

Impact of community-based health insurance in rural India on self-medication & financial protection of the insured

David M. Dror¹, Arpita Chakraborty^{1,2}, Atanu Majumdar¹, Pradeep Panda¹ & Ruth Koren³

¹Micro Insurance Academy, New Delhi, India & Institute of Health Policy & Management, Erasmus University, Rotterdam, The Netherlands, ²Public Health Foundation of India, Gurgaon, India & ³Tel Aviv University, Rabin Medical Center, Petah Tikva, Israel

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Background & objectives: The evidence-base of the impact of community-based health insurance (CBHI) on access to healthcare and financial protection in India is weak. We investigated the impact of CBHI in rural Uttar Pradesh and Bihar States of India on insured households' self-medication and financial position.

Methods: Data originated from (i) household surveys, and (ii) the Management Information System of each CBHI. Study design was "staggered implementation" cluster randomized controlled trial with enrollment of one-third of the treatment group in each of the years 2011, 2012 and 2013. Around 40-50 per cent of the households that were offered to enroll joined. The benefits-packages covered outpatient care in all three locations and in-patient care in two locations. To overcome self-selection enrollment bias, we constructed comparable control and treatment groups using Kernel Propensity Score Matching (K-PSM). To quantify impact, both difference-in-difference (DiD), and conditional-DiD (combined K-PSM with DiD) were used to assess robustness of results.

Results: Post-intervention (2013), self-medication was less practiced by insured HHs. Fewer insured households than uninsured households reported borrowing to finance care for non-hospitalization events. Being insured for two years also improved the HH's location along the income distribution, namely insured HHs were more likely to experience income quintile-upgrade in one location, and less likely to experience a quintile-downgrade in two locations.

Interpretation & conclusions: The realized benefits of insurance included better access to healthcare, reduced financial risks and improved economic mobility, suggesting that in our context health insurance creates welfare gains. These findings have implications for theoretical, ethical, policy and practice considerations.

Key words Community-based health insurance - financial protection - hardship financing - rural India - self-medication

There is little published research on the impact of health insurance on welfare gains of insured persons in the informal sector. A systematic review of health insurance offers inconclusive evidence of effective financial protection of insured poor¹. Considering that commercial or social health insurance schemes are rare in rural India², it is necessary to explore the impact of health insurance on insured households (HHs) covered by mutual aid insurance, or community based health insurance (CBHI) operated among grassroots communities in India. The importance of awareness-raising in voluntary uptake of CBHI³, the key parameters that determine uptake^{4,5}, the impact of thresholds and caps on the coverage level of CBHI⁶, and the method through which members decide on benefits packages⁷ are some important aspects of CBHI. However, much less is known on the impact of being insured under CBHI. The aim of this study was, therefore, to assess the impact of CBHI on access to healthcare and financial protection within a large-scale randomized controlled field experiment in three rural locations in India.

We hypothesize that CBHI improves insured HHs' (i) access to healthcare, by reducing self-medication; and (ii) financial protection, by reducing hardship financing and enhancing economic mobility. We consider reduction in self-medication, namely consumption of unprescribed medicines, as an indicator of improved access to healthcare because it is independent of requiring a uniform benefits package in all studied locations, and because self-medication is recognized globally as a major health risk that can lead to misdiagnosis, excessive or prolonged use of medicines, unsuitable dosage, drug interactions and polypharmacy⁸⁻¹³.

Two measures of financial protection were applied: first, the proportion of HHs that borrowed with interest to pay healthcare costs, because borrowing-with-interest is a strong indicator of the risk of falling into indigent status¹⁴⁻¹⁸; and second, the effect of insurance on economic mobility (*i.e.* the measurement of the capacity of a participant in a system to improve (or reduce) his/her economic status)¹⁹ measured by consumption spending on non-health items.

Material & Methods

Three CBHI schemes were implemented in cooperation with local grassroots non-government organizations (NGOs): BAIF Development Research Foundation in Pratapgarh, Uttar Pradesh; *Shramik*

Bharti in Kanpur-Dehat, Uttar Pradesh; and *Nidan*, in Vaishali, Bihar, with technical assistance by the Micro Insurance Academy (MIA), New Delhi (<https://www.microinsuranceacademy.org/project/uttar-pradesh-and-bihar-india/>).

This study was designed as a cluster randomized controlled trial (CRCT)²⁰ in which HHs were included in the sample if at least one female was affiliated in March 2010 to a Self-Help Group (SHG) operated in each of the three study locations by the grassroots NGOs. The three locations were divided into 48 equal-size clusters (a cluster was a group of geographically proximate villages). In each location, clusters were randomly assigned to one of three enrollment years (2011, 2012 and 2013) when one third of the HHs were offered to enroll in the CBHI (staggered implementation study-design). Under this study design, those HHs that were defined as control in early waves of the implementation were invited to join in later years.

