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Title: An extended cost-effectiveness analysis of schizophrenia treatment in India under universal public finance

Author (1): Neha Raykar
Public Health Foundation of India

Author (2): Aditi Nigam
Center for Disease Dynamics, Economics, and Policy

Author (3): Dan Chisholm
World Health Organization

Correspondence to: Neha Raykar nigam@cddep.org

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Abstract:

BACKGROUND: Schizophrenia remains a priority condition in mental health because of its early onset, severity, and the human rights violations it often inflicts on patients. It also imposes a catastrophic economic burden on patients, their families, and health care systems.

AIMS AND METHODS: This paper develops an extended cost-effectiveness analysis (ECEA) for schizophrenia treatment in India to evaluate the consequences of universal public finance (UPF) on health and financial outcomes across income quintiles.

RESULTS: Using plausible values for input parameters, we conclude that health gains from UPF are concentrated among the poorest, whereas the non-health gains in the form of out-of-pocket private expenditures averted due to UPF are concentrated among the richest income quintiles. Value of insurance is the highest for the poorest quintile and declines with income.

CONCLUSIONS: The purpose of this analysis is to locate the relative position of schizophrenia interventions within a wider extended cost-effectiveness and priority-setting framework in the health sector. This is relevant because treatment of schizophrenia is all too often regarded as overly expensive or unaffordable. UPF can play a crucial role in ameliorating the adverse economic and social consequences of schizophrenia and its treatment in resource-constrained settings where health insurance coverage is generally poor.

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1. INTRODUCTION

The paper considers an extended cost-effectiveness analysis (ECEA) of intervention in schizophrenia treatment using recently developed methodology [1]. The proposed intervention package is antipsychotic medication (first- or second-generation) combined with basic psychosocial treatment, administered at a population-wide platform over one year. First-generation antipsychotic medication (FGAM) is either tablet doses of haloperidol-chlorpromazine or an injection of fluphenazine with biperiden administered for side effects. The second-generation antipsychotic medication (SGAM) considered is tablets of risperidone. We use a weighted average of FGAM and SGAM anti-psychotic medication with basic psychosocial treatment as a single treatment package. We evaluate the effects of universal public finance (UPF) for schizophrenia treatment in India on health and financial outcomes. Health gains are measured in terms of disability-adjusted life years. Measures of health gains include cost-effectiveness ratio under UPF; measures of non-health gains include private expenditure averted due to UPF and money-metric value of insurance as a measure of financial protection against the risk of an adverse health shock.

Previous studies have calculated the cost-effectiveness of schizophrenia treatments in resource-constrained developing countries to consider the relative costs per unit of health gains. Patel et al. review cost effectiveness of select mental disorders and conclude that first-generation antipsychotic drugs in low-income and middle-income countries and their benefits can increase through psychosocial treatments at the community level [2]. Chisholm et al. analyze cost-effectiveness of first- and second-generation antipsychotic drugs, alone or in combination with psychosocial counseling in Chile, Nigeria, and Sri Lanka and find that community-based outpatient provision of older (first-generation) antipsychotic drugs and psychosocial treatment is the most cost-effective intervention. Moreover, the cost of increasing treatment coverage through a community-based service model together with efficient treatment options is very low (investment of <Int.$1 per capita) [3]. Chisholm and Saxena evaluate comparative costs and effects of a package of interventions for a cluster of five neuropsychiatric conditions, including schizophrenia, in sub-Saharan Africa and Southeast Asia and find neuroleptic antipsychotic drugs and psychosocial treatment to be the most cost-effective intervention for schizophrenia [4]. Phanthunane et al. survey patients seeking treatment for schizophrenia in Thailand to provide detailed breakdown of the costs involved in schizophrenia treatment including health care costs and productivity losses to patients and families [5]. Cost-effectiveness studies on chronic schizophrenia treatments have also compared the efficacy of typical (first-generation) versus atypical (newer) drugs in low-resource settings, such as China and Thailand [6,7]. Clinical studies evaluate cost-effectiveness and compliance rates of first- versus second-generation antipsychotic drugs using pharmaco-economic analysis and find the latter to have a higher cost-effectiveness and better safety profile [8,9].

Our paper differs from the existing cost-effectiveness work on schizophrenia treatment in three ways. First, we focus on India, which has an estimated 4 million people with schizophrenia, differentially affecting about 25 million family members, according to an estimate by the World Health Organization (WHO). On a more general level, as Sinha and Kaur point out, poor awareness about mental health symptoms, treatment availability, and potential benefits of treatment, along with the myths and stigma associated with these conditions, causes huge treatment gaps in countries like India, usually up to 75%, especially among low- and lowermiddle-income families [10]. Schizophrenia remains a priority condition in resource-constrained economies such as India because of its severity, its often catastrophic effect on the welfare and income of family members, and the significant risk associated with its patients being exposed to severe human rights violations.

Second, while existing studies evaluate cost-effectiveness under current scenarios of treatment coverage in the respective countries, we extend the analysis to evaluate cost-effectiveness of publicly financed schizophrenia treatment in India. UPF is expected to increase uptake of treatment, thereby increasing health gains. It also crowds out private out-of-pocket (OOP) treatment costs and financially insures individuals against catastrophic health expenses. Third, this paper extends the standard cost-effectiveness analysis to include the non-health financial benefits of UPF to private individuals.

