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ORIGINAL ARTICLE

The effect of a community-based health insurance on the out-of-pocket payments for utilizing medically trained providers in Bangladesh

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Background: We aimed to estimate the effect of the community-based health insurance (CBHI) scheme on the magnitude of out-of-pocket (OOP) payments for the healthcare of the informal workers and their dependents. The CBHI scheme was piloted through a cooperative of informal workers, which covered seven unions in Chandpur Sadar Upazila, Bangladesh.

Methods: A quasi-experimental study was conducted using a case-comparison design. In total 1292 (646 insured and 646 uninsured) households were surveyed. Propensity score matching was done to minimize the observed baseline differences in the characteristics between the insured and uninsured groups. A two-part regression model was applied using both the probability of OOP spending and magnitude of such spending for healthcare in assessing the association with enrolment status in the CBHI scheme while controlling for other covariates.

Results: The OOP payment was 6.4% ($p < 0.001$) lower for medically trained provider (MTP) utilization among the insured compared with the uninsured. However, no significant difference was found in the OOP payments for healthcare utilization from all kind of providers, including the non-trained ones.

Conclusions: The CBHI scheme could reduce OOP payments while providing better quality healthcare through the increased use of MTPs, which consequently could push the country towards universal health coverage.

Keywords: Bangladesh, community-based health insurance, healthcare financing, informal workers, out-of-pocket payments

Introduction

The government of Bangladesh has expressed its desire to achieve universal health coverage (UHC).[1] Like many low- and middle-income countries (LMICs), out-of-pocket (OOP) health expenditures constitute a large share (63.3%) of total expenditures.[2] Reliance on OOP has two onsequences. Firstly, it it leads to a catastrophic economic burden on households.[3] Secondly, it leads to an unmet need for healthcare because low income people simply cannot afford it.[4] This often leads low-income people to seek healthcare from non-trained providers, who are cheaper, but may, in many cases results in adverse effects on

health or inadequate care.[5] These dual issues of catastrophic health expenditure and inadequacy of healthcare address the 'financial risk protection' and 'service coverage' dimensions of UHC, respectively.[6] The Sustainable Development Goals have included UHC (goal 3) as an important agenda objective.[7]

The heavy reliance on OOP payments is a challenge to the achievement of UHC since healthcare is considered a luxury when supplied by private for-profit providers without financial protection.[8] Furthermore, the accumulation of prepaid funds (e.g. taxes as social insurance contributions) from informal workers is difficult since they often are not under the national income tax. Achieving UHC is further challenged by including informal workers in Bangladesh in the public financing system for healthcare. This challenge has been recognized in the first healthcare financing strategy of Bangladesh.[1] Value-added taxes are being paid by all consumers irrespective of their employment status, which ultimately contribute to the public fund. Government revenue through taxes for social health protection schemes (along with funding from development partners) and micro- and/or community-based health insurance (CBHI) are prioritized and considered as the potential mechanisms for financing the healthcare of low-income people. Like many LMICs, the tax base in Bangladesh is small and the inclusion of low-income people, particularly informal workers, in the tax system is still a challenge. The CBHI could be a suitable mechanism to achieve their goals. The CBHI scheme is often criticized for their small size to function effectively for risk pooling. This type of scheme has limited coverage and often excludes expensive treatment such as surgery.[6] However, such a scheme is still useful to expand protection against the financial risk of ill health where other prepayment schemes are limited or difficult to implement.[6] Some studies have reported that the CBHI scheme is vulnerable to adverse selection due to its voluntary nature.[9–11] However, careful designing of the scheme may overcome such problems.

For mitigating the consequences of OOP payments, risk-pooling mechanisms are recommended for financing healthcare. However, the inclusion of informal workers in risk pooling mechanisms (e.g. social health insurance) is a challenge because of their irregular income and the difficulty of collecting contributions from them through the tax system.[12,13] Occupational associations and cooperatives could be a base for engaging such workers for healthcare financing.[13–15] This study thus aims to evaluate a pilot CBHI scheme of informal workers to estimate its effect on the magnitude of OOP payments for healthcare while utilizing services from medically trained providers (MTPs). UHC is concerned with safe, effective, people-centred and timely care.[16] In the context of LMICs, it can be argued that services from MTPs might have better outcomes than that of providers without adequate medical training.

