

Modeling of Annual Treatment Costs and Health Outcomes of Antipsychotic Agents for Schizophrenic Populations

Based on a presentation by Josephine Mauskopf, PhD

Presentation Summary

Schizophrenia is associated with the extensive use of inpatient services, so the costs of treating it are substantial. As a result, a treatment that can reduce the symptoms leading to inpatient care may decrease the overall costs and increase the quality of life for patients, their families, and society. Today, healthcare planners are faced with the delicate balancing act of providing the best care possible within limited budgets. A risk in budget assessment is looking at line items individually rather than at the total healthcare costs and clinical outcomes. For example,

a drug may increase pharmacy budgets but lower inpatient services use or increase employment. A population model is described that can be used to predict the impact of new agents, such as atypical antipsychotics, and help decision makers plan budgets and revise current treatment strategies accordingly. Population models enable planners to plug in the cost and incidence numbers for their patient population and examine the total cost and patient outcomes. Such models provide a bigger picture of disease state management within a given setting.

“Why is a population model of potential use to decision makers?” asked Josephine Mauskopf, PhD, Assistant Research Director, Center for Economics Research, Research Triangle Institute, Research Triangle Park, North Carolina. In an era of cost containment, population models are increasingly needed to make decisions on healthcare budgets and treatment patterns in well-defined populations. This is a timely question with regard to schizophrenic populations who use approximately 2.5% of US healthcare expenditures.¹ The implications are relevant today and will continue to be as new treatments emerge.

Dr. Mauskopf developed a population model for schizophrenic patients with which to examine the impact of new agents (eg, atypical antipsychotics) on costs and patient outcomes. The model can be used to estimate the effects of the new agents on current healthcare budgets for different geographical areas, treatment patterns, and disease severity. It also can be used to predict the cost and patient impact of different drug-use guidelines in the population of interest and help develop budgets before observational data become available. However, in a few years, when observational data are available, such a model may be obsolete, Dr. Mauskopf

noted.

The Model Structure

The first step in building a population model is to choose the costs and patient outcomes of interest to the decision maker. In her study, Dr. Mauskopf divided the outcomes into 3 groups:

- Healthcare costs (ie, inpatient, outpatient, and drugs)
- Direct patient outcomes (ie, positive and negative symptom days, extrapyramidal symptom [EPS] days, productivity, suicide rate)
- Proxy outcomes (ie, hospital days—a proxy for family burden)

The positive and negative symptom days are measured together using the Brief Psychiatric Rating Scale (BPRS), and the EPS days are counted as the expected number of days when anti-Parkinson drugs must be taken.

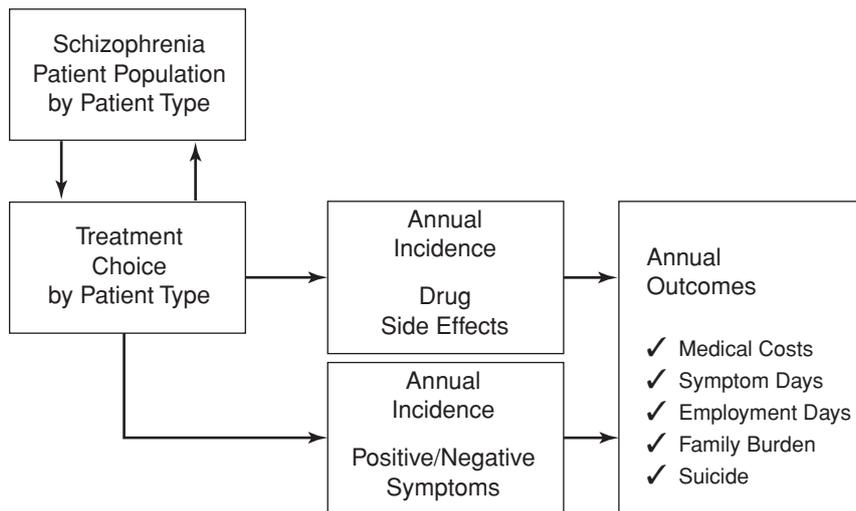
Productivity is measured in terms of person-months of work per year. Suicide completions are estimated. Hospital days, based on a review of the literature, were defined as a proxy for family burden, because families feel more anxiety when relatives are in mental hospitals.²⁻⁵

