Annual Health Outcomes and Treatment Costs for Schizophrenia Populations

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This article describes a model that estimates annual patient health and cost outcomes for schizophrenia under alternative treatment scenarios. We estimate these outcomes for typical antipsychotics and show how treatment with atypical antipsychotics could have an impact on these outcomes. Patients are divided into 5 subcategories—newly diagnosed, no episode, acute episode(s), extended care, and institutionalized—and patient health and cost outcomes are estimated for each category. The proportion of people in each category is estimated for U.S. general, state mental hospital, and community mental health populations. Outcomes include extrapyramidal and moderate/severe schizophrenia symptom days, employed days, suicides, hospital days, and health costs. For patients treated with typical antipsychotics, annual per-patient symptom days ranged from 55 to 365 and costs ranged from $16,000 to $57,000, depending on disease severity. Atypical antipsychotics may reduce symptoms and costs through better efficacy for negative symptoms and better compliance.

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Schizophrenia is a chronic mental illness often associated with repeated and prolonged admissions to the hospital or other residential treatment facilities.[1] This large amount of inpatient utilization contributes significantly to the high cost of medical care for the disease. Although schizophrenia affects only 1% of Americans, or approximately 2 million people, about 2.5% of U.S. health care expenditures go toward schizophrenia treatment.[2] Additionally, schizophrenia has substantial economic and quality-of-life effects on patients, their families, and society at large.[3]

Schizophrenia is characterized primarily by changes in reasoning. The symptoms, which usually first appear in late adolescence or early adulthood, are commonly grouped into 2 categories: positive and negative. Positive symptoms can be described as abnormal thought and behavioral patterns, such as hallucinations and delusions. Negative symptoms indicate a loss of normal function and include apathy, withdrawal, and incoherent speech.[4] Currently, 2 main classes of drugs exist for the treatment of schizophrenia patients. Typical antipsychotics such as haloperidol can effectively treat positive symptoms, but are not as beneficial for negative symptoms.[5] These drugs also often cause severe extrapyramidal symptoms (EPS) that lower a patient's quality of life and decrease compliance.[6,7] A relatively new class of drugs, known as the atypical antipsychotics and including clozapine, risperidone, and olanzapine, has greater efficacy against the negative symptoms and causes fewer EPS.[8]

Because this new class of drugs is now available for treating schizophrenia, decision makers (e.g., clinicians, health service administrators, insurers, and other payers) need to estimate what will happen to patients' health and to health care budgets if their patients are switched to the new drugs. The acquisition costs of the atypical drugs are higher than those for the typical drugs, but patient health outcomes are better and reductions in hospital costs associated with better health outcomes may partially or totally offset the higher drug costs. Recent studies have shown such cost reductions with atypical drugs in specific population subsets, including patients refractory to typical drugs[9] and patients suffering from acute psychotic episodes.[10,11] Although there are several studies in the literature that estimate the population costs of schizophrenia when treated with typical drugs (e.g., Rice and Miller,[12] Wyatt et al.,[1] Dickey et al.[13]), these estimates are all derived from observational databases and do not include a method for estimating the impact of alternative treatments

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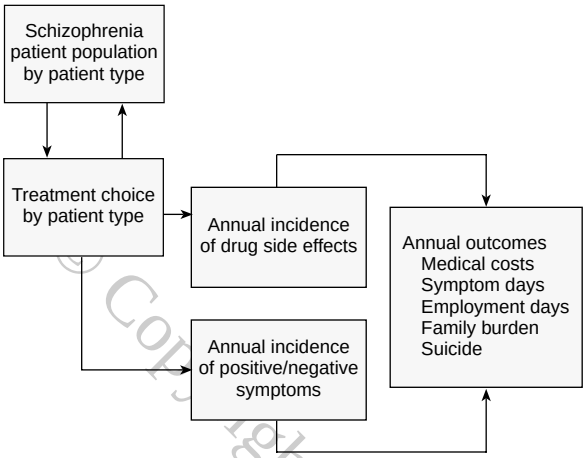
Figure 1. Schizophrenia Budget Model Structure



on these costs, nor do they present estimates of the disability suffered by the schizophrenia population. Similar observational studies for the atypical agents will not be available for several years, and so, until then, decision makers must rely on techniques such as modeling to estimate the effect of switching to atypical antipsychotics on patients and costs.