Description of the scheme

Labour Association for Social Protection

A group of workers established a cooperative—the Labour Association for Social Protection (LASP)—that included 14 Unions (the lowest administrative unit in the rural Bangladesh) and a municipality in the Chandpur subdistrict of Bangladesh. The LASP implemented a CBHI pilot scheme in seven unions from January 2013 to June 2014 with support from Grand Challenge Canada. A research team from icddr,b (formerly the International Centre for Diarrhoeal Disease Research, Bangladesh) provided technical support for capacity building in collaboration with the Sajida Foundation, a microcredit and health institute. The areas of technical support comprised training of management and field staff, relationship development with healthcare providers and stakeholders, making policies and operational directives relevant to social protection (with an emphasis on health protection), training on information technology (IT) and database management of IT staff, training of labour leaders/prospective leaders and developing and applying monitoring tools.

Membership

Membership in the LASP was open to informal blue-collar workers for a membership fee. Informal workers refers to the own account workers who do not have a formal job contract.[17] Informal workers in urban Bangladesh included rickshaw pullers, shopkeepers, restaurant workers, day labourers, factory workers and transport workers.[18,19] A maximum of six household members could get access to benefits for one membership, with a possibility of including more household members for an additional fee. The membership fee (premium) was 50 Bangladeshi Taka (BDT) per month. The premium was determined through informal discussion with the workers in the Chandpur subdistrict and considering findings of willingness-to-pay studies among a similar group of workers.[15,18] Initially the fee was collected weekly and after 1 y it was revised to monthly, as it was difficult to reach all members on a weekly basis.

Benefits package and providers

The benefits package of the CBHI scheme included both health and non-health benefits. In addition to the cooperatives' own doctors, pharmacy facilities and other private and public healthcare providers were engaged to provide services for members. The benefits package offered by LASP required a low co-payment. It included the following health benefits: Bachelor of Medicine and Bachelor of Surgery (MBBS) doctor's consultation at co-payment 30 BDT (US$0.40); medicine 20% discount from the maximum retail price; diagnostic tests 50% discount on market price; specialist doctor's consultation (e.g. paediatricians, gynaecologists, cardiologists, endocrinologists) at co-payment 100 BDT (US$1.30); hospitalization-maximum 4000 BDT (US$52) per household per year; periodic visits to satellite clinics in rural areas. Non-health benefits included weekly/monthly savings opportunities and a computer course at a lower price than the market price.

Materials and methods

Study design

A quasi-experimental case–comparison study was conducted. The households that were insured (case) and uninsured (comparison) were asked about their OOP payments for healthcare in the previous 3 mon. The difference in OOP payments between insured and uninsured households was the main variable of interest in this study.

Study population and sample

The Chandpur subdistrict consists of 14 Unions and a municipality. Of these 14 Unions, 7 closely located Unions of Chandpur were under the CBHI scheme and were included in this study. There are 98109 households in the subdistrict, of which 63.5% (62296 households) live in rural areas and the rest (35813 households) in urban.[20] Since the scheme covered about 50% of the population of the subdistrict, an estimated 31148 rural households and 17907 urban households were available to join the scheme. In the absence of comparable studies in Bangladesh, we estimated the sample size based on 6.2% healthcare utilization rates in the uninsured groups, as observed in an earlier study on micro-health insurance in the Philippines.[21] Considering 5% increase in healthcare utilization in insured group the sample size was estimated at 777 households from each of the insured and uninsured groups, assuming level of significance 5%, 90% power and a 10% non-response rate.[22,23] The total sample size was thus 1554 households. However, 1292 households (83.1% response rate) responded to this survey, for a total of 6694 individuals (insured, 3548; uninsured, 3146).

Random sampling was done for the insured group from the list of all enrolled households and the uninsured households were identified from the same village with a similar occupation as the insured household head. The household survey was conducted from April to June 2014. We lost 16.9% of the targeted sample due to a low response rate (83.1%). Due to nonresponse the power of the study was dropped from 90% to 88%. However, this should not affect the estimates, as the power of sample calculation varied between 80% and 90% in the literature.[24]

Data collection and variables

A structured questionnaire was administered in face-to-face interviews with the head of each household. Five trained field research assistants were involved in conducting the interviews. One field research officer, along with the study investigators, supervised the data collectors. Information on the demographic characteristics of individual members and household socio-economic characteristics were collected. Data about healthcare seeking of any household members and associated OOP payments in the past 90 days were gathered. Generally, the informal workers sought healthcare from village doctors, drug sellers, traditional healers, doctors, private clinics, medical colleges and district hospitals, subdistrict health complexes and clinics managed by non-governmental organizations (NGOs).[25,26] MTPs include doctors with an MBBS degree/general practitioners, specialized doctors, private clinics, medical college and district hospitals, the Upazila Health Complex and NGO clinics since these healthcare organizations employ medically well-educated staff, whereas village doctors, drug sellers and traditional healers constituted the non-trained providers in this study. The OOP payments for healthcare included medical fees, user charges for public hospital care, purchases of medicines (whether prescribed or not), insurance co-payments and payments for appliances and diagnostic tests.[27]