The rest of the paper is organized as follows. Section 2 explains the data sources and assumptions behind the major input parameters used in the model. Section 3 presents the methodology behind the ECEA. Section 4 summarizes the health and financial outcomes for each income quintile. Section 5 discusses the results and the limitations of the model.

2. DATA

To perform a quintile-based income analysis, we assume an evenly distributed cohort size of 200,000 individuals in a population of 1 million. Other inputs used in the model are largely based on assumptions and parameters used in previously published studies; these inputs are presented in Table 1 and are divided between population-wide inputs and quintile-specific inputs. The coefficient of relative risk aversion is assumed to be 3.00 [11,12]. Disability weights for residual and acute cases are 0.576 and 0.756 respectively [13]. We use a weighted average composite disability weight of residual and acute schizophrenia, assuming a ratio of 80:20 between residual and acute cases. Treatment effectiveness (on the average level of functioning / disability) is 23.5 percent based on an average of: 23 percent for FGAM with basic psychosocial treatment (chlorpromazine 100 mg daily and/or fluphenazine deconate 25 mg daily, supportive psychosocial treatment) and 24 percent for SGAM with basic psychosocial treatment (risperidone 4 mg daily, supportive psychosocial treatment) [14–16]. Adherence to treatment is set to be 76 percent for both lines of treatment [17].

Next, we present quintile-specific inputs parameters used in the model. The average treatment coverage rate for schizophrenia is 40 percent based on a World Health Survey study from 1947 – 2010 on coverage of schizophrenia treatment in 6 states in India [18]. We assume a socioeconomic gradient for treatment coverage rates, typically due to increased detection and healthcare utilization rates among the richer socioeconomic groups [18]. Assuming the average value for the middle income group to be 40 percent based on this literature, we distribute the coverage rates to range from 30 percent in the poorest income group to 50 percent in the richest.

Data on schizophrenia prevalence rates are from the Global Burden of Disease study's 2010 DisMod-MR output [19]. These rates are stratified by region, age group, and gender. However, since we analyze health and financial consequences of UPF across income groups, we require epidemiological inputs (such as prevalence rates) to be stratified by income quintiles. To this end, we apply DisMod's epidemiological indicators for South Asia to a large household survey in India: Round 3 of the District Level Household and Facility Survey [20]. DLHS-3, conducted in 2007–08, is a nationally representative data set on reproductive and child health indicators, covering 720,320 households and over 3.7 million individuals from 601 districts across India [20]. The survey reports demographic information (age, gender, socioeconomic status) for each member of the household and also computes a wealth quintile for each individual based on her household's composition of owned assets. To each such individual in the DLHS-3 sample, we assign the relevant schizophrenia prevalence rate from DisMod, based on the individual's age and gender. Thus, the DLHS-3 sample now has information on every individual's prevalence rate for schizophrenia, besides her gender, age in completed years, and wealth quintile. Using sampling weights, we then derive a weighted average prevalence rate for each income quintile, assuming the DLHS-3 wealth quintiles are a good approximation of the income quintile distribution in India. We therefore use income and wealth quintiles/groups interchangeably in the rest of the paper. The prevalence rates per income quintile are presented in Table 1.

As seen in the table, these rates increase with higher income groups. This is a reflection of better schizophrenia detection and health care utilization rates by the richer groups. Moreover, the age distribution of the DLHS-3 sample also partially explains this upward trend in prevalence rates; the relative sample shares of the age-groups with the highest schizophrenia prevalence rates from DisMod (males and females combined) increase with income. We discuss this in detail in Section 5. Finally, overall probability of receiving care is calculated as a product of prevalence rate per quintile and treatment coverage rates per quintile.

Table 1. Parameters used for UPF of schizophrenia treatment, and their corresponding sources

Input	Value	Source
Demography		

Cohort size	1000000					Authors' assumption
Cohort size per quintile	200000					Authors' assumption
Treatment impact						
a. Population-wide:						
Coefficient of relative risk aversion	3					[11,21]
Disability weight (residual state)	0·576					[13]
Disability weight (acute state)	0·756					[13]
Treatment effectiveness (anti-psychotic medication + psychosocial treatment)	24%					[4]
Treatment adherence rate	76%					[17]
b. Quintile-specific:	I	II	III	IV	V	
Current coverage	30%	35%	40%	45%	50%	[18]
Target coverage	80%	80%	80%	80%	80%	Authors' assumption
Prevalence rates per quintile	0·25%	0·26%	0·27%	0·29%	0·32%	[19,20]
Overall probability of seeking care	0·08%	0·09%	0·11%	0·13%	0·16%	Authors' calculations
Income						
Average monthly GDP per capita income (current USD)	$641	$911	$1,177	$1,562	$3,211	[22]

Using the World Bank's Poverty Calculation Net (PovCalNet) tool, we compute the current average monthly per capita gross domestic product (GDP) per quintile as follows [22]. The tool reports the share of each decile as a proportion of the total monthly consumption of India based on a sample of households surveyed in 2009. The consumption shares by decile are based on estimated Lorenz curves; households are ranked by consumption per person, and distributions are population (household size and sampling expansion factor) weighted. Based on the consumption shares, which range from 3.7 percent in the lowest decile to 28.8 percent in the highest decile, we create a multiplier for each quintile based on its relative share of consumption. This is done by taking each quintile's percentage share of consumption and dividing it by the average percentage share across all the quintiles. This gives us a relative weight for each quintile that is further multiplied by the annual GDP per capita of $1,500 (current USD) to calculate the average annual GDP per capita for each quintile, which ranges from $641 in the poorest quintile to $3,211 in the richest quintile (Table 1) [22]. Assuming the population per quintile is 200,000, the total annual GDP of this economy with a population of 1 million is $15 billion.