Data for this analysis originated from two sources: (i) household surveys, conducted as part of the CRCT study design²⁰; and (ii) the Management Information System maintained for each CBHI scheme by MIA (known as MIA-MIS) for operational details.

The ethics committee of the University of Cologne, Germany, a scientific partner in this project, approved both project design and research tools. The MIA Ethics Committee also approved the study.

Household information: A baseline survey was conducted in March-May 2010, with a sample of 3,685 HHs (21,373 individuals). The questionnaire queried socio-demographic characteristics, HH consumption expenditures for food and non-food items and financial issues. Information was collected on self-reported long-term and short-term health events, hospitalization, healthcare seeking (including self-medication), the associated costs, and how those costs were financed.

An endline survey was conducted in March-April 2013, when 3,307 HHs (18,322 individuals) of the HHs included in the baseline were revisited. Attrition rates during the follow up rounds were around 10 per cent.

Benefits packages: The groups of prospective insured persons were involved, together with representatives of the grassroots NGOs, in selecting benefits packages⁷. The benefits packages and premiums of the three CBHIs differed, and thus analysis of the data was done separately for each location.

Study cohorts and descriptive statistics: The unit of randomization for the CRCT experiment was the cluster. A HH was defined as insured if at least one female from the family was an active SHG member and enrolled in CBHI. Enrollment was voluntary. Each HH that was offered to enroll could do so, or not. A HH that joined could also enroll other members, in the year the principal member joined or in subsequent years. Not all HHs that were offered joined the CBHI, nor all individuals therein. A HH that chose not to enroll when offered could not do so later.

For the purpose of analyzing the impact of insurance only the insured HHs were included in the treatment group, but the insured group did not form a randomized sample of the target population because of the voluntary choice. In order to match appropriate control samples from the uninsured HHs and the uninsured individuals [irrespective of whether they were “offered and not joined” (ONJ) or “not offered” (NO)] to the treatment groups composed only of enrolled HHs [“offered and joined” (OJ)], we applied Kernel Propensity Score Matching (K-PSM)²¹.

The details of the cohorts are shown in Table I. The descriptive statistics of the two sub-cohorts for the baseline and endline are shown in Table II (for HHs) and Table III (for individuals). In Table II, the monthly per capita consumption expenditure (MPCE) was calculated using the methods followed by the National Sample Survey Organization, India²², and converted to purchasing power parity international dollar (PPP\$).

Methods : The outcome variables (self-medication, borrowing-with-interest for healthcare, and non-health consumption expenditure) were defined in the following ways:

Self-medication was defined as 1 if an individual resorted to self-medication for an illness at least once in the last 30 days prior to the survey; 0 otherwise. The results were expressed as the number of people who reported an illness and self-medication at least once, divided by the total number of people who reported an illness in the previous 30 days.

Borrowing-with-interest was defined as 1 if a household reported borrowing-with-interest at least once for illnesses not requiring hospitalization (acute or chronic) in the 30 days prior to the survey; 0 otherwise.

Household-level consumption expenditure for non-health items was defined as mean/average household

expenditure from all the sources excluding health-related expenditure per month (MPCE non-health). We also computed MPCE (non-health) quintiles and movement of HHs (upward/downward) across MPCE (non-health) quintiles over time. The outcome variable for this third indicator was computed by comparing the expenditure quintiles of the same households at two time-points (before and after intervention). Hence, DiD was not relevant and the temporal dimension was not included as an independent variable.

The extent of self-medication may vary by individual and episode. The decision to borrow was usually taken at the household level; and MPCE reflected the socio-economic status of a household and was estimated at household level in context. Therefore, the first indicator (self-medication) was defined at the individual level and the last two indicators (borrowing with interest and quintile shift) were defined at the household level.

Matching technique: As explained, the voluntary affiliation introduced selection bias to the treatment cohorts, both at inter- and at intra-household stage. K-PSM was used to construct comparable control and treatment groups to enable to attribute the changes in the outcome variables (self-medication and financial protection) from baseline and endline. The method was used to calculate the weighted averages of the observed characteristics of the uninsured groups to construct the counterfactual outcome²¹. Kernel propensity scores was estimated as a parametric logit model and the common support requirement of K-PSM was used to discard the unmatched observations from the analysis²³. Finally, the balancing property of the K-PSM was satisfied using the Student’s t-test, *i.e.* HHs/individuals with the same propensity score had the same distributions of all co-variables for each of the areas (Tables II, III).