Income is an unreliable estimate of the socio-economic status of informal workers due to seasonal variations and underreports of their income in the LMIC context.[19,28] Therefore we used asset quintiles as a measure of socio-economic status rather than income levels. Household wealth status was categorized into five quintiles based on the available assets in the household, such as housing material, sanitation facilities, access to utility services and access to drinking water. A principal component analysis was conducted using these asset variables to estimate the asset score after adjustment for household size, which was used for the categorization of household wealth status.[29]

Propensity score matching

Due to the absence of baseline information for the insured and uninsured groups, there was a high possibility of baseline bias after the direct matching of household and individual characteristics. We therefore employed a propensity score matching (PSM) approach to minimize the observed differences between the insured and uninsured groups while estimating the effect of the CBHI scheme on OOP payments.[30,31]

PSM is a statistical tool that weighs differences in observable variables between the individuals of the case and comparison groups. It is a useful tool for reducing selection bias where complete randomization is challenging.[32] The propensity score represents the conditional probability of assignment to a particular intervention given a vector of observed covariates. The matching was done at the level of the individual. However, both individual (e.g. gender, age) and household (e.g. household size, asset quintile) characteristics were used for this matching since such characteristics were associated with healthcare utilization and OOP payments. We also included age group and the illness status of individuals (as a dummy variable; 1=suffered from illness, 0=did not suffer from illness) in the PSM as a proxy for health status to address the adverse selection problem.

The main purpose of the matching was to identify unique controls with similar characteristics except for the outcome of interest (i.e. OOP payment). The radius matching was done by PSM between two groups of observations (insured and uninsured) with a weight equal to 1. We tried other matching methods, such as kernel matching, but none served our purpose of identifying two groups of observations for use in a two-part model. We therefore used radius matching, which was supported by available literature.[33]

We applied a logistic regression model for estimating the propensity score. Based on the closeness of the estimated propensity score of each individual from the insured group to an individual from the uninsured group, a matched sample was drawn. Using the psmatch2 command in Stata 13 (StataCorp, College Station, TX, USA), we applied a radius matching method to estimate the matched sample using the recommended calliper size (the standard deviation of the logit score multiplied by 0.2).[33] Figure 1 shows the distribution of propensity scores before and after matching in the insured and uninsured groups. Before propensity score adjustment, the insured and uninsured groups were dissimilar with regard to the characteristics. However, after matching they were mostly similar (Figure 1). Finally, 2502 individuals from the insured group and the same number from the uninsured group were included in the analysis.

Statistical analysis

The main hypothesis of this study was that the OOP payments for utilizing an MTP were lower for insured compared with uninsured

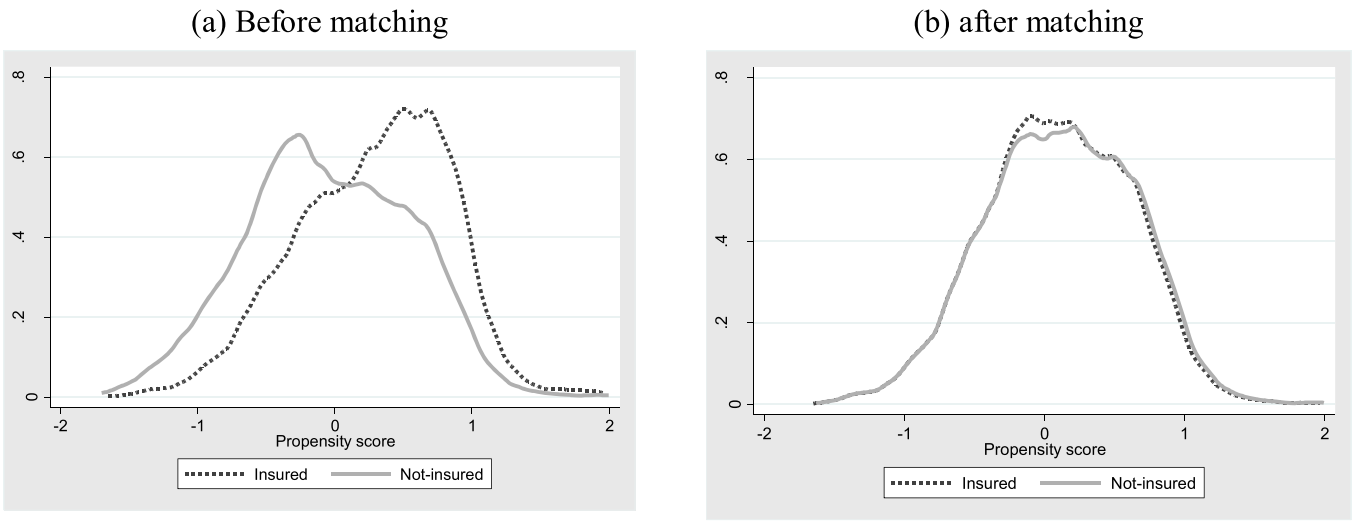

Figure 1. Propensity score distribution in the insured and uninsured groups before and after matching.