After presenting her model to several audiences, it was suggested to Dr. Mauskopf that she include compliance rates with typical and atypical agents as a proxy outcome for efficacy, substance abuse rates, and criminal activity. Substance abuse among schizophrenic patients is substantial, although estimated rates of abuse vary.⁶⁻⁸ Studies have found that substance abuse can heavily influence medical resource use, especially hospitalization.⁹⁻¹¹ In this model, Dr. Mauskopf assumed that schizophrenic patients with a history of drug abuse tend to use twice as many medical resources as nonabusing patients, so their costs are twice as high.¹²

Other audiences have requested more specific estimates of the cost of social services when patients switch from typical to atypical agents. Such costs, Dr. Mauskopf noted, are in addition to healthcare costs and could be defined as services not covered by Medicaid but that must be borne by other parts of state government. Estimates of these additional outcomes are still under development.

The model developed by Dr. Mauskopf is simpler than many models devised by economists (Figure). “It’s actually harder to develop a simple model,” she said, explaining that for any group of patients subdivided by different levels of disease severity (ie, patient type), treatment choices may vary. In a

Figure. Schizophrenia Population Model Structure



Source: Adapted from Mauskopf J, David K, Grainger D, Gibson PJ. Annual health outcomes and treatment costs for schizophrenia populations. *J Clin Psychiatry* In press.

given population, the combination of treatment choice and patient type will predict the annual number of days with drug side effects and positive or negative symptoms. Treatment choice and clinical outcomes determine annual healthcare use (ie, costs as well as patient and family burden). Cost and patient outcomes are the measures used by healthcare planners to devise treatment patterns.

In Dr. Mauskopf's model, 5 severity levels were used to subdivide the patients in a treated population (Table 1). Refractory patients were defined as those who were resistant to or intolerant of typical agents and needed either year-round inpatient care (ie, institutionalization) or extended inpatient care with some outpatient care (ie, extended care). Patients responsive to typical agents were subdivided into 2 groups: those who had at least 1 acute episode during the year and those who did not. The fifth category included patients who were newly diagnosed with the disease.

The proportion of each patient group may vary by treatment site. Three patient population distributions were chosen because the disease severity mix in the population for which a decision maker is responsible can vary. The US population estimates were derived from published studies.^{6,13-17} The mental hospital and community mental health center were modeled using populations with more and fewer severely ill patients, respectively.

Other specific inputs to the model included population size, percentage of substance abusers, annual resource use by disease severity, and unit healthcare costs. "Clearly, to customize this model to a specific population, I would need to know the proportion of the different patient disease severity categories in the population," Dr. Mauskopf said, adding that the model could also integrate the cost per type of service for a specific population.

To obtain estimates for all outcomes, input parameters must be

comprehensive and cover each disease severity category and each treatment type (ie, typicals and atypical) for a 1-year period. These parameters include:

- Suicide attempts and completions and their associated costs,
- Healthcare resource use (hospital or nursing home days, outpatient psychiatry visits, group therapy sessions, drugs used),
- Employment rates and average duration of work in 1 year, and
- Days of moderate to severe symptoms (defined as a BPRS score >36) and EPS days (defined as the number of days in a year when the patient has to take anti-Parkinson drugs). EPS, in particular, can interfere with patient compliance and quality of life, so such data are important because they can help determine the amount of resources to be used.

Published studies (ie, clinical trials or observational studies) were used to estimate these model parameters for typical drugs.¹⁷⁻²⁵

Table 1. Disease Severity Categories

Patient Disease Category	US Population	Mental Hospital Population	Community Mental Health Population
Newly Diagnosed Responsive	3%	0%	5%
With Episode Responsive	8%	0%	25%
No Episode Refractory	46%	0%	60%
Extended Care Refractory	37%	86%	10%
Institutionalized	6%	14%	0%

Source: Adapted from Mauskopf J, David K, Grainger D, Gibson PJ. Annual health outcomes and treatment costs for schizophrenia populations. *J Clin Psychiatry* In press.