Annual treatment costs for antipsychotic medication with basic psychosocial treatment, advice, follow-up inpatient and outpatient care, and intensive psychosocial treatment of acute cases are obtained from the Mental Health Global Action Programme (MHGAP) costing tool for primary and secondary care in India [14]. Table 2 presents the costs of all the treatment resources used as inputs in the model. The average annual treatment cost per case is approximately $177 (2012 USD). To evaluate the consequences of UPF for private (OOP) expenses toward schizophrenia treatment, it is necessary to find the proportion of total treatment costs that are borne by private individuals. We apply quintile-specific shares of per capita public health spending to average per capita public health spending in India for 2004 and derive the total per capita public spending per quintile; to this we add the estimated OOP per capita spending on all health conditions, again by quintile, for the year 2004-05 [23,24]. We then calculate the proportion of the total treatment cost (public and private) that is borne out of pocket. At least 70% of the total treatment costs for schizophrenia are borne by private individuals. This has strong implications for non-health gains from introduction of UPF that leads to crowding out of private expenditures.

Table 2. Treatment resource costs and shares of out-of-pocket (OOP) private expenditure

Treatment resource costs	% of cases needing	Quantity per service user (per year)	Unit cost (price)	Cost per case
I. Primary health center				
Anti-psychotic medication primary care visits	100%	4	$1·78	$7·12
Basic psychosocial treatment	100%	6	$1·78	$10·68
Intensive psychosocial treatment	10%	18	$5·56	$10·01
II. Hospital				
Outpatient visits for short term inpatients	50%	12	$2·51	$15·06
Inpatient treatment- psychiatric unit-short term	15%	28	$8·83	$37·09
Inpatient treatment- residential unit-long term	2%	180	$8·47	$30·49
III. Drug				
Chlorpromazine	25%	1095	$0.01	$3.67
Haloperidol	50%	584	$0.00	$1.17
Risperidone	10%	913	$0.07	$7.95
Fluphenazine	10%	12	$0.60	$0.96
Biperiden	10%	70	$0.10	$0.94
IV. Other				
Lab tests	50%	1	$5.00	$2.50

Total cost per case (2012 USD/year)	**$177.42**

3. METHODOLOGY

Cost-effectiveness Analysis

We use disability-adjusted life years (DALYs) as the health outcome to evaluate the consequences of UPF for schizophrenia treatment. Cross-sectional DALYs for the current income quintile in the disease state are calculated for a combination of FGAM and SGAM with basic psychosocial treatment under the current treatment scenario (based on current treatment coverage) and the alternative treatment scenario (treatment coverage targeted under UPF), which considers the incremental cost and effect of scaling up treatment to 80 percent of the population. Thus, after the implementation of UPF, 80 percent of the population that needs treatment would receive publicly financed care.

Since schizophrenia treatment is accorded no direct mortality effect, DALYs were estimated using the prevalent YLD method:

YLD = prevalent cases * (effect size * adherence) * disability weight * average duration of disability * target coverage

For this model, all patients treated for schizophrenia are assumed to receive a combination of antipsychotic drugs and basic psychosocial treatment; 90 percent receive haloperidol or chlorpromazine with biperiden (for side effects), and the remaining 10 percent receive a fluphenazine injection. Fifteen percent are assumed to receive inpatient psychiatric care in a short-term community-based psychiatric unit, 2 percent are long-term community-based residential patients, and 50 percent have outpatient visits (for follow-ups) [14]. Finally, 10 percent of treated patients are modeled to receive more intensive, individual-based psychosocial treatment.

Value of Insurance

Following Verguet et al., we calculate the expected value of a gamble concerning the cost of treating schizophrenia without UPF at the individual level, as follows:

$$Y_p = (1-p)y + p(y-c)$$

where p = overall probability of receiving care for schizophrenia (calculated as, coverage*prevalence rates per quintile), c = treatment cost, and y = income [1].

The certainty equivalent, assuming a coefficient of relative risk aversion *r*, is

$$Y^* = [(1-p)y^{1-r} + p(y-c)^{1-r}]^{1/1-r}$$

Money metric value of insurance *v(p, y, c)* at the individual level is then

$$v(p,y,c) = Y_p - Y^*$$

The total insurance value per quintile of income is

$$Delta(v) * quintile\ size * target\ coverage$$

where target coverage is assumed to be 80 percent.