individuals. Descriptive statistics present the mean and variations (standard deviation) of OOP payments in the insured and matched uninsured groups. We presented this variable using several dimensions, including asset quintiles, occupation, household size and geographic area. We performed the Shapiro–Wilk test and found that OOP healthcare payments were not normally distributed ($p<0.01$). We therefore employed the Wilcoxon–Mann–Whitney test, a non-parametric test, to make inferences on the significance of the mean differences in the OOP healthcare payments between the insured and uninsured groups. Further, two-part regression analysis was conducted to estimate the effect of individuals' enrolment in the CBHI scheme on OOP payments for seeking healthcare from an MTP. Additionally, we estimated the association of OOP payments with healthcare utilization from non-trained providers. The OOP payment was a limited dependent variable and was continuous over most of its distribution but had a mass of observations at zero values. The decision for a healthcare expenditure and the magnitude of that expenditure might not be statistically independent.[34,35]

Application of an ordinary least squares (OLS) estimation method of the regression coefficient to only part of the sample who spent for healthcare raised the possibility of sample selection bias.[36] In this case, a two-part regression model was applied.[34,37] The first part involved the likelihood of incurring any healthcare costs, where 0 and 1 meant 'no cost' and 'any cost', respectively. This was incorporated in the two-part model with a logit function. The second part considered the magnitude of OOP healthcare payments. An OLS function was used to model it with the consumption decision. Thus the two-part model used information on both the probability and the magnitude of OOP payments for healthcare simultaneously in assessing predictors like enrolment in the CBHI scheme along with other covariates.[28,38]

In sum, the dependent variable for the logit model part was a dichotomous variable that indicated whether OOP expenses were incurred (the participation decision). The OLS regression part of the model analysed the natural logarithm of OOP payments (Y_i) as a function of the covariates.[37] In addition to our main variable of interest, i.e. membership in the CBHI scheme, several control variables, including asset quintiles, education, household composition, healthcare utilization, geographic location and health condition, were included in the regression model. Let us consider Y_i is the semi-continuous OOP payment variable. The observed OOP payments can be presented by two variables. The occurrence of OOP payments will be a dummy variable, as below:

$$Y_{1i} = \begin{cases} 1, & \text{if } Y_i > 0 \\ 0, & \text{otherwise.} \end{cases} \quad (1)$$

The magnitude of the OOP payment variable (Y_{2i}) will be approximately normally distributed, which will be a subset of the OOP payment variable (Y_i), where $Y_i>0$. In the two-part model, we are interested in both the distribution of the occurrence variable (Y_{1i}) and the magnitude variable (Y_{2i}), given that $Y_i>0$. Therefore the two-part regression model can be specified using two equations,[39]

$$Logit(Y_{1i}) = \theta_0 + \theta_1 X_{1i} + \theta_2 X_{2i} + \theta_3 X_{3i} + \cdots + u_i \ldots, \quad (2)$$

where θ_0 is a constant; X_1 indicates if the household had membership in the CBHI scheme with values 0 or 1 (0=did not have membership, 1=had membership); θ_1 is the coefficient that shows the magnitude and direction of the relationship; X_2, X_3, … denote control variables; θ_2, θ_3, … represent the estimated coefficients; and u_i is the random error term of the model, and

$$\ln\ (Y_{2i}) = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \cdots + \varepsilon_i \ldots, \quad (3)$$

where β_0 is a constant; X_1 indicates if the household had membership in the CBHI scheme with values 0 or 1 (0=did not have membership, 1=had membership); β_1 is the coefficient that shows the magnitude and direction of relationship; X_2, X_3, … denote control variables; β_2, β_3, … represent the

estimated coefficients; and ε_i is the random error term of the model.

A Tobit model can address the problem with a large number of zero responses of the dependent variable. Although the two-part model is a more popular approach to modelling medical expenditures, and preferred by O'Donnell et al.,[28] we included findings from a Tobit model in the supplementary materials. We presented a 95% CI for the coefficients of the regression analysis and the standard error for OOP payment estimates.