Table 2. Health Outcomes by Disease Severity Using Typical Drugs

Patient Disease Category	Suicide Rate	Moderate/Severe Symptom Days	EPS Days
Newly Diagnosed Responsive	5.6%	70	148
With Episode Responsive	2.1%	59	94
No Episode Refractory	0%	0	82
Extended Care Refractory	1.0%	365	365
Institutionalized	1.0%	365	365

Source: References 21, 22, 23, 24, and Cohen F, Lavelle J, Rich C, Bromet E. Rate and correlate in suicide attempts of first admission psychotic patients. *Acta Psychiatr Scand* 1994;90:167-171; Meltzer H, Okayli G. Reduction of suicidality during clozapine treatment of neuroleptic-resistant schizophrenia: Impact of risk benefit assessment. *Am J Psychiatry* 1995;152:183-190.

Table 3. Outcomes for Population of 300 Schizophrenics With Severity Profile of General US Population With Schizophrenia

Outcomes	US Population	Mental Hospital Population	Community Mental Health Population
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
Mod./Sev. Symptom Days	49,050	109,500	16,413
EPS Days	61,995	109,500	35,020
Suicides	2.24	2.9	2.7
Employed Months	310	0	484
Inpatient Days, High Family Anxiety	23,969	50,400	10,639

*Inpatient costs include acute hospital, psychiatric hospital, nursing home and any inpatient residential care facility.

[†]Drug costs include typical agents and anti-Parkinson drugs.

Source: Adapted from Mauskopf J, David K, Grainger D, Gibson PJ. Annual health outcomes and treatment costs for schizophrenia populations. *J Clin Psychiatry* In press.

Costs and Outcomes

Dr. Mauskopf presented some examples of the different cost and outcomes calculations based on disease severity and treatments. For patients taking typical agents, annual treatment costs ranged from \$1000 for patients with no acute episodes to \$117,000 for institutionalized populations.¹² These figures were derived using specific numbers from the input parameters (eg, hospital days, nursing home days) and unit costs (ie, cost per day). Decision makers who want to use the model can input their costs per type of service for specific populations to calculate their own annual costs.

Using published information, Dr. Mauskopf estimated the prevalence of each patient outcome by disease severity (Table 2).¹² These population estimates enable calculations to be made for overall costs, either for a group of patients or on a per-patient basis (Tables 3 and 4).

Dr. Mauskopf suggested ways in which atypical agents might affect costs and patient outcomes. In newly diagnosed and acutely ill patients, decreased negative symptoms may directly decrease the suicide rate, symptom days, and inpatient days and increase employment. "They may also have an impact on these same outcomes indirectly through increasing compliance with antipsychotic regimens for maintenance therapy and thereby reducing the incidence of relapse," Dr. Mauskopf predicted.

For chronically symptomatic patients, the same effects on outcomes, including increased outpatient care, may be seen directly through decreased EPS days and increased treatment response. An effect also could be seen indirectly through increased compliance with antipsychotic therapy. "Clearly, compliance is definitely one of the key variables in estimating the impact of atypical agents on cost and patient outcomes," she said.

Conclusion

Using the available literature on schizophrenic populations and the effectiveness of typical agents, the population model can estimate the annual healthcare costs and patient outcomes for any population of schizophrenic patients. As new efficacy and effectiveness data concerning treatment with atypical agents become available, they can be used to estimate the impact of these new drugs on annual costs and outcomes. Cost and patient outcome estimates can help decision makers plan annual budgets for switching to atypical agents or other new therapies and estimate the likely health benefits.

Acknowledgement

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Table 4. Per Person Outcomes for Schizophrenia

Outcomes	US Population	Mental Hospital Population	Community Mental Health Population
Total Costs	\$28,790	\$57,208	\$16,012
Inpatient*	\$26,047	\$53,760	\$12,555
Outpatient	\$2441	\$3060	\$3208
Drugs [†]	\$301	\$388	\$249
Mod./Sev. Symptom Days	164	365	55
EPS Days	207	365	117
Suicides	0.007	0.01	0.009
Employed Months	1.0	0	1.6
Inpatient Days, High Family Anxiety	80	168	35

*Inpatient costs include acute hospital, psychiatric hospital, nursing home, and any inpatient residential care facility.

[†]Drug costs include typical agents and anti-Parkinson drugs.

Source: Adapted from Mauskopf J, David K, Grainger D, Gibson PJ. Annual health outcomes and treatment costs for schizophrenia populations. *J Clin Psychiatry* In press.

... DISCUSSION HIGHLIGHTS ...