Analysis of self-medication: To estimate the impact of insurance on self-medication of insured individuals, the conditional difference-in-difference (DiD) method was used²⁴. This method combines K-PSM with DiD, so that at each period, a counterfactual outcome was estimated semi-parametrically for the insured cohort based on the observed covariates. Based on the conditionality of being enrolled in CBHI, the DiD estimator could be represented by the following specification:

$$DiD = E(SM_{T1} - SM_{T0} | INSUR=1, P(X)) - E(SM_{T1} - SM_{T0} | INSUR=0, P(X)) \dots \dots \dots (1)$$

Where, E was the expected value of the difference in self-medication (SM) between the post-intervention

Table I. Description of the cohorts by enrollment status

Year	Offered & joined	Offered & not joined	Not offered
2011	Year 1 HHs and joined CBHI (n=525)	Year 1 HHs and did not joined CBHI (n=810)	Years 2 and 3 HHs (n=2350)
2012	(i) Year 2 HHs and joined CBHI; (ii) HHs that renewed in Y2 (n=822)	(i) Year 2 HHs and did not join CBHI; (ii) HHs that dropped out in Y2 (n=862)	(i) Year 3 HHs (ii) HHs that did not join (but were offered) CBHI in Y1 (n=1634)
2013	(i) Year 3 HHs and joined CBHI; (ii) HHs that renewed in Y2 & again renewed in Y3; (iii) HHs that renewed in Y3 (from Y2) (n=728)	(i) Year 3 HHs and did not join CBHI; (ii) HHs that renewed in Y2 and dropped out in Y3; (iii) HHs that dropped out in Y3 (from Y2) (n=1025)	(i) HHs that did not join in Y1; (ii) HHs that did not join in Y2; (iii) HHs that dropped out in Y2 (from Y1) (n=1554)

CBHI, Community-Based Health Insurance; HHs, households.
 Year represents implementation year.
 Prior to enrollment each year, HHs in clusters assigned to one of the three years of this project were offered to join: 1335 HHs (in year 1) of the 3685 HHs of the total sample. 1244 HHs (in year 2) of the remaining 2350 HHs, and 1106 were assigned for year 3.
 Y1, Y2 and Y3- year 1, 2 and 3 of implementation, respectively

(T1) and pre-intervention (T0) periods, subject to the probability of enrollment in CBHI (INSUR=1 means insured, 0 otherwise), which in turn depends on the set of observable covariates (X). The covariates (X) include age, years of education, number of (short-term and long-term) illnesses in the last one month, dummies for gender, marital status, employment status, caste of the household (1 if scheduled caste / scheduled tribe), household size, highest level of education in the household, MPCE (non-health) of the household and average travel time to the nearest health facility for outpatient (OP) care.

A DiD regression was performed for self-medication at the individual-level, using the following specification:

$$SM_{jt} = \alpha'INSUR_{jt} + \beta'TIME_t + \gamma'INTR_{jt} + \delta'X_{jt0} + \epsilon'_{jt} \dots\dots (2)$$

Where SM_{jt} signifies whether individual j at time t self-medicated or not (yes=1, no=0).

TIME signifies the dummy for time periods (0 and 1 for pre- and post-intervention periods, respectively); INTR was the interaction term between INSUR and TIME (INTR=INSUR× TIME). Vector X represents the set of observable variables for individual j mentioned above.

Standard errors were adjusted for clustering on the household level in the model mentioned in equation (2).

Analysis of borrowing for non-hospitalization events: Following a similar methodology, the conditional DiD method was used to analyze the impact of insurance

on borrowing for non-hospitalization events. Non-hospitalization events were covered by all benefits packages, and therefore, the analysis was done in all locations.

The DiD equation for borrowing for non-hospitalization events can be expressed as:

$$DiD = E(BR_{T1} - BR_{T0} | INSUR=1, P(X)) - E(BR_{T1} - BR_{T0} | INSUR=0, P(X)) \dots\dots\dots(3)$$

Where, E is the expected value of the difference in borrowing-with-interest between time period T1 and T0, subject to the probability of enrollment in CBHI (INSUR=1 means insured, 0 otherwise). The covariates (X) include dummies for caste of the household (1 if scheduled caste/scheduled tribe), MPCE (non-health), household size, highest level of education in the household, enrollment in *Rashtriya Swasthya Bima Yojna* (RSBY - the government’s hospital insurance scheme for below-poverty-line persons) (1 if enrolled in RSBY), having a savings account (1 if at least one savings account holder in the family), average travel time for OP care and number of long-term and short-term illnesses of all members in the household in last one month.

The DiD regression, performed for borrowing at the household-level, can be expressed as:

$$BR_{it} = \alpha'INSUR_{it} + \beta'TIME_t + \gamma'INTR_{it} + \delta'X_{it0} + \epsilon'_{it} \dots\dots (4)$$

Where BR_{jt} signifies whether household j at time t had borrowed or not (1 if yes, 0 if no).