Results

Table 1 reports the percentages of participants in the insured and uninsured groups by sociodemographic characteristics, before and after matching by propensity score. Before matching, there were significant associations of age group, occupation, household size, years of schooling and asset quintiles with the insurance enrolment status. After matching, we found no significant association of occupation, household size, years of schooling and asset quintiles with the insurance enrolment status of the participants. However, a significant association was observed between age and insurance enrolment status after matching.

The matched sample showed that most of the participants were 15–60 y old (63.6% of insured and 61.4% of uninsured) and the proportion of females (49.7% of insured and 49.6% of uninsured) was similar in the two groups. Most of the participants were married (49.9% of insured and 48.7% of uninsured).

The highest proportion of respondents were housewives (21.7% of insured and 23.3% of uninsured). The proportions of agricultural workers, daily labourers, shopkeepers, service workers and transport workers were similar in both groups. The average household size was five persons or more in both groups (49.4% in insured and 51.2% in uninsured). The average household monthly income was significantly higher in the insured group (19 148 BDT) compared with the uninsured group (17 969 BDT) before matching (Supplementary Table 1). Since we used the asset quintile in the PSM for matching, we did not include household monthly income for matching.

Table 2 presents the descriptive statistics on OOP payments in both groups for seeking healthcare from MTPs and from any providers. The average OOP payments for seeking healthcare from all providers were lower in the insured group (2512 BDT) compared with the uninsured group (2660 BDT), although not statistically significant. However, when we compared the mean payments for utilizing healthcare from an MTP, we observed a significantly lower amount in the insured group compared with the uninsured group (4189 BDT vs 5154 BDT). We further observed that, irrespective of provider type, the OOP payments between the insured and uninsured groups were significantly different when disaggregated into different socio-economic characteristics, namely age group, marital status and occupation (Table 2).

Table 3 shows the estimated effects of CBHI enrolment on OOP payments for healthcare utilization from MTPs and from all types of providers while controlling for relevant covariates, like demographic and socio-economic characteristics. It was found that insured individuals were 1.43 times more likely (95% CI 1.22 to 1.68) to spend for services from MTPs and their OOP payments were significantly less, by 6.40%, compared with uninsured individuals.

Along with enrolment in the CBHI, marital status, occupation, education and asset quintile influenced the OOP payments for utilizing services from MTPs. Marital status (being unmarried) had a significantly negative effect on OOP payments. However, an individual's asset quintile, residential location, illness type and inpatient care utilization had a significantly positive effect on OOP payments. CBHI enrolment status, however, did not appear to have a significant association with OOP payments when we considered utilization of healthcare from all types of providers (including MTPs and non-trained ones) together in the analysis.

In addition to the two-part model, we estimated the average insurance effect using the teffects psmatch command. This analysis showed findings similar to a two-part model, meaning that the OOP expenditure was significantly lower among the CBHI-enrolled individuals when utilizing healthcare from MTPs (Supplementary Table 2). Further, the inclusion of the inverse probability weights from PSM in the analysis did not change the association between insurance enrolment and OOP payments for services from MTPs (see Supplementary Table 3). The Tobit model also showed significantly less OOP payments among the insured group for utilizing MTPs compared with the uninsured group while controlling for a number of demographic and socio-economic factors (Supplementary Table 4). It implies that the use of different relevant analysis techniques verified our findings from the two-part model.

Discussion

The pilot CBHI scheme offered a health benefits package consisting of mainly primary care with an affordable co-payment and an opportunity for reimbursement for inpatient care with a ceiling. We found that OOP payments for healthcare utilization from MTPs were significantly lower among workers in the insured group compared with the uninsured group, which can be explained by the lower co-payments of enrollees. The health services from non-trained providers, in contrast, were not covered by the insurance benefits package, and OOP payments for such services did not decrease as expected. Since enrollees in the insurance scheme utilized health services from service providers other than the contracted ones (by the scheme), the OOP payments for health services from all types of providers did not decrease significantly.

However, it needs to be noted here that in achieving UHC, the quality of healthcare is crucial. The World Health Organization noted that healthcare should be safe, effective, people-centred and timely.[16] Securing such quality of care and contracting with MTPs for healthcare delivery is imperative, which was a focus of this study. The CBHI scheme had assigned a doctor and diagnostic centre. Information about the place for care seeking in advance could have a favourable influence on travel costs of care seekers. Further, care seeking in satellite clinics did not cost the patients for travel, as the insured patients lived close to such clinics.