4. RESULTS

Cost-effectiveness

In this section, we present quintile-based outcomes of standard cost-effectiveness of UPF relative to the current treatment scenario for schizophrenia, where treatment is a combination of FGAM and SGAM with basic psychosocial treatment (Table 3). Regarding health gains from UPF: extending schizophrenia treatment from baseline coverage rates ranging from 30 to 50 percent across quintiles to a target coverage rate of 80 percent for all quintiles under UPF, averts 22 to 28 DALYs from the richest quintile to the poorest quintile. This is 7 percent of the DALY burden averted through UPF. As seen in Table 2, the total annual cost of treatment per case is USD $177.42. In the absence of UPF, the total annual costs of treatment per quintile range from $26,721 in the poorest to $57,059 in the richest quintile. Based on our assumptions, 70 percent of these costs are borne by private individuals. Extending treatment to 80 percent of the population increases the total annual treatment costs, ranging from $71,257 in the poorest quintile to $91,295 in the richest quintile. This yields a cost- effectiveness ratio of USD $1,589 per DALY averted for each income quintile.

Table 3. Results

Outcome	**Income Quintile I**	**Income Quintile II**	**Income Quintile III**	**Income Quintile IV**	**Income Quintile V**	**Total**
YLD (current burden)	307	316	333	354	394	1,704
DALY averted by UPF (averted burden)	28	26	24	23	22	122
Current coverage						
Total costs of treatment	$26,721	$32,042	$38,666	$46,156	$57,059	$200,644

Private costs of treatment	$18,705	$22,429	$27,066	$32,309	$39,942	$140,451
Current costs met by government	$8,016	$9,613	$11,600	$13,847	$17,118	$60,193
Target coverage (under UPF)						
Total costs of treatment	$71,257	$73,238	$77,331	$82,055	$91,295	$395,176
Additional costs to government	$44,535	$41,196	$38,666	$35,899	$34,236	$194,532
OOP expenses averted	$49,880	$51,267	$54,132	$57,439	$63,906	$276,623
Cost-effectiveness ratio (Cost/DALY averted)	$1,589	$1,589	$1,589	$1,589	$1,589	
Insurance value	$7,282	$5,587	$4,972	$4,302	$2,439	$24,582

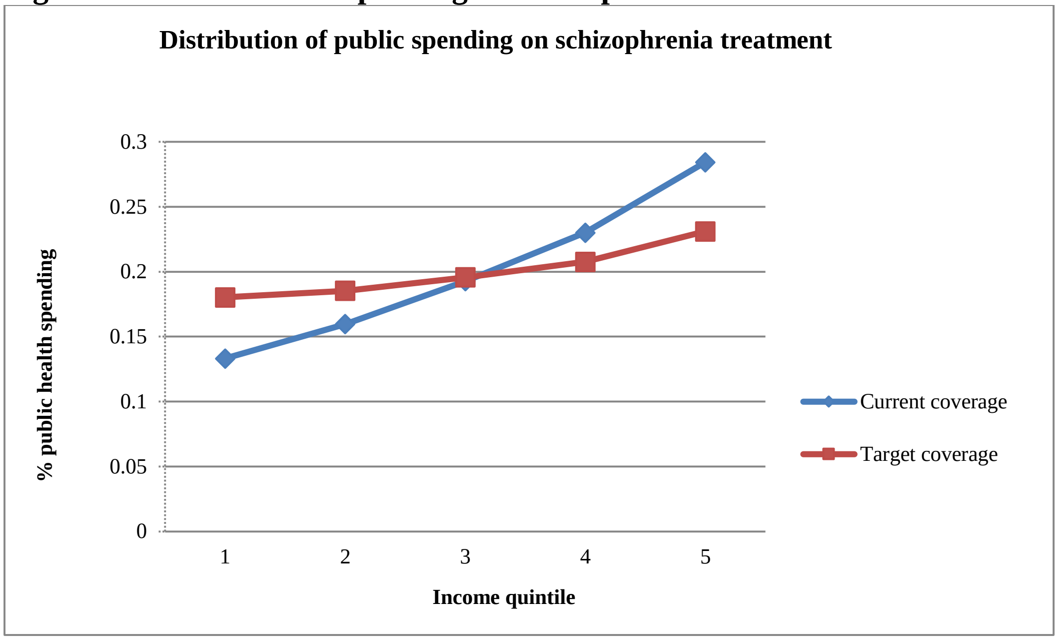
Notes:

UPF = universal public financing for 80% of population in need. Results are based on a population of 1 million people, with intervention benefits equally divided among income quintiles of 200,000 persons each (quintile I having the lowest household income and quintile V, the highest). “Target coverage” of UPF for schizophrenia treatment for all income groups was set at 80 percent. All monetary values or costs are expressed in U.S. 2012 dollars. “Total costs” = (direct government expenditures) + (private expenditures, including out-of-pocket costs). “Insurance value” = financial risk protection provided (based on current coverage).