Table II. Descriptive statistics for insured and uninsured households

Household indicators	2010				2013			
	Not-insured (NI)	Insured (I)	Difference	P-value	Not-insured (NI)	Insured (I)	Difference	P value
	Mean	Mean	(NI-I)		Mean	Mean	(NI-I)	
<i>Pratapgarh</i>								
Percentage of scheduled caste/scheduled tribe households	0.79 (0.01)	0.86 (0.03)	-0.07	0.035	0.78 (0.01)	0.84 (0.02)	-0.06	0.072
Household size	6.06 (0.08)	6.28 (0.2)	-0.22	0.329	5.66 (0.08)	6.03 (0.18)	-0.37	0.041
Highest level of education in the household	9 (0)	9 (0)	0	0.510	9 (0)	10 (0)	-1	0.001
Monthly per capita expenditure (in purchasing power parity – international dollar)	1161 (24)	1071 (36)	90	0.144	1633 (32)	1609 (48)	23	0.720
Average travel time to health facilities for out-patient services	19 (0)	20 (1)	-1	0.515	17 (0)	16 (1)	1	0.153
Average number of short-term and long-term illnesses (last 30 days)	2.44 (0.05)	2.79 (0.14)	-0.35	0.008	2.62 (0.06)	3.16 (0.12)	-0.54	<0.001
<i>Kanpur Dehat</i>								
Percentage of scheduled caste/scheduled tribe households	0.79 (0.01)	0.80 (0.04)	-0.01	0.770	0.80 (0.01)	0.77 (0.03)	0.03	0.336
Household size	6.06 (0.08)	5.75 (0.18)	0.31	0.192	5.53 (0.08)	5.75 (0.17)	-0.22	0.211
Highest level of education in the household	10 (0)	10 (0)	0	0.815	10 (0)	10 (0)	0	0.689
Monthly per capita expenditure (in purchasing power parity – international dollar)	1780 (49)	1816 (131)	-36	0.812	2242 (45)	2316 (91)	-74	0.445
Average travel time to health facilities for out-patient services	30 (1)	38 (3)	-8	0.029	22 (1)	24 (2)	-2	0.372
Average number of short-term and long-term illnesses (last 30 days)	2.16 (0.05)	2.08 (0.13)	0.08	0.610	3.22 (0.08)	3.32 (0.13)	-0.10	0.532
<i>Yaishali</i>								
Percentage of scheduled caste/scheduled tribe households	0.91 (0.01)	0.94 (0.02)	-0.03	0.193	0.92 (0.01)	0.92 (0.02)	0.00	0.945
Household size	5.30 (0.06)	5.57 (0.12)	-0.27	0.061	5.20 (0.07)	5.70 (0.12)	-0.50	<0.001
Highest level of education in the household	7 (0)	7 (0)	0	0.332	7 (0)	8 (0)	-1	<0.001
Monthly per capita expenditure (in purchasing power parity - international dollar)	1440 (32)	1371 (64)	69	0.354	1863 (37)	1819 (59)	-44	0.571
Average travel time to health facilities for out-patient services	17 (0)	17 (1)	0	0.625	16 (1)	15 (1)	1	0.252
Average number of short-term and long-term illnesses (last 30 days)	1.79 (0.04)	1.89 (0.09)	-0.1	0.269	2.76 (0.06)	3.16 (0.12)	-0.40	0.002

Figures in parentheses are standard error of mean
Student t test was used for comparison