In addition to our main variable of interest, we found some significant association of control variables with the dependent variable. Unmarried individuals spent 5.7% less OOP compared with married individuals for MTP utilization. A number of

Table 1. Characteristics of respondents and household before and after PSM matching

Characteristics	Before matching			After matching		
	Insured, % (95% CI)	Uninsured, % (95% CI)	p-Value[a]	Insured, % (95% CI)	Uninsured, % (95% CI)	p-Value[a]
n	3548	3146		2502	2502	
Age group (y)						
Child (0–14)	30.0 (28.5 to 31.5)	32.3 (30.6 to 33.9)		29.5 (27.7 to 31.3)	32.9 (31.1 to 34.7)	
Adult (15–60)	64.1 (62.5 to 65.6)	61.5 (59.8 to 63.2)	0.091	63.6 (61.7 to 65.5)	61.4 (59.5 to 63.3)	0.018
Elderly (>60)	5.9 (5.2 to 6.7)	6.3 (5.4 to 7.1)		6.8 (5.8 to 7.8)	5.7 (4.8 to 6.6)	
Gender						
Male	48.0 (46.4 to 49.6)	49.6 (47.8 to 51.3)	0.204	50.3 (48.3 to 52.2)	48.4 (46.4 to 50.4)	0.184
Female	52.0 (50.4 to 53.6)	50.4 (48.7 to 52.2)		49.7 (47.8 to 51.7)	51.6 (49.6 to 53.6)	
Marital status						
Married	50.4 (48.7 to 52.0)	49.4 (47.6 to 51.1)	0.211	49.9 (47.9 to 51.8)	48.7 (46.8 to 50.7)	0.057
Unmarried	45.4 (43.8 to 47.0)	47.1 (45.3 to 48.8)		45.6 (43.7 to 47.6)	47.9 (46.0 to 49.9)	
Other (widowed, divorced, separated)	4.2 (3.5 to 4.9)	3.6 (2.9 to 4.2)		4.5 (3.7–5.3)	3.4 (2.7 to 4.1)	
Occupation						
Agricultural worker	2.8 (2.2 to 3.3)	3.1 (2.5 to 3.7)		2.7 (2.0 to 3.3)	2.6 (1.9 to 3.2)	
Labour	7.3 (6.4 to 8.1)	6.1 (5.2 to 6.9)	<0.001	6.4 (5.4 to 7.4)	6.5 (5.5 to 7.4)	0.408
Shopkeeper	4.4 (3.7 to 5.1)	6.3 (5.5 to 7.2)		5.4 (4.5 to 6.2)	5.2 (4.3 to 6.1)	
Service worker	5.5 (4.7 to 6.2)	7.0 (6.1 to 7.9)		7.1 (6.1 to 8.1)	6.1 (5.1 to 7.0)	
Housewife	23.4 (22.1 to 24.8)	23.0 (21.6 to 24.5)		21.7 (20.1 to 23.4)	23.3 (21.6 to 24.9)	
Transport worker	3.2 (2.6 to 3.7)	3.5 (2.9 to 4.2)		4.0 (3.3 to 4.8)	3.4 (2.7 to 4.1)	
Small business	2.0 (1.5 to 2.5)	2.2 (1.7 to 2.7)		2.3 (1.7 to 2.9)	2.1 (1.6 to 2.7)	
Not working or unemployed	48.3 (46.7 to 50.0)	47.6 (45.8 to 49.3)		48.2 (46.3 to 50.2)	49.4 (47.5 to 51.4)	
Other	3.1 (2.6 to 3.7)	1.3 (0.9 to 1.7)		2.2 (1.6 to 2.7)	1.5 (1.0 to 2.0)	
Household size						
≤3 persons	3.4 (2.8 to 3.9)	9.0 (8.0 to 10.0)		4.8 (3.9 to 5.6)	4.4 (3.6 to 5.2)	
4–5 persons	34.0 (32.4 to 35.5)	49.7 (47.9 to 51.4)	<0.001	45.8 (43.9 to 47.8)	44.4 (42.5 to 46.4)	0.410
≥6 persons	62.7 (61.1 to 64.2)	41.3 (39.6 to 43.0)		49.4 (47.5 to 51.4)	51.2 (49.3 to 53.2)	
Years of schooling						
No institutional education	20.8 (19.4 to 22.1)	21.3 (19.8 to 22.7)		21.4 (19.8 to 23.0)	21.9 (20.3 to 23.5)	
Primary level (years 1–5)	38.6 (37.0 to 40.2)	38.9 (37.2 to 40.6)	0.090	36.1 (34.2 to 38.0)	37.6 (35.8 to 39.5)	0.632
Junior level (years 6–8)	23.6 (22.2 to 25.0)	22.3 (20.8 to 23.7)		24.6 (22.9 to 26.3)	23.3 (21.6 to 25.0)	
Secondary level (years 9–10)	11.3 (10.3 to 12.4)	12.0 (10.8 to 13.1)		11.9 (10.6 to 13.1)	12.0 (10.7 to 13.2)	
Higher secondary level (years 11–12)	4.3 (3.7 to 5.0)	3.6 (2.9 to 4.2)		4.2 (3.4 to 4.9)	3.7 (3.0 to 4.5)	
Tertiary level (>12)	1.4 (1.0 to 1.7)	2.1 (1.6 to 2.6)		1.8 (1.3 to 2.4)	1.5 (1.0 to 2.0)	
Location						
Urban	33.9 (32.3 to 35.4)	33.0 (31.3 to 34.6)	0.430	35.4 (33.5 to 37.3)	34.4 (32.6 to 36.3)	0.458
Rural	66.1 (64.6 to 67.7)	67.0 (65.4 to 68.7)		64.6 (62.7 to 66.5)	65.6 (63.7 to 67.4)	
Asset quintiles						
Poorest	18.0 (16.7 to 19.3)	21.3 (19.9 to 22.8)		19.2 (17.6 to 20.7)	18.3 (16.8 to 19.8)	
2nd	16.2 (15.0 to 17.4)	22.7 (21.3 to 24.2)	<0.001	20.2 (18.6 to 21.8)	19.6 (18.0 to 21.1)	0.785
3rd	19.6 (18.3 to 20.9)	19.7 (18.3 to 21.1)		19.9 (18.3 to 21.4)	21.1 (19.5 to 22.7)	
4th	24.0 (22.6 to 25.4)	16.9 (15.6 to 18.2)		19.1 (17.5 to 20.6)	19.5 (17.9 to 21.0)	
Richest	22.2 (20.8 to 23.6)	19.4 (18.0 to 20.8)		21.7 (20.1 to 23.3)	21.6 (20.0 to 23.2)	