As discussed earlier, in the absence of UPF, a large share of total treatment costs is incurred by private individuals in India. With UPF, this cost burden will be transferred onto the government. The impact of UPF on private costs averted is shown in Table 3. The total OOP private expenditure averted due to UPF is $276,623. Moreover, it increases across income quintiles, ranging from $49,880 for the poorest quintile and $63,906 for the richest quintile. It must be noted that OOP expenditures are mainly a function of prevalence rates, coverage rates, and the percentage share of health expenses that are out-of-pocket, and unit cost per case. Since unit cost per case and the percentage of out-of-pocket expenses are constant across all quintiles, this upward trend in OOP expenses averted from UPF is mainly a reflection of average prevalence rates rising with income and the gradient of current coverage rates across quintiles as seen in Table 1. We posit that the increases in prevalence rates are partially due to better detection/reporting of schizophrenia and greater utilization of medical services by the richer groups. Another plausible explanation concerns the demographic composition of the survey data that is used in the computation of quintile-based prevalence rates: we observe from the DisMod data that prevalence rates of schizophrenia are the highest for both males and females in the age group of 35-44 years, followed by the 45-54 age group. In the DLHS-3 sample that we use to compute weighted average prevalence rates per wealth quintile, we observe that the proportions of these two high-prevalence age groups increase with higher income quintiles. For instance, the combined share of males and females belonging to the age group of 35-44 years in the sample ranges from approximately 10 percent in the poorest quintile to 13 percent in the richest quintile. Similarly, share of the 45-54 age group in the sample ranges from approximately 7 percent in the poorest quintile to 11 percent in the richest quintile. The rising shares of the high-prevalence groups across income groups could partially explain the increase in average prevalence rates across income groups and thereby OOP expenses averted through UPF. Under this scenario, if 80 percent of a population of one million is targeted for coverage through UPF, the government must meet a total cost of $395,176 per one million individuals. The government can raise the finances required for these expenses possibly through taxation.

Figure 1 compares the quintile distribution of public health spending on schizophrenia treatment under current coverage (ranging from 30 to 50 percent) versus that under UPF's target coverage of 80 percent. Under current coverage, distribution of public health spending accords with evidence in Mahal et al. of a regressive pattern of health spending that disproportionately favors the rich; this is mainly a manifestation of higher coverage rates and prevalence rates among the richer groups [24]. Introduction of UPF flattens this distribution, thus creating distributional consequences of universalizing healthcare coverage and costs. It must be noted that the distribution of public health spending would be perfectly elastic if prevalence rates were equal across the quintiles.

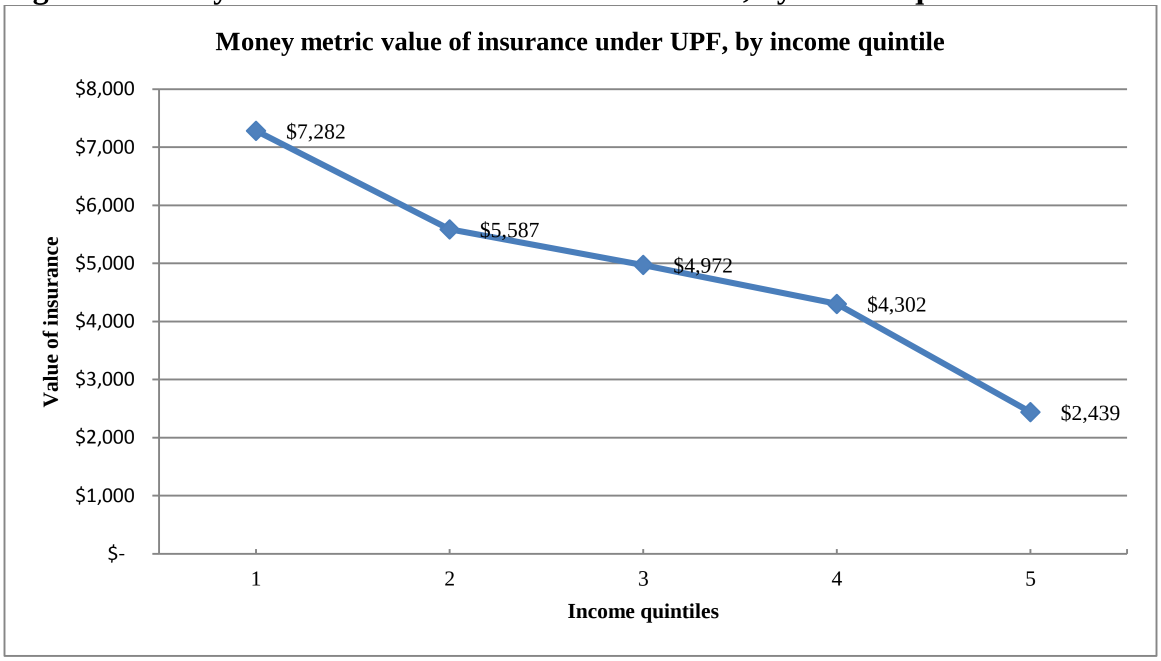
Figure 1. Distribution of spending on schizophrenia treatment



Value of Insurance

An additional financial consequence of a health intervention such as UPF is the money metric value of insurance, which is the amount an individual is willing to pay to receive risk protection i.e., to be in a healthy state vis-à-vis a poor health state. The total annual value of insurance from UPF for the entire population of 1 million is USD $24,582. The value is the highest for the lowest income quintile and decreases as income rises. The annual insurance value for the poorest quintile is USD $7,282, which is approximately 30 percent of the total value. The second income quintile has an annual insurance value of USD $5,587; the third income quintile, $4,972; and the fourth income quintile, $4,302. The highest income quintile has an annual insurance value of USD $2,439, which is approximately 10 percent of the total value.

