributable to drugs, outpatient care/professional fees, hospital inpatient stays and services, and long-term care.

Patient-level excess costs for individuals with private health insurance, Medicaid, and Medicare coverage are presented in Table 2. An average privately insured schizophrenia patient cost $8747 more than a control patient in 2002. The estimated excess annual per-patient cost for patients with schizophrenia enrolled in Medicaid was $22,077 versus $31,631 for Medicare patients.

The weighted mean (of the privately insured [16%], Medicare [22%], Medicaid [32%], and uninsured [30%] schizophrenia population) per-patient excess direct health care costs was estimated at $15,464. This estimate comprised drug costs ($3432), outpatient care and professional fees ($4730), hospital inpatient stays and services ($1881), and long-term care ($5422).

Direct Non–Health Care Costs

Excess non–health care costs were estimated at approximately $9.3 billion in 2002 for schizophrenia-related law enforcement, research and training, and homeless shelter living (Table 1). These costs represent approximately 15% of the total excess costs associated with schizophrenia. The prevalence of schizophrenia in the homeless population of the United States was estimated to be 21.4%.[23–27] Homeless shelter costs contributed approximately $6.4 billion to the excess annual costs of schizophrenia. Schizophrenia-related law enforcement and research and training contributed approximately $2.6 billion and $0.3 billion, respectively, to the total excess annual cost of patients with schizophrenia.

Direct Cost Offsets

The total excess number of individuals living in mental health inpatient settings, nursing homes, and prisons or jails was over 187,000 individuals daily in 2002, resulting in cost-of-living offsets of approximately $1.7 billion. These cost offsets were deducted from the other direct cost estimates to obtain the overall direct societal costs.

Indirect Costs

Total excess costs of productivity loss due to schizophrenia were estimated at $32.4 billion, representing 52% of all schizophrenia-related costs. Increased unemployment due to schizophrenia resulted in a cost of over $21.6 billion and was the largest contributor to the total excess indirect costs (Figure 2). Additionally, lost productivity costs due to reduced workplace productivity, premature mortality, and additional caregiving were approximately $1.7 billion, $1.1 billion, and $7.9 billion, respectively. The mean per-patient excess indirect cost was estimated at $22,032.

Sensitivity Analysis

Input parameter values and assumptions are key drivers of the estimated costs of schizophrenia in 2002. The extent to which these assumptions influence estimates was determined through several sensitivity analyses.

Figure 2. Excess Indirect Costs for Patients With
Schizophrenia in the United States in 2002 ($32.4 billion)
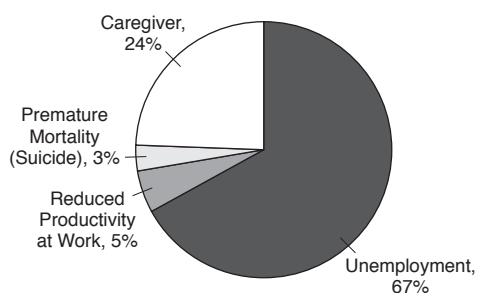
First, we varied the schizophrenia prevalence rates in the United States using the range provided in the epidemiologic literature.[3] Application of the lower (0.3%) and upper bound (1.6%) values of schizophrenia prevalence rate in this analysis resulted in excess schizophrenia cost estimates of $39.9 billion and $180.8 billion, respectively.

A second sensitivity analysis was conducted by varying the 3% discount rate used in the estimation of lost productivity costs resulting from premature mortality or suicide. The use of a 0% discount rate increased total excess costs of schizophrenia to $64.1 billion. Use of a 5% discount rate reduced the total excess cost of schizophrenia to $62.3 billion.

A review of the literature indicated that 50% to 80% of individuals with schizophrenia have regular contact with family caregivers. A sensitivity analysis applying the lower and upper bound estimates of the family caregiver contact rate results in a decrease and increase of 23%, respectively, in lost productivity costs due to caregiving. The corresponding estimated total excess costs of schizophrenia were $60.9 billion and $64.5 billion, respectively.