[a] χ^2 test.

Table 2. OOP payments (in BDT) for utilization of MTPs and all providers among insured and uninsured individuals by their demographic and socio-economic characteristics

Characteristics	All providers			MTPs		
	Insured	Matched-uninsured	p-Value	Insured	Matched-uninsured	p-Value
n	806	769		380	332	
Total OOP payment (BDT)	2512	2660	0.313[a]	4189	5154	<0.001[a]
Age group (y)						
Child (0–14)	1338	1244	<0.001[b]	2781	2655	0.002[b]
Adult (15–60)	2846	3252		4435	5723	
Elderly (>60)	3526	2957		4872	6907	
Sex						
Male	2628	2417	0.573[b]	4425	5147	0.284[b]
Female	2416	2851		4017	5159	
Marital status						
Married	3177	3472	<0.001[b]	4745	5879	<0.001[b]
Unmarried	1374	1348		2700	3057	
Other (widowed, divorced, separated)	2818	3225		4510	6897	
Household head occupation						
Agricultural worker	4549	2360	<0.001[b]	8102	4286	<0.001[b]
Labour	2868	2397		4313	5728	
Shopkeeper	1962	3527		2607	4920	
Service worker	4075	1390		6771	2562	
Housewife	2845	3664		4288	5968	
Transport worker	1912	1787		2883	3856	
Small business	2626	6098		3840	9355	
Not working or unemployed	1980	1819		3605	3849	
Other	1770	6705		4105	23 267	
Household size						
≤3 persons	2074	2567	0.771[b]	3502	4719	0.120[b]
4–5 persons	2496	2931		3662	5795	
≥6 persons	2578	2421		4827	4596	
Years of schooling						
No institutional education	2167	1816	0.250[b]	4415	3778	0.244[b]
Primary level (years 1–5)	2623	2635		4284	6278	
Secondary level (years 9–10)	2658	3517		4200	5965	
Higher secondary level (years 11–12)	2323	3948		2956	8530	
Tertiary level (>12)	1305	3428		1743	4674	
Location						
Urban	2805	2707	0.674[b]	4892	4609	0.092[b]
Rural	2378	2640		3868	5455	
Asset quintiles						
Poorest	2453	2352	0.006[b]	5240	4899	0.267[b]
2nd	1836	1900		3202	5124	
3rd	2189	2358		3706	4076	
4th	2789	2624		4500	4882	
Richest	3274	4011		4332	6296	

[a]Wilcoxon–Mann–Whitney test.
[b]Two-way analysis of variance.

studies have reported a similar association between marital status and OOP expenditures.[40–42] The healthcare needs may be higher among married compared with unmarried individuals, which results in higher OOP payments by married workers.[43,44] Higher OOP payments among better-off informal workers (e.g. second and richest quintiles) compared with poor workers (e.g. the poorest quintile) can be explained by the ability to pay and utilization of expensive private facilities not covered by