Figure 2. Money metric value of insurance under UPF, by income quintile



5. DISCUSSION

While existing research considers the cost-effectiveness of schizophrenia treatment in low-resource settings including India, our paper considers the extension of the current literature to evaluate the cost-effectiveness of publicly financed schizophrenia treatment in India and includes the non-health financial benefits of UPF to private individuals. Our results show that when current coverage is extended to 80 percent under UPF, the cost-effectiveness of treatment remains the same. As seen in Table 3, health gains in terms of DALYs averted from UPF are the highest among the poor; however, these gains come at a higher cost for the poorest quintile, since UPF covers a larger proportion of this income group vis-à-vis the richest.

The money metric value of insurance is a quantifiable measure of financial protection under UPF and this ECEA illustrates that it is feasible to design essential packages of publicly financed health services to include financial protection as an additional outcome besides health gains. We see a relatively slow downward trend in the insurance values from the lowest income quintile to the highest income quintile; risk protection from UPF would accrue primarily to low-income groups. Total value of insurance is USD $24,582, of which, 30 percent accrues to the poorest income quintile.

Finally, we offer a few caveats on the results. The model is severely limited in scope because of the overall paucity of reliable data on mental health disorders in general and schizophrenia in particular for India. Many of the epidemiological and efficacy parameter values used in this analysis rely on regional (South Asia) estimates. Furthermore, data on treatment costs come largely from the MHGAP costing tool, which is based on a small sample of individuals from a relatively small study site in India (Sehore, Madhya Pradesh); estimates on costs of services are therefore non-representative at the national level. Moreover, we are unable to estimate comprehensive costs, such as the transportation, time, and opportunity costs involved in receiving treatment. To test the variability of our main outcomes based on plausible ranges of the input parameters derived from various sources, we perform an uncertainty analysis for the key variables used in the model using the Latin Hypercube Sampling technique. Please see Appendix A for details and results.

A further concern is the use of DALYs as a measure of health outcome for schizophrenia treatment. Although DALYs are a useful measure of the efficiency of schizophrenia care relative to other health investments, they are not as sensitive to clinical change as condition-specific measures. Moreover, they do not deal with comorbidity and cannot reflect the effect of treatment on the patients' families [4].

Lastly, although the paper extends standard cost-effectiveness analysis to include certain financial outcomes, we do not account for non-health benefits of treatment in the form of workforce and household productivity gains. A benefit-cost analysis would be needed to measure those effects.

CONFLICT OF INTEREST

The authors have no conflict of interest.

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Appendix: Uncertainty Analysis (Latin Hypercube Sampling)

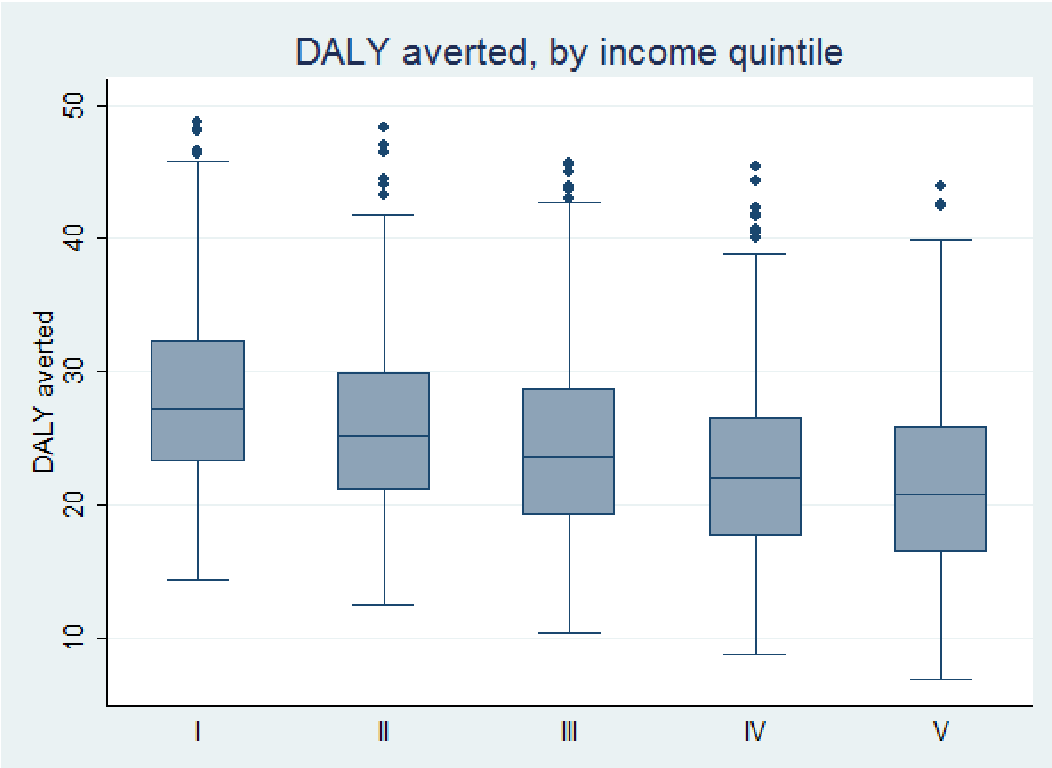
We performed uncertainty analysis to test for the reliability of model predictions using the Latin Hypercube Sampling (LHS) scheme with 1000 simulations [25]. Under the LHS scheme, a probability distribution is constructed for each input parameter that is not known with certainty. Input parameters that are known with large certainty, either because they are hypothetical values constructed for the simplicity of the model (such as population/cohort size) or because they are reliable values derived from large, nationally representative Indian survey datasets are excluded from the model. Table A1 describes the baseline values and the assumed range and distributions for those input parameters that are likely to be affected by uncertainty, either because they are aggregate, regional estimates not specific to India, or because they are based on local village-level field studies with small sample sizes that may not be representative of the country as a whole. We specified a plausible range of minimum and maximum values for the uncertain parameters based on available literature or on assumptions made by the working team.