Capturing the health care costs associated with the medically uninsured is difficult due to a lack of information. The exclusion of such costs (we assumed that uninsured schizophrenia patients had zero direct health care costs) from this analysis may underestimate societal direct health care costs. We conducted a sensitivity analysis using the mean Medicaid patient direct health care costs to impute those of the uninsured patients. This approach increased the excess direct health care costs and excess total costs associated with schizophrenia to approximately $30.8 billion and $70.8 billion, respectively.

The criterion of a single diagnosis of schizophrenia was used to identify the study sample in the core analysis when calculating direct health care cost. Some misdiagnosed patients may be included in the sample due to this relatively loose criterion. However, using more strict criteria such as a minimum of 2 schizophrenia diagnoses or at least 1 inpatient hospitalization due to schizophrenia

may bias the sample selection toward more severely ill patients, therefore arbitrarily overestimating the mean direct health care cost of schizophrenia. As a sensitivity analysis, a stricter criterion of at least 2 schizophrenia diagnoses or at least 1 inpatient claim with a schizophrenia diagnosis was used. Since more severely ill schizophrenia patients were likely captured by this criterion for the calculation of per-patient direct medical costs, the total excess direct health care costs increased to $23.2 billion, and the total schizophrenia excess costs increased to $63.1 billion.

Finally, using the per-patient excess direct health care costs of the privately insured schizophrenia population under age 65 years, we imputed the excess cost of Medicare schizophrenia patients under age 65 years. This analysis created a lower bound estimate for the total excess direct health care costs and total schizophrenia excess costs of $20.8 billion and $60.8 billion, respectively.

DISCUSSION

Schizophrenia is associated with substantial excess direct and indirect costs. Although the cost estimates were highly sensitive to the prevalence of schizophrenia in the United States in 2002, even the lowest estimate of schizophrenia prevalence (0.3%) represented an excess schizophrenia cost of considerable magnitude ($39.9 billion). The Kessler et al.[3] review of available epidemiologic surveys indicates the limitations of recently reported schizophrenia prevalence rates. The large variation in the results of the prevalence-based sensitivity analysis indicates that the uncertainty about the prevalence of schizophrenia is the main limitation of the cost estimates of schizophrenia. The 5.1 per 1000 population prevalence rate used in this study was validated with the authors' independent analysis based on several administrative claims databases (private insurance and Medicaid- and Medicare-covered populations) (E. Q. Wu, Ph.D.; L. Shi, Ph.D.; H. Birnbaum, Ph.D., et al., unpublished data, Aug. 2005) and published statistics. Prevalence rate estimates may be improved by using sampling designs that account for response bias and the underrepresentation of various populations in epidemiologic surveys.[3] With different prevalence rates, the estimates of total excess costs for schizophrenia range from $39.9 billion to $180.8 billion.

The relative contribution of specific components of direct health care costs in this study can be compared to the Wyatt et al.[4] study due to the similarities in cost breakdowns presented in both studies. However, differences in methodologies and sources make direct comparisons of absolute dollar amounts difficult. Instead, the proportional contributions of different cost components are the basis for the following comparison. In the Wyatt et al.[4] study of schizophrenia costs in 1991, inpatient cost was the largest component of the direct health care cost (59%),

while drug cost accounted for less than 1% of all direct health care costs. Rice and Miller's study results presentation[5] does not allow for specific comparisons with our results, but suggest a similar nominal cost of prescription drugs. Results from our study indicate that the pattern of direct health care costs shifted dramatically in the past decade. We find that hospital inpatient costs, outpatient costs, and drug costs made up 12%, 31%, and 22% of direct health care costs, respectively, in 2002. The shifting cost patterns are, in part, related to Medicaid payment practices and the expansion of managed behavioral health care programs.[28] In addition, while the adoption of new atypical antipsychotics has increased drug spending,[28,29] use of these medications, in conjunction with community-based programs, may have reduced hospital inpatient utilization in the schizophrenia population and allowed schizophrenia patients to have a greater likelihood of treatment in outpatient settings.[28]

Cost differences across different insurance types may be related to their different populations and case mixes. Privately insured schizophrenia patients are more likely to be employed or married. An individual's employment or marital status may imply less severe schizophrenia and result in lower direct health care costs. Conversely, the largest direct health care costs may originate from Medicare schizophrenia patients who are either elderly or disabled.