Dr. Noordsy: You have estimated that about 50% of the overall population are responsive to typical drugs, with or without episode, which is consistent with the pharmacological studies.^{14,17,26-29} However, I think it could be simplified by a policy maker who may be inclined to leave nonresponding patients as they are. But what we're really often talking about is some proportional reduction (eg, 20%, 30%, 40%) in BPRS or PANSS [Positive and Negative Syndrome Scale] scores. In my experience, those people are still very symptomatic. They may have particular improvements in

Table 5. Annual Costs: Newly Diagnosed—Treatment With Typical Drugs

	Units	Unit Cost	% Using	Average Per Patient Cost
Acute hospital (days)	70.1	\$430.00	100	\$30,177
Outpatient psychiatry (visits)	12	\$50.00	100	\$600
Group therapy (sessions)	12	\$43.00	65	\$335
Outpatient treatment (days)	49	\$68.00	43.6	\$1453
Haloperidol (days)	365	\$0.08	90	\$26
Anti-Parkinson drug (days)	365	\$0.54	40.5	\$80
Autopsy cost for completed suicide	1	\$1840.00	5.6	\$103
Total cost				\$32,775

Source: Population model calculations.

positive symptoms but not in negative symptoms or other domains. Perhaps it would be useful to look more closely at that group, because they could potentially benefit greatly from changes in medication strategy.

Dr. Mauskopf: I see your point, and we are in the process of changing the descriptions of these patients. I have only shown you the data for patients taking typical antipsychotics. If you model the impact of atypical drugs on patients who are responsive to typical drugs, you see a reduction in the relapse rate that will reduce the number of hospital days; you can then see the benefit. If you show the data for both typical and atypical drugs, you also can see the difference in EPS days and in symptom days.

Dr. Noordsy: You may not see a difference in positive symptom days, but you may see it in negative symptom days or other patient outcomes such as work.

Dr. Mauskopf: You might see it in hospital days as well. If you reduce the relapse rate, you reduce the acute hospital days. But you are correct. The current model does not capture all the health benefits, particularly those attributable to reduced negative symptoms.

Dr. Noordsy: I would guess that for most community mental health centers the way you've distributed populations suggests a much more benign population than tends to exist there. Your proportions might be more consistent with a private practice setting. In fact, in community mental health centers, you tend to see an overdistribution of patients who are nonresponsive to typical drugs compared with patients who respond well. Then the highly responsive patients tend to get filtered into the private sector. In my community mental health setting, I would estimate that at least 50% of

patients if not more are nonresponsive to typical drugs. In my study, we are looking at the similar categorization of a starting point, so I may be able to give you some numbers with which to work.

Dr. Mauskopf: This is hypothetical. I wanted to show at least some variability to demonstrate the effect. One of the things I've been wrestling with is developing a set of definitions to which someone could easily assign their population numbers. That would mean we need to change the descriptions to more realistic assessments of the patients. If you think you could actually tell me the proportions of patients, then I have come close to what I wanted to do.

Dr. Lehman: How do these models take into account other changes occurring in the healthcare system? For example, with managed care, the rates of hospitalization and the days in hospital have been dramatically reduced. This changes the cost equation that you tried to achieve. How do you model that?

Dr. Mauskopf: We modeled annual health costs for the different patient types using data from published studies.^{17,24,25} Our calculations start from units of healthcare service use, such as acute hospital stay (in days) and outpatient visits, as well as the unit costs of each service (Table 5). So when you multiply the unit cost by the number of units used and the percentage using them, you come up with the average cost per patient. In this way, if a particular organization focuses on moving patients out of hospitals and into nursing homes, then you can redo the calculations to determine your average costs for each patient type. The model is constructed to make it easy to change the numbers. We are going to make a computer model and allow users to model 2 options: they can either apply their

population numbers and use our cost estimates, or they can plug in their own estimated costs as well.

Dr. Lehman: One of the current problems is the way costs are segmented. Often, the debate is not centered on the overall cost effectiveness of a treatment or the impact of a new treatment on a system of care, but instead on pharmacy costs, which might be tracked as a line in the budget. The auditor may see only that the pharmacy costs have tripled; other costs may not have been tracked or are not considered in the discussion. It is frustrating to try to get people who make decisions about paying for care and access to care to look at a total budget rather than just a segment of it.