In this article, we describe the structure and input parameters for a population model designed to estimate the annual patient outcomes and health care costs for a group of schizophrenia patients under different treatment patterns. Estimates are derived using annual treatment algorithms and annual patient outcome estimates for patients with different degrees of disease severity. To demonstrate this model, we estimate patient outcomes and cost of schizophrenia treated with typical antipsychotics in 3 populations.

METHOD

Model Overview

Figure 1 illustrates the structure of the population model for schizophrenia. The population comprises those schizophrenia patients who present for treatment any time during a 1-year time period and includes patients with different levels of disease severity. Different treatment choices can be made at each level of disease severity. In this article, we assume that typical antipsychotics are used for all severity groups. The combination of disease severity and treatment choice determines the annual number of days with positive or negative disease symptoms and drug side effects. These clinical outcomes, along with the treatment choice, then determine the annual health care use, costs, and patient and family burden. Health care services not related to schizophrenia are not included in the model.

Table 1. Disease Severity Categories of U.S. Schizophrenia Population

Patient Disease Category	U.S. Population	Mental Hospital Population	Community Mental Health Population
Newly diagnosed	3%	0%	5%
Acute episode	8%	0%	25%
No episode	46%	0%	60%
Extended care	37%	86%	10%
Institutionalized	6%	14%	0%

Patient Severity Categories

Patient severity categories are designed to correspond to different degrees of patient disability and health care resource use as well as to be understandable to decision makers and match data availability. The 5 patient severity categories are newly diagnosed, no acute or chronic episodes, acute episodes (generally responsive to typical agents), extended episodes but with some outpatient care possible (may be refractory to or intolerant of typical therapy), and institutionalized (generally refractory to or intolerant of typical therapy). Treatment costs and quality-of-life outcomes will differ for patients in each of these categories. For any 1-year time period, a patient can be classified into one of these categories. While individual patients may change category from year to year, we assume that the proportion of the population in each category stays constant over time unless new treatments are introduced.

We model schizophrenia's impact on 3 patient populations: the overall U.S. schizophrenia population, a population of more seriously ill patients who might be treated by a state mental hospital, and a population of the less seriously ill who might receive inpatient care at a community mental health center. Each population is defined by its distribution of disease severity (Table 1).

We estimate the severity distribution for the general U.S. schizophrenia population as follows. Based on a 1-month prevalence of 6 per 1000, estimated by Regier et al.[14] using data from the Epidemiologic Catchment Area Study, there are approximately 1.6 million people with schizophrenia in the United States. Lieberman[15] reported that 50,000 new cases are diagnosed annually, so newly diagnosed patients would account for approximately 3% of the schizophrenia population. A study by Juarez-Reyes et al.[16] estimated that 43% of schizophrenia patients would be defined as treatment refractory (experiencing prolonged or continuous episodes of symptoms) and thus would be eligible for treatment with clozapine. We assume that 14% of the refractory patients (6% of the total population) are institutionalized, based on data from Rosenheck et al.[9] The remaining 54% of the total schizophrenia population (100% – 3% – 43%) are assumed to be in either the acute episode or no episode category in a given year. We assume that 14% of the 54%

Table 2. Health Care Services and Unit Costs in U.S. Dollars

Health Care Service	Cost to Acutely Ill Patients[a]	Cost to Chronically Ill Patients[b]
Acute hospital, d[28]	$430.00	
Chronic inpatient or residential care, d[9]		$ 320.00
Agranulocytosis, case[9]		2240.00
Outpatient psychiatrist, visit[28]	50.00	
Group therapy, session[28]	43.00	
Residential treatment, d[28]	305.00	
Partial residential treatment, d[28]	218.00	
Hospital outpatient treatment, d[28]	68.00	
Physician and therapist, visits[9]		43.50
Blood monitoring[9]		14.00
Haloperidol treatment, d[28]	0.08	0.08
Antiparkinsonian drug treatment, d[28]	0.54	0.54
Depot administration[30]	978	978

[a]Includes the patient disease categories newly diagnosed, acute episode, and no episode.
[b]Includes the patient disease categories extended care and institutionalized.