A recent study conducted by Bartels et al.[30] on the direct health care cost of schizophrenia patients in a Medicare/Medicaid dual-eligible population estimated the direct health care cost of schizophrenia patients in 1999 to be much higher than our results ($39,154–$43,461 for patients over age 65 years). This discrepancy may be the result of several methodological differences. First, the Bartels et al.[30] study sample comprised low-income, elderly, or disabled individuals with schizophrenia. The low-income elderly and disabled tend to incur high health care costs regardless of whether they have schizophrenia. Second, Bartels et al.[30] estimated the "patient" cost instead of the "excess" cost of schizophrenia. The authors did not use a nonschizophrenia control sample to control for the high cost of average low-income elderly/disabled individuals. Third, Bartels et al.[30] limited the cost analysis to patients who received some medical care, whereas our study also includes schizophrenia patients who did not have any medical service. When limiting the direct health care cost analysis to Medicaid/Medicare dual-eligible patients over age 65 years, we estimated that the average schizophrenia patient (absolute cost instead of excess cost) cost $54,968 in 2002.

The excess annual cost of an average schizophrenia patient (approximately $15,464) is significantly higher than that of patients with other common mental disorders such as depression. Greenberg et al.[31] estimated that the mean annual cost of a patient with depression was approximately $4500 in 2000 in the United States. However, because depression is a prevalent disorder (18.1 million patients in 2000), it is more costly at the national level ($83.1 billion in 2000) compared to schizophrenia ($62.7 billion in 2002).

Wyatt et al.[4] and Rice and Miller[5] found that lost productivity costs contribute substantially to the costs associated with schizophrenia. The results of our study also highlight the significance of indirect costs and indicate that approximately 52% of all excess annual costs of schizophrenia patients in the United States in 2002 resulted from lost productivity. However, differences in methodologies make direct comparisons to previous studies difficult.

Direct health care costs presented in this study have the common limitations associated with claims data analyses in the absence of detailed economic cost information. Payment from different insurers and patients was used as a proxy for actual costs to society in the study. This approach assumed no transfer payment to the health care providers as extra profit beyond the true costs. It may not reflect the true societal opportunity cost of the medical resources used by schizophrenia patients. To the extent that reimbursement exceeds costs, our direct health care cost estimates will be biased upward. Conversely, to the extent that reimbursement is insufficient to cover costs, our estimates will be biased downward. With additional data, the approaches used to calculate direct health care costs from the societal perspective may be improved. In addition, we recognize that reliance on a single state's Medicaid data may not be representative of the overall national Medicaid population and may lead to some bias. Consequently, we adjusted California Medicaid data to be representative of national, mean Medicaid costs.

For several reasons, the excess direct costs reported here may be downward estimates. It has been estimated that less than 40% of individuals in the United States who suffer from serious mental disorders receive any treatment.[32] Although the treatment rate for schizophrenia is likely to be higher than for serious mental disorders overall, the approach we have applied in this study may underestimate the total economic burden since it assumes there are no additional direct costs for untreated sufferers of schizophrenia. Furthermore, diseases with severe illness such as schizophrenia can have substantial impact on an individual's financial status and may lead to Medicaid eligibility. Therefore, to the extent that schizophrenia leads patients to Medicaid eligibility, using a matched control sample from Medicaid may lead to an overestimate of the control sample's medical costs, thus leading to a downward bias in excess cost estimates. Another reason that the cost estimates are underestimates is that non-Medicaid state mental health system spending on services for this population was not included. Another additional cost not included here is for family members of schizophrenia patients who may utilize extra mental health and other

services, such as found in a study of family members of patients with attention-deficit/hyperactivity disorder.[6] In addition, the indirect costs are underestimates to the extent that productivity loss due to premature death other than suicide is not considered.