Dr. Mauskopf: I agree. Some of the first population models I did were for the state of North Carolina to estimate the impact of AIDS [acquired-immune deficiency syndrome] drugs. I estimated the drug program's budget, but I also provided them with the total health system cost so those numbers could be used in the political arena to justify the costs. Although the drug budget may increase by \$100,000 or \$200,000, these costs are often partially or wholly offset by a reduced cost somewhere else, for example, fewer opportunistic infections or in this case symptom days. In the political arena, you can argue for increased budgets. When the budgets are separate, the individual stakeholders don't like it but state legislators do, and mental health is often financed by state funds.

Dr. McCombs: In schizophrenia, it is difficult because there are cost offsets, such as correctional facilities, and a lot of social services.

Dr. Mauskopf: The last time I presented this model, people were asking about other expenses, including

social services and legal costs. There has been a lot of discussion of compliance and its correlation with drug abuse, criminal activity, and efficacy. In the political environment, it could be helpful to have these numbers.

Dr. Lehman: Unfortunately, we are getting these treatments at a time when the focus is on cost reduction. I would speculate that there is a relatively small percentage of people with schizophrenia who cost a great deal of money each year. Better treatment technologies actually reduce the costs for those patients, primarily through allowing them to stay out of the hospital. I think there are a larger number of patients who are stable but not doing very well. The newer treatments may cost more for a while because they are much more active treatments and using them is the right thing to do. That's a harder sell. For other conditions such as cancer or heart disease, we don't hear the same debates about offsetting cost. That is unfortunate, and it's something for which the advocacy groups should push. I'm most concerned about patients who are seen only 4 or 5 times a year for a medication visit.

Dr. Mauskopf: In my model, I break cost down by different diagnoses, such as typical medications with the newly diagnosed or the responsive, no episode. When you look at the responsive, no episode group, the costs go up with atypical agents, but the number of EPS symptom days goes down, as well as other factors. I never show the costs without revealing the benefits.

Dr. Noordsy: You have the challenge of reflecting a change in the quality of life in your analysis. It's easier to show a decrease in the number of EPS days. How do you show a person has more functional days?

Dr. Mauskopf: I have tried to measure functional days using the BPRS as a

proxy measure, but I'm not sure it is very sensitive. I would welcome suggestions on a better way of measuring functional improvement.

Dr. Aquila: I want to follow up on Dr. Lehman's point. I think we have to stay focused on the bigger picture. There are patients who are seen 4 or 5 times a year and are currently using a lower proportion of resources. However, in the bigger picture, we still have a very large budget for treating this illness. I think some preliminary data show we can offset those costs to our patients, not only in terms of the squeaky wheel getting the grease but also in terms of people who can really benefit from new interventions that allow them to get back to work. That's what every politician is saying nowadays, "Let's get people back to work." Most of the patients want to work, so I think we can shift those costs and make the argument by being better advocates.

Dr. Cohen: If we can show that people improve to the point where they can work again, that's an incredibly powerful argument when you go to legislators and ask for money, specifically for more drugs, new technologies, and new treatment programs.

My word of caution concerns pharmacy budgets, where people in various states have identified line items for specific drugs. I think this is a very dangerous proposition because with the stroke of a pen, the funding can be gone. This patient population is being discriminated against and treated differently than people with medical disorders. I don't see any examples of restriction on the access to drugs for stroke in emergency room settings or in other situations where access to care is not an issue. Restrictions have been focused on disease states like schizophrenia, and the deck is stacked against such patients.

Think about refractory patients; they are at a high risk for failure. We've used expensive treatments, and they've failed; the patients are still in hospitals. I know those in this room advocate early treatment, that is, treating patients with newer technologies earlier so we have the best chance for the patient's lifetime and can realize cost savings in terms of healthcare utilization.

Dr. McCombs: And after that, we have a woodwork or an inventory effect, where we have many patients under treatment for years whose ability to return to work has deteriorated. If these new products are as good as we hope, there will be a temporary increase in cost involved in getting these patients integrated into society. If we use the newer medications early, we won't always have those costs. Such patients will never lose their employment or their ability to be employed. So when you approach legislators, it's important to make sure they understand that some of these costs may be high, but they won't be in 5, 6, or 7 years.