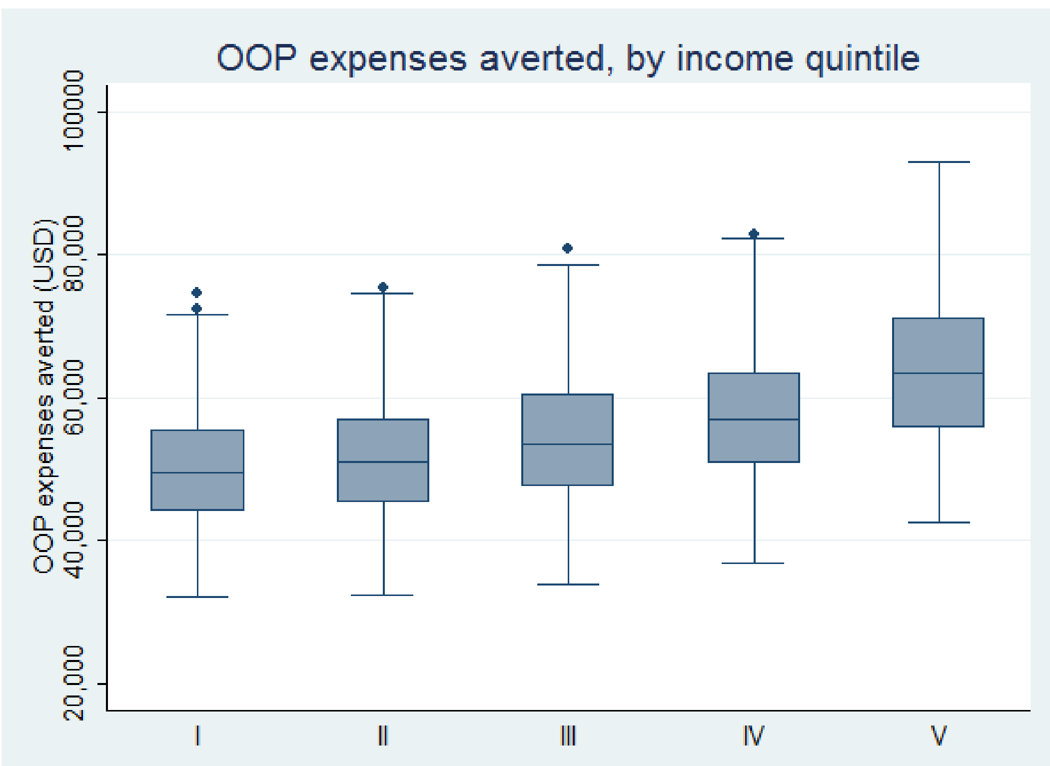
Table A1. Input parameters with uncertainty

Input parameters	Probability distribution	Baseline values	Max	Min	Source
Disability weight (residual)	Uniform	0·58	0·76	0·40	[13]
Disability weight (acute)	Uniform	0·76	0·89	0·57	[13]
Treatment efficacy (anti-psychotic + psychosocial treatment)	Uniform	0·24	0·26	0·22	[14–16]
Treatment adherence rate	Uniform	0·76	0·84	0·68	[17]
Total cost per case	Uniform	$177·42	$212·90	$141·93	[14]
Current coverage rate by income quintile[18]					
I	Uniform	0·30	0·40	0·20	
II	Uniform	0·35	0·45	0·25	
III	Uniform	0·40	0·50	0·30	
IV	Uniform	0·45	0·55	0·35	
V	Uniform	0·50	0·60	0·40	
Target coverage rate by income quintile					
Quintiles I - V	Uniform	0·80	0·90	0·70	Author's assumption
Percentage of all costs that are Out Of Pocket (OOP) by income quintile					
Quintiles I - V	Uniform	0·70	0·80	0·60	Author's assumption

Figure A1 shows the summary statistics from the LHS scheme with 1000 simulations for three outcomes – DALY averted, OOP expenses averted, and money metric value of insurance – in the form of box plots representing quartile values for each income quintile. We do not show the corresponding boxplots for cost-effectiveness ratio here since the ratio is constant across quintiles. The summary statistics for this outcome are included in Table 2A. Table 2A presents the values including means for all four outcomes in tabular form. It is worth mentioning that the relatively larger variation across quintiles for value of insurance is most likely due to the variation in prevalence rates, which range from 0.251% (Q1) to 0.322% (Q5). This variation in prevalence is due to the age distribution of the DLHS survey and may reflect better detection rates among the richest as explained earlier.