The sample selection criterion that Medicaid-eligible patients be continuously eligible for 12 months may lead to a nonrepresentative Medicaid sample to the extent that Medicaid-eligible patients chose not to enroll in the program or dropped out within 1 year.

This study's findings indicate that schizophrenia is a costly disease that results in significant costs in excess of those incurred by matched controls. The dramatic decrease in hospitalization costs in the past decade has been accompanied by the substantial increase in the use of atypical antipsychotics during the same period.[33] Similar trends, in which the mix of direct costs has shifted away from inpatient to outpatient and prescription drug care, were observed in a recent national cost-of-depression study that described changes in costs from 1990 to 2000.[30] Although some research regarding schizophrenia has suggested otherwise,[34] future research should investigate the extent to which new, effective pharmaceutical treatments may lead to potential reduction of medical service costs such as inpatient service utilization and improved patient outcomes. This is of particular interest to the extent that reduced side effects lead to improved compliance, which is a major concern in mental health patient management. As noted earlier, however, Medicaid payment practices and the expansion of managed behavioral health care may have also contributed to the reduction in inpatient spending.[28]

REFERENCES

1. American Psychiatric Association. Practice Guideline for the Treatment of Patients with Schizophrenia, Second Edition 2004. Available at: http://www.psych.org/psych_pract/treatg/pg/prac_guide.cfm. Accessed Jan 18, 2005
2. Crown WH, Neslusan C, Russo PA, et al. Hospitalization and total medical costs for privately insured persons with schizophrenia. Adm Policy Ment Health 2001;28:335–351
3. Kessler RC, Birnbaum H, Demler O, et al. Prevalence and correlates of nonaffective psychosis: results from NCS-R. Biol Psychiatry. In press
4. Wyatt RJ, Henter I, Leary MC, et al. An economic evaluation of schizophrenia: 1991. Soc Psychiatry Psychiatr Epidemiol 1995;30:196–205
5. Rice DP, Miller LS. The economic burden of schizophrenia: conceptual and methodological issues, and cost estimates. In: Moscarelli M, Rupp A, Sartorius N, eds. Handbook of Mental Health Economics and Health Policy, vol 1: Schizophrenia. New York, NY: John Wiley & Sons; 1996:321–334
6. Birnbaum HG, Kessler RC, Lowe SW, et al. Costs of attention deficit-hyperactivity disorder (ADHD) in the US: excess costs of persons with ADHD and their family members in 2000. Curr Med Res Opin 2005;21: 195–206
7. Birnbaum HG, Shi L, Dial E, et al. Economic consequences of not recognizing bipolar disorder patients: a cross-sectional descriptive analysis. J Clin Psychiatry 2004;64:1201–1209
8. Barnett A, Birnbaum H, Cremieux P, et al. The costs of cancer to a major employer in the United States: a case-control analysis. Am J Manag Care 1990;6:1243–1251
9. Centers for Medicare & Medicaid Services. Health Care Financing Review, Statistical Supplement, 2002. Washington, DC: US Government Printing Office; 2003
10. United States Bureau of Justice Statistics Publications. Justice Expenditure and Employment in the US 2001. Available at http://www.ojp.usdoj.gov/bjs/pubalp2.htm#jee. Accessed July 14, 2004
11. Criminal Justice Institute, Inc. The Corrections Yearbook, 2002. Middletown, Conn: Criminal Justice Institute; 2003
12. National Institute of Mental Health. The Numbers Count: Mental Disorders in America. Available at: http://www.nimh.nih.gov/publicat/numbers.cfm. Accessed Dec 1, 2004