Table III. Descriptive statistics for insured and uninsured individuals

Individual indicators	2010				2013					
	Not-insured (NI)		Insured (I)		Not-insured (NI)		Insured (I)		Difference (NI-I)	P value
	Mean	(NI-I)	Mean	(I)	Mean	(NI-I)	Mean	(I)		
<i>Pratapgarh</i>										
Average age (yr)	24 (0)	-2	26 (1)	0.082	22.97 (0.25)	28.89 (0.73)	-5.92	<0.001		
Proportion of females	0.51 (0.01)	-0.05	0.56 (0.02)	0.026	0.53 (0.01)	0.64 (0.02)	-0.11	<0.001		
Proportion of married	0.44 (0.01)	-0.07	0.51 (0.02)	0.001	0.44 (0.01)	0.58 (0.02)	-0.14	<0.001		
Proportion of self-help group members	0.29 (0.01)	-0.18	0.47 (0.03)	<0.001	0.23 (0.01)	0.55 (0.02)	-0.32	<0.001		
Average years of education	4.46 (0.05)	0.36	4.10 (0.17)	0.057	4.67 (0.07)	4.55 (0.18)	0.12	0.533		
Average number of acute and chronic illness	0.4 (0.01)	-0.15	0.55 (0.03)	<0.001	0.45 (0.01)	0.69 (0.02)	-0.24	<0.001		
<i>Kanpur Dehat</i>										
Average age (yr)	24 (0)	-4	28 (1)	<0.001	23.59 (0.28)	29.45 (0.74)	-5.86	<0.001		
Proportion of females	0.48 (0.01)	-0.07	0.55 (0.03)	0.008	0.49 (0.01)	0.54 (0.02)	-0.05	0.019		
Proportion of married	0.44 (0.01)	-0.14	0.58 (0.03)	<0.001	0.44 (0.01)	0.63 (0.02)	-0.19	<0.001		
Proportion of self-help group members	0.32 (0.01)	-0.25	0.57 (0.04)	<0.001	0.2 (0.01)	0.64 (0.03)	-0.44	<0.001		
Average years of education	4.91 (0.06)	0.17	4.74 (0.24)	0.496	5.1 (0.07)	5.24 (0.19)	-0.14	0.466		
Average number of acute and chronic illness	0.35 (0.01)	-0.10	0.45 (0.03)	0.004	0.56 (0.01)	0.75 (0.03)	-0.19	<0.001		
<i>Vaishali</i>										
Average age (yr)	23 (0)	1	22 (1)	0.033	21.45 (0.26)	25.15 (0.63)	-3.7	<0.001		
Proportion of females	0.51 (0.01)	-0.06	0.57 (0.02)	0.001	0.52 (0.01)	0.56 (0.02)	-0.04	0.019		
Proportion of married	0.45 (0.01)	0.02	0.43 (0.02)	0.253	0.44 (0.01)	0.59 (0.02)	-0.15	<0.001		
Proportion of self-help group members	0.34 (0.01)	-0.14	0.48 (0.02)	<0.001	0.22 (0.01)	0.6 (0.02)	-0.38	<0.001		
Average years of education	3.16 (0.05)	-0.01	3.17 (0.13)	0.960	3.39 (0.05)	3.91 (0.16)	-0.52	0.002		
Average number of acute and chronic illness	0.34 (0.01)	-0.01	0.35 (0.02)	0.597	0.51 (0.01)	0.71 (0.02)	-0.20	<0.001		

Figures in parentheses are standard error of mean. Student t test was used for comparison

Standard errors are adjusted for clustering on the cluster level in the model mentioned in equation (4).

Analysis of quintile movement of MPCE (non-health): To assess the association between affiliation in CBHI and the economic status of the household, we conducted a marginal effect estimate of logit regression of the direction of quintile shift, in which the household MPCE (non-health) was the dependent variable. The probability of quintile shift was:

$$(QSHIFT)_{ht} = \alpha' CBHI_{ht} + \beta' SD_{ht} + \gamma' HE_{ht} + \delta' FIN_{ht} + \varepsilon_{ht}.$$

.....(5)

$QSHIFT_{ht}$ is 1 if the household h experienced an MPCE-non-health-quintile upgrade from pre ($t-1$) to post (t) intervention phase, else 0, for the analysis of upward quintile movement. Similarly, for the analysis of downward quintile movement, $QSHIFT_{ht}$ is 1 if the household experienced a quintile downgrade in the post-intervention period. The vector CBHI comprised three dummy variables indicating whether the household has been insured for two years, one year or zero years (else uninsured). A household's economic status was assumed to depend on its socio-demographic status (SD), represented by the caste dummy, highest education level, and whether this was a joint family (joint=1, nuclear=0); recent health events in the family (HE) and existing financial profile (FIN) were looked at through proxies: enrollment in RSBY, having a savings account, having borrowed for non-health reason in the last 12 months, affiliation to another insurance (health, life or crop), and whether household members shared their income to meet day-to-day expenses. Standard errors were adjusted for clustering on the cluster level in the model mentioned in equation (5).

Results

Self-medication as an indicator of healthcare-seeking:

In the context of measuring impact of CBHI, a reduction in self-medication among the insured could be viewed as evidence that easier/more affordable access to healthcare for insured persons rendered self-medication less necessary. We examined whether insured people were less inclined to resort to self-medication in non-hospitalization events. Prior to the intervention in 2010, self-medication was more prevalent among the treatment group than the uninsured group, and the difference was significant in Pratapgarh (Table IV). Post-intervention (2013), the DiD value was negative in Pratapgarh and Vaishali, suggesting that the insured group was less likely to self-medicate than the uninsured, but the difference was not significant. In Kanpur-Dehat, the DiD value was negative in 2013, after two years of being insured 16 per cent of the insured reported self-medication, compared to 30.2 per cent in 2010 before insurance cover; the uninsured group in the same location reported 19 per cent in 2013 and 27 per cent in 2010. The DiD regression results also confirmed the findings; the sign of the interaction terms was negative for all three locations.