(8% of the total population) have one or more episodes in the year (second year relapse rates after an episode from Conley et al.[17]) and the rest do not have an episode that year (46% of the total population).

To create a hypothetical severity distribution for a state mental hospital, we start with the U.S. population severity distribution and assume that only the extended care patients are treated at this site. To create a hypothetical severity distribution for a community mental health center, we assume that they treat very few extended care patients (10%) and that the majority of their patients are newly diagnosed or have acute episodes only.

Patient Outcomes and Costs for Each Patient Severity Group

For each patient severity group, we estimate the following outcomes:

1. direct patient outcomes, including moderate-to-severe symptom days, EPS days, productivity, and suicide rates;
2. proxy outcomes, including hospital days (proxy for family burden); and
3. health care costs, including inpatient, outpatient, and drug costs.

These outcomes are likely to vary depending on the treatments used. In this article, we demonstrate the model assuming that all patients are treated with typical drugs.

Direct patient outcomes are estimated from a variety of published and unpublished sources. Days with moderate or severe symptoms (Brief Psychiatric Rating Scale [BPRS] score > 36) are assumed to be zero for a patient with no episode, 42 days for each acute episode,[18] 365 days for extended care or institutionalized patients on typical drugs, and the number of days equal to days in the hospital for the newly diagnosed patients.[19]

EPS days for patients taking typical drugs are estimated based on reports from a clinical study of the percentage of patients needing to take antiparkinsonian or other drugs to treat the symptoms. The rate is 45% for haloperidol, a typical antipsychotic drug.[20]

Productivity is measured as the product of employment rate and months of employment. For the newly diagnosed, Gupta et al.[19] found that 49% of first-episode patients were unemployed during the year. We assume that the patients who are employed work for the full time that they are not hospitalized, 9.6 months. Patients who are refractory to treatment and have extended care or are institutionalized are assumed to be 100% unemployed.[21,22] We assume that only 13% of patients with episodes work during the year[23] and that these patients work for an average of 11.3 months. For patients without an episode, we assume a 14% employment rate throughout the year.[23]

We estimate the rates of suicide attempts and completions by assuming that the proportion of suicide attempts to completions is 23%, the same as that in the general U.S. suicide population.[24] We then apply this rate to the rates of suicide for responsive (13.1% per episode) and refractory patients (8.5% per episode) taken from Meltzer and Okayli.[25] Because suicide rates may decline later in the disease and the Meltzer and Okayli estimates were for patients within 10 years of diagnosis, we halve their rates to 6.55% per episode for acute care patients and 4.25% per episode for the extended care patients. Suicide rates for newly diagnosed patients are taken from Cohen et al.,[26] who found an attempt rate of 18% among first admissions. The costs per suicide attempt and per completion are estimated using data from Palmer et al.[24]

We use hospital days as a proxy measure for family burden. Reynolds and Hoult[27] showed that the level of worry is higher among families of patients who are treated primarily in an inpatient setting compared to those treated in the community.

The health care costs for each patient are calculated using estimates of the unit costs for health care services and estimates of the health care services used by each patient. Table 2 presents our unit cost estimates, and Table 3 presents the health care service use for newly diagnosed, acute, and extended care patients when treating all patients with typical antipsychotics. Table 4 presents the annual total health care costs as well as the annual inpatient, outpatient, and drug costs for each patient severity category. The estimates are derived from 3 published sources: Gupta et al.[19] for the newly diagnosed patients, Palmer et al.[28] for the acutely ill patients, and Rosenheck et al.[9] for the extended care patients. Estimates for newly diagnosed patients assume an acute relapse rate of 44.2% and a chronic relapse rate of 4.4%.[19] Estimates for those with an acute episode assume a relapse rate of 40% within the same