Figure A1. Summary statistics from LHS scheme with 1000 simulations


DALY averted, by income quintile
DALY averted
10
20
30
40
50
I
II
III
IV
V


OOP expenses averted, by income quintile
OOP expenses averted (USD)
20,000
40,000
60,000
80,000
100000
I
II
III
IV
V

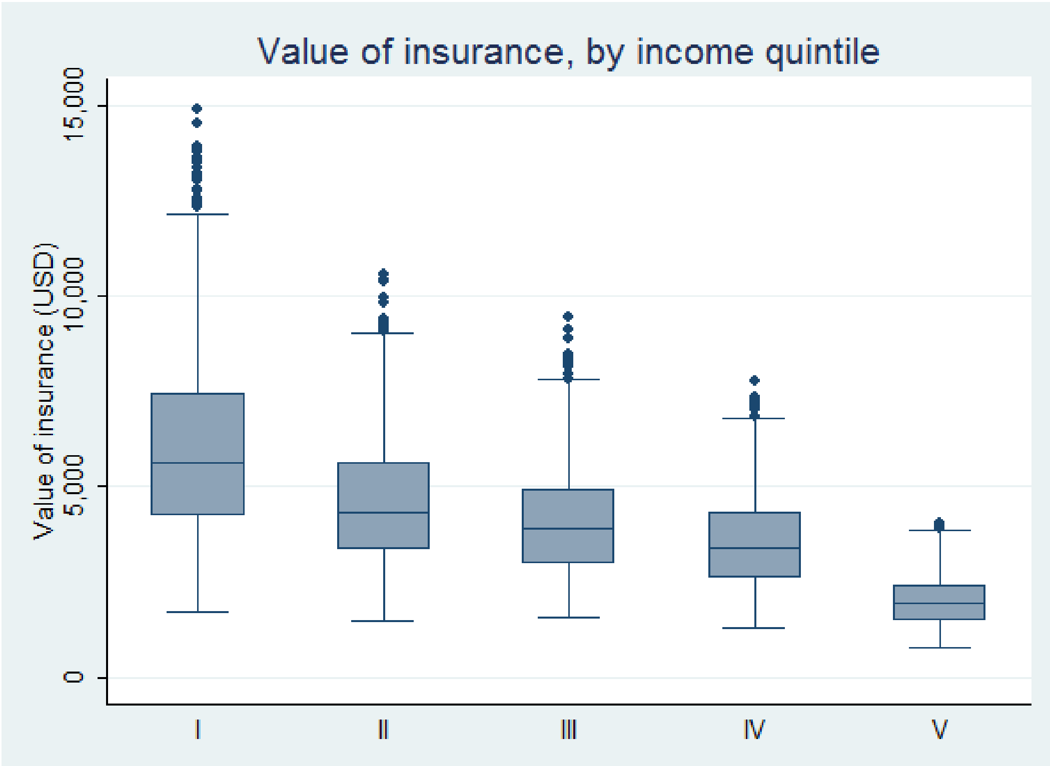


Table A2. Summary statistics of Latin hypercube distribution for ECEA outcomes

Outcome	DALY Averted					
Income quintile	I	II	III	IV	V	Total
Minimum	14·35	12·48	10·44	8·83	6·95	74·40
1st Quartile	23·23	21·08	19·24	17·66	16·46	104·47
Mean	27·85	25·76	24·22	22·43	21·41	121·66
Median	27·20	25·19	23·61	22·05	20·84	120·11
3rd Quartile	32·28	29·90	28·61	26·50	25·88	136·14
Maximum	48·78	48·39	45·69	45·36	43·90	190·97
Outcome	**OOP Expenses Averted**					
Income quintile	**I**	**II**	**III**	**IV**	**V**	**Total**

Minimum	$32,049	$32,309	$33,885	$36,911	$42,565	$200,060
1st Quartile	$44,036	$45,180	$47,542	$50,646	$55,748	$248,197
Mean	$49,874	$51,290	$54,131	$57,433	$63,940	$276,668
Median	$49,352	$50,984	$53,515	$56,888	$63,354	$276,665
3rd Quartile	$55,333	$56,949	$60,270	$63,380	$71,136	$303,926
Maximum	$74,464	$75,415	$80,724	$82,814	$92,919	$367,834
Outcome	**Cost-Effectiveness Ratio (USD/DALY Averted)**					
Income quintile	**I**	**II**	**III**	**IV**	**V**	**Total**
Minimum	$940	$940	$940	$940	$940	$940
1st Quartile	$1,407	$1,407	$1,407	$1,407	$1,407	$1,407
Mean	$1,640	$1,640	$1,640	$1,640	$1,640	$1,640
Median	$1,605	$1,605	$1,605	$1,605	$1,605	$1,605
3rd Quartile	$1,850	$1,850	$1,850	$1,850	$1,850	$1,850
Maximum	$2,791	$2,791	$2,791	$2,791	$2,791	$2,791
Outcome	**Value of Insurance**					
Income quintile	**I**	**II**	**III**	**IV**	**V**	**Total**
Minimum	$1,706	$1,488	$1,581	$1,273	$794	$8,697
1st Quartile	$4,212	$3,317	$2,980	$2,600	$1,471	$15,592
Mean	$6,028	$4,609	$4,083	$3,522	$2,000	$20,242
Median	$5,633	$4,329	$3,882	$3,382	$1,927	$19,666
3rd Quartile	$7,444	$5,604	$4,905	$4,288	$2,417	$24,322
Maximum	$14,890	$10,568	$9,459	$7,751	$4,029	$39,162