Financial protection – Borrowing for non-hospitalization events: We examined the impact of being insured by CBHI on hardship financing associated with non-hospitalization events at least once in the 30 days preceding the survey (hospitalizations were not covered everywhere and prevalence rates were very low). Since the relevant unit for borrowing-with-interest was the HH, we compared borrowing of insured HHs (*i.e.* those with at least one person insured in CBHI) to uninsured HHs.

Table IV. Difference-in-difference (DiD) for self-medication among insured and uninsured groups

Group	Year	Pratapgarh	Kanpur Dehat	Vaishali
Not-insured	Pre (2010)	0.135	0.270	0.141
Insured		0.162	0.302	0.165
Not-insured	Post (2013)	0.150	0.191	0.193
Insured		0.157	0.160	0.177
Difference in pre (2010)		0.026 (0.086)	0.032 (0.147)	0.024 (0.175)
Difference in post (2013)		0.008 (0.679)	-0.031 (0.235)	-0.016 (0.481)
Difference-in-difference		-0.019 (0.444)	-0.063* (0.066)	-0.040 (0.161)

Figures in parentheses are *P* values (Student *t* test)

In 2010, *i.e.* prior to the intervention, a higher percentage of insured than uninsured HHs borrowed in Kanpur-Dehat and Vaishali, while in Pratapgarh the difference was minimal (Table V). In 2013, after the intervention, a substantially lower-percentage of insured HHs than uninsured HHs reported borrowing: 31.8, 27.7 and 42.5 per cent of insured HHs, compared to 46.1, 51.6 and 52.7 per cent of uninsured HHs, respectively in Pratapgarh, Kanpur-Dehat and Vaishali. Incidence of borrowing was seven percentage points lower among the insured than among the uninsured HHs in Kanpur Dehat, and the difference was significant ($P<0.05$). Overall, the DiD values were negative for all three locations, indicating that the insured HHs reported less borrowing than the uninsured HHs over time. The DiD was significant ($P<0.05$) for Kanpur-Dehat and Vaishali.

The interactions between time and treatment dummies were also negative for all three locations and significant for Kanpur-Dehat ($P<0.05$) and Vaishali ($P<0.05$). After being insured for two years (*i.e.* in 2013) HHs were less likely to borrow for healthcare costs than in 2010 (the time dummy was negative and significant for all the three locations). Scheduled caste/scheduled tribe HHs were more likely to borrow compared to HHs of a higher caste. Borrowing was positively related to MPCE (non-health) [probably reflecting the improved ability of HHs with higher MPCE (non-health) to obtain credit, but still rather low to require loans]. In Kanpur-Dehat and Vaishali, highest education level in the HH had a negative effect on borrowing. HHs with RSBY cover were more likely to borrow for non-hospitalization events in Pratapgarh and Vaishali. In these two locations, HHs with savings

accounts were less likely to borrow than HHs without savings accounts.

Financial protection - Quintile movement of MPCE (non-health): Financial protection was reflected not only in absolute terms but also in the relative position of a household compared to others in the same community. Therefore, we measured the position of a household along the local income distribution in MPCE (non-health) as evidence of impact of health insurance on financial protection. HHs with two consecutive years of insurance by CBHI were 51.8 percentage point more likely to experience quintile upgrade compared to HHs that never joined CBHI in Vaishali (Table VI). In Pratapgarh, after one year of CBHI coverage, HHs were 28.2 percentage point more likely to have a quintile upgrade compared to the uninsured HHs. Among other explanatory variables, SC/ST HHs in Vaishali were more likely to have a quintile upgrade. In Kanpur-Dehat, quintile upgrade was positively associated with the highest education level in the household. On the other hand, having a savings account in Vaishali and past borrowing for non-health purposes were negatively related to quintile upgrade.

As expected, an opposite pattern was observed for downward shift. After two consecutive years of CBHI cover, insured HHs were less likely to experience a downward quintile shift in MPCE (non-health) compared to uninsured HHs; the effect was consistently negative for all three locations, and it was significant in Kanpur Dehat ($P<0.05$, Beta=-0.607) and in Vaishali ($P<0.05$, Beta=0.675). The SC/ST HHs had less probability of quintile downgrade compared to

Table V. Difference-in-difference (DiD) for borrowing for non-hospitalization events among insured and uninsured households

Group	Year	Pratapgarh	Kanpur Dehat	Vaishali
Uninsured	Pre (2010)	0.465	0.485	0.481
Insured		0.461	0.516	0.527
Uninsured	Post (2013)	0.334	0.348	0.469
Insured		0.318	0.277	0.425
Difference in pre (2010)		-0.004 (0.884)	0.031 (0.356)	0.046 (0.151)
Difference in post (2013)		-0.014 (0.611)	-0.071 (0.035)	-0.044 (0.154)
Difference-in-difference		-0.011 (0.794)	-0.102 (0.033)	-0.090 (0.043)