Table 3. Annual Health Care Service Use

Health Care Service Units	Newly Diagnosed[19] Units Used	Newly Diagnosed[19] Patients Using Service, %	Acute Episode[28] Units Used	Acute Episode[28] Patients Using Service, %	No Episode[28] Units Used	No Episode[28] Patients Using Service, %	Extended Care[9] Units Used	Extended Care[9] Patients Using Service, %	Institutionalized[9] Units Used	Institutionalized[9] Patients Using Service, %
Acute hospital, d	70.1	100	30.8	100	0	0				
Outpatient psychiatry, visits	12	100	5.9	100	4	65				
Group therapy, sessions	12	65	15.6	65	24	65				
Outpatient physician or therapy, visits							83	100	0	0
Residential treatment, d			85.3	50	0	0				
Partial residential treatment, d			60.4	50	0	0				
Inpatient or residential care, d							136	100	365	100
Hospital outpatient, d	49	43.6	74.6	33	0	0				
Haloperidol treatment, d	365	90	155	100	365	30	365	75	365	100
Antiparkinsonian drug treatment, d	365	40.5	210	45	365	22.5	365	75	365	100
Depot administration, d			275	20	365	20	365	25	0	0
Added medical costs for suicide attempts			1	9.2	0	0				
Autopsy costs for completed suicide	1	5.6	1	2.1	0	0	1	1	1	1

Table 4. Annual Costs in U.S. Dollars by Disease Severity and Cost Category

Disease Severity Category	Total Costs	Inpatient Costs	Outpatient Service Costs	Drug Costs
Newly diagnosed[19]	$ 32,709	$ 30,177	$2491	$106
Acute episode[28]	35,999	26,787	8988	210
No episode	1050	0	801	248
Extended care[9]	47,469	43,498	3568	415
Institutionalized	117,033	116,800	18	226

Table 5. Outcomes for Population of 300 Schizophrenia Patients[a]

Outcomes	U.S. Population	Mental Hospital Population	Community Mental Health Population
Moderate-to-severe symptoms, d	49,050	109,500	16,413
EPS, d	61,995	109,500	35,020
Suicides	2.24	2.9	2.7
Employed, d	9,300	0	14,520
Inpatient, d (high family anxiety)	23,969	50,400	10,639
Total costs, $	8,636,887	17,162,396	4,803,539
Inpatient	7,814,111	16,128,000	3,766,485
Outpatient	732,341	918,000	962,459
Drugs	90,435	116,388	74,595

[a]Abbreviation: EPS = extrapyramidal symptoms.

year.[17] For all patient severity categories, we assume that 50% of the patients abuse drugs or alcohol.[29] We also assume that people who abuse drugs or alcohol use twice the health care services as those who do not.[13]

RESULTS

Table 5 presents the population estimates for the 3 populations modeled: the overall U.S. schizophrenia population, a state mental hospital population, and a community mental health center population. We assume that there are a total of 300 people with schizophrenia being treated in each population. We show the annual number of symptom days and EPS days for the whole population of 300, as well as the number of suicides, employed days, and hospital days. In all cases, the disease burden is higher for the more severely ill population (the state mental hospital population) than for the less severely ill population (the community mental health center population). The total annual costs range from $4.8 million to $17.2 million depending on the severity mix of the population. Inpatient costs range from 78% to 94% of the total costs for the 3 populations. Table 6 presents estimates for the same 3 populations presented as mean per-person annual outcomes.

Table 6. Per Person Outcomes for Schizophrenia Populations

Outcomes	U.S. Population	Mental Hospital Population	Community Mental Health Population
Moderate-to-severe symptoms, d	164	365	55
EPS, d	207	365	117
Suicides	0.007	0.01	0.009
Employed, d	30	0	48
Inpatient, d (high family anxiety)	80	168	35
Total costs, $	28,790	57,208	16,012
Inpatient	26,047	53,760	12,555
Outpatient	2441	3060	3208
Drugs	301	388	249

DISCUSSION

In this article, we describe an approach for estimating the cost and patient outcomes for a schizophrenia popula-

Figure 2. Difference Between Typical and Atypical Drugs: Responsive and Newly Diagnosed Patients