13. United States Census Bureau. Historical Income Tables: People. Available at: http://www.census.gov/hhes/income/histinc/p09.html. Accessed July 31, 2004
14. Drake RE, Fox TS, Leather PK, et al. Regional variation in competitive employment for persons with severe mental illness. Adm Policy Ment Health 1999;25:493–504
15. Mueser KT, Salyers MP, Mueser PR. A prospective analysis of work in schizophrenia. Schizophr Bull 2001;27:281–296
16. Slade E, Salkever D. Symptom effects on employment in a structural model of mental illness and treatment: analysis of patients with schizophrenia. J Ment Health Policy Econ 2001;4:25–34
17. United States Bureau of Labor Statistics. Employment Status of the Civilian Noninstitutional Population by Age, Sex, and Race. Available at: ftp://ftp.bls.gov/pub/special.requests/lf/aat3.txt. Accessed July 31, 2004
18. United States Department of Labor, Bureau of Labor Statistics. Occupational Employment and Wage Estimates, 2002. Available at: http://www.bls.gov/oes/home.htm#publications. Accessed July 29, 2005
19. Goerree R, O'Brien BJ, Blackhouse G, et al. The valuation of productivity costs due to premature mortality: a comparison of the human-capital and friction-cost methods for schizophrenia. Can J Psychiatry 1999;44: 455–463
20. National Center for Health Statistics Self-Inflicted Injury/Suicide. Available at: http://www.cdc.gov/nchs/fastats/suicide.htm. Accessed Oct 15, 2004
21. Gold MR, Siegel JE, Russell LB, et al. Cost-Effectiveness in Health and Medicine. New York, NY: Oxford University Press; 1996
22. McGuire TG. Measuring the economic costs of schizophrenia. Schizophr Bull 1991;17:376–388
23. Wolff N, Helminiak TW, Morse GA, et al. Cost-effectiveness evaluation of three approaches to case management for homeless mentally ill clients. Am J Psychiatry 1997;154:341–348
24. Herman DB, Susser ES, Jandorf L, et al. Homelessness among individuals with psychotic disorders hospitalized for the first time: findings from the Suffolk County Mental Health Project. Am J Psychiatry 1998;155: 109–113
25. Munoz M, Vazquez C, Koegel P, et al. Differential patterns of mental disorders among the homeless in Madrid (Spain) and Los Angeles (USA). Soc Psychiatry Psychiatr Epidemiol 1998;33:514–520
26. D'Amore J, Hung O, Chiang W, et al. The epidemiology of the homeless population and its impact on an urban emergency department. Acad Emerg Med 2001;8:1051–1055
27. North CS, Eyrich KM, Pollio DE, et al. Are rates of psychiatric disorders in the homeless population changing? Am J Public Health 2004;94: 103–108
28. Frank RG, Goldman HH, Hogan M. Medicaid and mental health: be careful what you ask for. Health Aff (Millwood) 2003;22:101–113
29. Baugh DK, Pine PL, Blackwell S, et al. Medicaid spending and utilization for central nervous system drugs. Health Care Financ Rev 2004;26: 57–73
30. Bartels SJ, Clark RE, Peacock WJ, et al. Medicare and Medicaid costs for schizophrenia patients by age cohort compared with costs for depression, dementia, and medically ill patients. Am J Psychiatry 2003;11:648–657
31. Greenberg PE, Kessler RC, Birnbaum HG, et al. The economic burden of depression in the United States: how did it change between 1990 and 2000? J Clin Psychiatry 2003;64:1465–1475
32. Bijl RV, de Graaf R, Hiripi E, et al. The prevalence of treated and untreated mental disorders in five countries. Health Aff (Millwood) 2003;22:122–133
33. Frank RG, Berndt ER, Busch AB, et al. Quality-constant "prices" for the ongoing treatment of schizophrenia: an exploratory study. Q Rev Econ Finance 2004;44:390–409
34. Duggan M. Do new prescription drugs pay for themselves? the case of second-generation antipsychotics. J Health Econ 2005;24:1–31