Figures in parentheses are *P* values

Table VI. Marginal effect estimations of shift in monthly per capita expenditure (Non-health) quintiles by households from 2010 to 2013

	Upward shift			Downward shift		
	Pratapgarh	Kanpur Dehat	Vaishali	Pratapgarh	Kanpur Dehat	Vaishali
<i>Duration in community-based health insurance (CBHI)</i>						
Completed two years in CBHI	0.0979 (0.235)	0.120 (0.333)	0.518** (0.194)	-0.602* (0.256)	-0.285 (0.356)	-0.675** (0.225)
Completed one year in CBHI	0.282 (0.153)	-0.289 (0.181)	-0.136 (0.151)	-0.0658 (0.155)	0.219 (0.174)	-0.0103 (0.148)
<i>Household socio-economic characteristics</i>						
Scheduled caste/scheduled tribe households (base=Non-scheduled caste/scheduled tribe)	0.184 (0.129)	0.249 (0.158)	0.341* (0.135)	-0.375** (0.132)	-0.394* (0.165)	-0.498** (0.142)
Highest level of education	-0.0107 (0.0176)	0.0402 (0.0213)	-0.00553 (0.0161)	0.0114 (0.0177)	-0.0176 (0.0212)	0.00107 (0.0163)
<i>Household health events</i>						
No of illness in last one month	-0.00369 (0.0413)	-0.000895 (0.0485)	0.0292 (0.0514)	-0.00858 (0.0413)	0.0437 (0.0480)	-0.0670 (0.0523)
No of hospitalization in last 12 months	-0.116 (0.168)	-0.126 (0.154)	0.0383 (0.148)	0.126 (0.161)	0.160 (0.147)	0.182 (0.145)
<i>Household financial profile</i>						
Enrolled in <i>Rashtriya Swasthya Bima Yojna</i> (base=Non-enrolled in <i>Rashtriya Swasthya Bima Yojna</i>)	0.200 (0.164)	-0.231 (0.179)	-0.110 (0.128)	-0.228 (0.172)	0.0751 (0.175)	0.0598 (0.129)
Holder of savings account (base=no savings a/c)	-0.182 (0.127)	-0.140 (0.144)	-0.256 (0.150)	0.0344 (0.127)	-0.0501 (0.144)	0.179 (0.147)
Borrowed for non-health purposes in last 12 months	-0.484* (0.239)	-0.0875 (0.262)	-0.327 (0.204)	0.381 (0.259)	0.0329 (0.269)	0.683** (0.230)
Has insurance other than community-based health insurance and <i>Rashtriya Swasthya Bima Yojna</i> (other health, crop, life)	0.0926 (0.152)	-0.181 (0.167)	-0.0682 (0.166)	0.0697 (0.151)	0.208 (0.163)	0.00821 (0.163)
Household shares money of all members	0.0510 (0.166)	-0.0921 (0.184)	0.170 (0.140)	0.0561 (0.165)	0.104 (0.187)	-0.0831 (0.139)
Household is a joint family	0.0480 (0.128)	0.163 (0.142)	0.0433 (0.131)	0.0288 (0.128)	0.0613 (0.143)	-0.0700 (0.132)
Constant	-0.174 (0.296)	-0.711* (0.356)	-0.469 (0.247)	-0.884** (0.313)	-0.679 (0.361)	-0.909** (0.267)
Observations	1167	932	1179	1,167	932	1,179

Figures in parentheses are standard error values; $P^* < 0.05$; $** < 0.01$

upper-caste HHs in all three locations. Borrowing for non-health reasons was significantly associated with a household's downward quintile move in Vaishali.

Discussion

The study design of this staggered implementation model of CBHI, following the CRCT rules posited, "Enrolment decisions are intended to be made en-bloc: the members of each SHG must decide either to join the insurance scheme as a group, along with all the members of their households, or not enroll at all"²⁰. In reality, this assumption could not be upheld, as this condition was in direct conflict with the voluntary nature of enrollment. This raised an ethical issue. In our experiment, the gap between the assumption embedded in the CRCT design and people's voluntary decision-pattern made it impossible to follow the clusters of treatment and control, because the "insured" cohort included many persons that did not join, rendering meaningless the comparison of the control (uninsured) cohort to the treatment (insured) group that also included many uninsured persons. Other analysts have already voiced similar critique of CRCT on the ground of study design considerations^{25,26}.

The key to identifying the impact of CBHI was the accurate identification of the treatment group so that it would be composed only of those that were "offered and joined" (OJ), and the control, composed of all other persons that were not insured [including "offered not joined" (ONJ) and "not offered" (NO)]. Moreover, this had to be done separately for each location, because the socio-demographic profiles and the specific benefits in each location⁷ were different enough to render any aggregation of the data irrelevant. We solved the correction to the randomization of the treatment and control groups for the purpose of comparison of impact by applying K-PSM, as was previously shown by Gnawali *et al*²⁷. Our analysis of impact of CBHI differed in the findings and conclusions from another study²⁸ that performed the analysis differently.