Dr. Mauskopf: Unfortunately, I gave this presentation to decision makers from several states, and they were upset with the numbers I showed them. I had data on the impact of atypicals in a 3-year time horizon with some assumptions about switching. I had included in my conclusions the observation that if you start the newly diagnosed with atypicals, you may save more money in the long run, but not in 3 years. I demonstrated that it might cost a little bit more in the first year, but that the second and third year showed million-dollar cost savings in the total budget. I received a negative response. State legislators have such a short-term time horizon that they can't see past the first-year cost increases.

Health economists usually talk about continued higher costs with

new therapies. Results with the drug in question were wonderful, which is very good news. But the decision makers said, "Well, what about this possible first-year cost increase? We can't sell that." I don't know how I deal with that attitude.

Dr. Fitzgerald: I understand that position, coming from Tennessee, a state that has a managed care model for its Medicaid program. You've got approximately 8 managed care organizations [MCOs] that recognize patients can switch from one MCO to another. So the MCOs look very short term, that is, 1 year, for limits on what they are going to cover. That first year they may lose money, and then the patient goes to another MCO. That happens in private insurance coverage as well, so I suppose I can understand that position.

I also recognize that MCOs and health economists look specifically at the direct cost. In your model, where do you draw the line between direct cost and indirect cost? I noticed that you included the cost of an autopsy, and on suicide costs you included legal expense. When going to legislators and presenting your models, do you include the cost of items such as indemnity payments incurred as a result of patients bringing liability claims against physicians, pharmacists, nurse practitioners, and others?

Dr. Mauskopf: I have not done that, but including the cost of the autopsy is necessary. As an economist, I view indirect costs as productivity losses, but I estimate those in employment months, and I don't put dollar values on them. I'm not quite sure how to come up with those numbers.

Dr. Fitzgerald: It concerns me that in the political realm those numbers aren't included. Legislators talk about tort reform and the cost of medical malpractice claims. I think it's a very significant argument in favor of these

products, such as atypical agents or other advances. They can help avoid claims, which indirectly helps with tort crises that may be occurring in your states.

Dr. Cohen: As we talk about people returning to work, we have to readjust our thinking regarding successful treatment. If people return to work, they lose their benefits. In other countries, patients are given a stipend from the government to cover their food, housing, and medications. Psychiatrists from these countries have asked me how they can convince their patients to pay for more expensive medications that allow them to stay out of hospitals when they have to trade food and housing. This creates a terrible stress on people who don't handle stress very well.

In the United States, as patients move from hospitals or long-term care facilities (where drugs are part of the per-diem rate) to lower levels of care (perhaps a community mental health center), those centers will have to foot the bill if there is no Medicaid funding. What is the likelihood you will pay for these more expensive drugs rather than inexpensive drugs in exchange for recreational therapies, a social worker, or a psychologist? That's why pharmacists and others in patient care are very nervous; if you reduce the drug cost, you go back to the hospital. And the accountability for the consequences of such changes doesn't rest with the same people; the budgets don't rest with the same people. This is one of the true benefits of managed care—that all levels of care from one organization are seen together. We have to start looking at care in a global, macroeconomic fashion.

Dr. Mauskopf: You can do it through the political system or through the public by malpractice. When you have a system where budget is everything, you can find a congressman

who says, "We've got to have these drugs available." Or, if there are lawsuits from people who were denied atypical agents, for example, a family member commits suicide; sometimes you have to do it that way.

Dr. Noordsy: One limitation of the managed care model is that when private insurers manage it, they don't include other social costs such as legal expenses. I think managed care at the government level includes such costs better than managed care at the private level. We also should be in a situation where we could say that if effectiveness is twice as good, then some increase in cost is justified. We need to have advocacy groups who really work with us and enable people to say, "My son or daughter deserves better care to help him or her get to a better point in life, even if it does cost more."

Dr. Mauskopf: I've tried to make the population model address not only costs, but benefits as well. So when you are estimating the budget numbers, you're also estimating the population benefits. I need help to make sure I have enough estimates of benefits so people notice them and don't simply focus on the cost.

Dr. Noordsy: I think your model goes a long way toward that. However, I would suggest considering some of the benefits that families might experience that aren't necessarily in the medical cost arena, such as social functioning, vocational functioning, and avoidance of incarceration or homelessness.

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