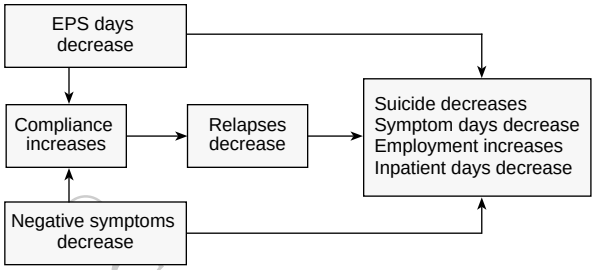
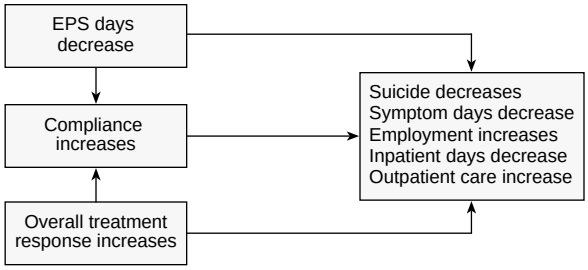


Figure 3. Difference Between Typical and Atypical Drugs: Refractory Patients



tion. The approach can be used to estimate these outcomes under current treatments as well as to estimate the impact of new treatments on outcomes. The examples of treatment with typical antipsychotics show that patients experience a high number of symptom days both from the disease itself and from side effects of the typical drugs used to treat it. Employment rates are low, suicide rates are high, and family burden is significant. The average annual health care costs per patient range from $16,000 to $57,000, depending on the disease severity mix of the population.

The present model estimates the following annual outcomes for a population of schizophrenia patients: inpatient, outpatient, and drug costs; number of days with moderate or severe schizophrenia symptoms (defined as a BPRS score of > 36); number of days requiring treatment with antiparkinsonian drug for EPS; number of employed days; number of suicide attempts and completions; and number of hospital days (a proxy for family anxiety). These outcomes were chosen to help decision makers plan their annual budgets as well as to demonstrate the patient and family benefits associated with alternative treatments. Other outcomes of interest to decision makers may be added in later versions of the model if data are available. These include compliance rates, use of social services, use of vocational services, criminal justice costs, and caregiver productivity losses. Because data sources were limited for many of the outcomes estimated in the model, the results presented in this article should not be viewed as definite. The advantage of the modeling approach described in this article is that the parameter values in the model can readily be changed to reflect local practice patterns, costs, and patient mix and can be updated as new outcomes become available.

Figures 2 and 3 present schematics showing how newer treatments, such as the atypical drugs, might affect the burden of schizophrenia. Figure 2 shows that for acutely ill and newly diagnosed patients, atypical antipsychotics would likely decrease EPS days and negative symptoms. This decrease may directly lower suicide rates, symptom days, unemployment, and inpatient days. It might also have an indirect impact on these same outcomes, through increased compliance with the antipsychotic regimen for maintenance therapy, which might decrease relapses. Figure 3 shows that when extended care patients are switched to atypical antipsychotics, there may be direct decreases in suicide rates, symptom days, unemployment rates, inpatient days, and outpatient care for those who respond to treatment. There may also be an indirect effect through better compliance with antipsychotic therapy. Data for estimating the cost and patient outcomes with atypical agents are being accumulated from published and unpublished sources and will be used in the population model to generate estimates of the population effects likely to be observed when patients are switched from typical to atypical drugs.

Evaluations of the impact of atypical antipsychotics on treatment outcomes have been undertaken in conjunction with randomized controlled trials.[10] Such trial-based evaluations have considerable internal validity and inform cost-effectiveness judgments in relatively restricted populations and time frames. Population-based models can be a useful adjunct for decision makers, since these models offer a means of applying the outcomes information from such trials in a systematic analysis with broader application.

In this article, we have estimated annual patient outcomes and health care costs for different populations of schizophrenia patients being treated with typical antipsychotics. We are currently using the model to develop estimates of the effect of switching different patients to atypical antipsychotics. These estimates will help decision makers to plan budgets after patients are switched to atypical drugs and to estimate the likely health benefits the new treatments will bring to their patients.

Drug names: clozapine (Clozaril), haloperidol (Haldol and others), olanzapine (Zyprexa), risperidone (Risperdal).

Disclosure of off-label usage: The authors of this article have determined that, to the best of their knowledge, the following agents are not approved for treatment of patients who are refractory to typical drugs: olanzapine, risperidone.

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