Impact of CBHI on self-medication: In our dataset, we observed a common denominator to the three study locations in that people self-medicated, which was at least in part independent of the composition of the benefits package. This could reflect people's behavioural choice to first self-medicate and consider approaching professional medical assistance only afterwards. In that framing, we examined self-medication in the light of a hypothesis that insured people would reduce that practice when insurance

facilitated access to healthcare. We confirmed that the morbidity patterns of the insured population did not change over the study period (data not shown). Our findings indicated that the insured population reduced its self-medication, and as this effect increased with the length of the period of insurance, it appeared as an impact of insurance status. The more positive attitude toward seeking medical help went hand-in-hand with that change.

Impact of CBHI on financial protection: The enrolled members reported higher incidence of illness before enrollment/without CBHI and a slightly lower income, which suggested a higher propensity toward hardship financing. A drop in health-related borrowing of HHs was observed among the insured, which was not apparent among the uninsured. The probability of an insured HH to benefit from quintile upgrade increased, and the risk of quintile downgrade decreased after being insured for two years. The association between being insured and economic mobility could be a direct effect related to the money saved during financing of ambulatory care. It could also be something else: perhaps being protected by insurance increased the likelihood of a HH to invest in productive assets or education that could increase income. It could be possible that the association between insurance and quintile-shift was not a cause-effect relationship, and more research might reveal whether this was a reflection of lifestyle choices (*e.g.* new enterprises that improve financial status).

Our demonstration that CBHI reduces self-medication while providing financial protection has implications for theoretical, ethical, policy and practice considerations. From a theory perspective, our results suggest that the role of the insured population in selecting package design and pricing, and their ability to favour benefits that were likely to reduce hardship financing uphold the arguments of Dror and Firth²⁹ about demand. From an ethical perspective, the use of CRCT in our experiment implied withholding access of some people to benefits, and thus may not be the most suited research design. From a policy perspective, the assertion that being covered by CBHI (*i.e.* by voluntary, contributory, non-subsidized health insurance that was governed locally and designed by and for specific communities) had a positive impact on its members sets a rational foundation for policymakers to support the expansion of CBHI. From a practice perspective, the evidence on the positive impact of CBHI points to an option to improve healthcare-related financial

protection and generate untapped contributions for health insurance, by catalyzing demand through CBHI.

Our study had certain limitations. The CRCT rules assumed that enrollment decisions would be *en-bloc* (which could be quasi-involuntary): all members of each SHG, along with all the members of their HHs, would have to join the insurance as a group, or not enroll at all. This assumption was inoperable, as many households in the control groups wanted to join instantly, and many in the treatment cohorts did not join. The process of randomization of CRCT thus did not work as planned. This introduced a limitation on impact evaluation. Similar observations have been made earlier^{25,26}. As our intervention required that the insured group would be involved in the design and pricing of their benefits packages, it was foreseeable that each of the three CBHI schemes might choose a different benefits package. Such heterogeneity restricted the choice of indicators for the impact evaluation.

One of the expected outcomes of insurance is the reduction in out-of-pocket (OOP) spending for health. Measuring the impact of insurance was challenged by data that often ignored indirect costs and by the fact that such costs were usually not covered by CBHI. The estimate of reduced borrowing due to CBHI coverage faced a similar challenge. We could obtain information on borrowing with interest, but people failed to properly report the principal amount borrowed separately from the amount of interest paid, especially when amounts were small. This was overcome by choosing binary rather than continuous variables as indicators.

Choosing reduction in self-medication as an impact indicator has its limitation in that such reduction would not eliminate social and cultural aspects, and the information on the amount spent on self-medication was unreliable as consumption of home-made remedies or of previously purchased medicines was often ignored. Therefore, we chose incidence of self-medication as the indicator rather than its cost.

Finally, DiD is the conventional method to estimate the causal effects when a study involves control and treatment groups before and after an intervention. In a non-linear model in DiD, where the outcome variable is binary in nature, the DiD values may not be a full-proof estimator of the true interaction effect. However, DiD is based on certain assumptions (common trend, absence of serial correlation of the outcome variables)

that have known limitations, which apply in this study as well. To reduce the limitation in the present analysis, the results obtained from the DiD analysis were cross-checked using logistic regressions.

Conflicts of Interest: None.

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Reprint requests: Dr David M. Dror, Micro Insurance Academy, 86, 1st floor, Okhla Industrial Estate, Phase III, New Delhi 110 020, India
e-mail: david@mia.org.in, daviddror@socialre.org

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