Table 3. Effect of CBHI scheme enrolment (individuals) on OOP payments for seeking healthcare from MTPs and any providers

Variables	Description	Priori expected theoretical association with OOP	OOP for utilizing MTPs		OOP for utilizing any providers	
			Stage 1. Participation (logistic model)	Stage 2. Log model of OOP spending	Stage 1. Participation (logistic model)	Stage 2. Log model of OOP spending
Health insurance status	Member (ref=no membership)	−	1.429*** (1.215–1.68)	−0.064*** (−0.091—0.037)	1.076 (0.953–1.215)	−0.009 (−0.027–0.009)
Age group	Adult, 15–60 y (ref=child, 0–14 y)	−	0.799 (0.569–1.121)	0.01 (−0.052–0.072)	0.697** (0.547–0.888)	0.006 (−0.034–0.046)
	Elderly, >60 y (ref=child, 0–14 y)	+	0.627* (0.394–0.998)	0.006 (−0.074–0.086)	0.744 (0.527–1.05)	−0.018 (−0.069–0.034)
Sex	Female (ref=male)	−	1.113 (0.87–1.422)	−0.035 (−0.079–0.01)	1.101 (0.927–1.309)	−0.009 (−0.036–0.018)
Marital status	Unmarried (ref=married)	−	0.367*** (0.267–0.504)	−0.057* (−0.112–0.002)	0.482*** (0.384–0.606)	−0.077*** (−0.115–0.039)
	Widowed/divorced (ref=married)		0.893 (0.571–1.398)	0.017 (−0.052–0.086)	0.918 (0.646–1.305)	−0.006 (−0.054–0.042)
Occupation	Labour (ref=agricultural worker)	−	0.66 (0.38–1.146)	−0.005 (−0.099–0.09)	0.515** (0.335–0.79)	−0.025 (−0.085–0.035)
	Shopkeeper (ref=agricultural worker)	+	0.853 (0.494–1.472)	−0.073 (−0.165–0.019)	0.606* (0.389–0.944)	−0.018 (−0.079–0.044)
	Service worker (ref=agricultural worker)	+	0.504* (0.283–0.895)	−0.039 (−0.138–0.06)	0.39*** (0.248–0.614)	−0.059 (−0.125–0.006)
	Housewife (ref=agricultural worker)	+	0.984 (0.588–1.648)	−0.02 (−0.109–0.069)	0.805 (0.536–1.209)	−0.018 (−0.074–0.038)
	Transport worker (ref=agricultural worker)	+	0.699 (0.377–1.296)	−0.104 (−0.21–0.003)	0.57* (0.352–0.924)	−0.074* (−0.142—0.005)
	Small business (ref=agricultural worker)	+	1.02 (0.536–1.942)	−0.051 (−0.152–0.05)	0.659 (0.387–1.123)	−0.027 (−0.1–0.046)
	Not working/unemployed (ref=agricultural worker)	−	0.828 (0.49–1.4)	−0.046 (−0.134–0.041)	0.625* (0.413–0.946)	−0.02 (−0.078–0.037)
	Other (ref=agricultural worker)	+	0.492 (0.216–1.119)	−0.03 (−0.171–0.11)	0.693 (0.39–1.232)	−0.106** (−0.184—0.028)
Household size	4–5 persons (ref≤3 persons)	+	0.837 (0.576–1.216)	−0.015 (−0.077–0.047)	0.753 (0.564–1.005)	−0.028 (−0.07–0.013)
	>6 persons (ref≤3 persons)	+	0.962 (0.662–1.397)	−0.034 (−0.096–0.028)	0.807 (0.604–1.077)	−0.043* (−0.084–0.002)
Education	Primary level (ref=no institutional education)	+	0.911 (0.726–1.143)	−0.019 (−0.057–0.02)	0.829* (0.702–0.98)	−0.009 (−0.034–0.016)
	Junior level (ref=no institutional education)	+	0.822 (0.635–1.063)	0.01 (−0.035–0.054)	0.631*** (0.52–0.766)	−0.004 (−0.034–0.026)
	Secondary level (ref=no institutional education)	+	0.684* (0.497–0.942)	0.013 (−0.043–0.068)	0.593*** (0.465–0.757)	0.024 (−0.015–0.064)
	Higher secondary level (ref=no institutional education)	+	1.117 (0.689–1.812)	−0.013 (−0.092–0.066)	0.949 (0.651–1.384)	−0.006 (−0.063–0.051)
	Tertiary level and other (ref=no institutional education)	+	0.903 (0.475–1.717)	−0.034 (−0.126–0.058)	0.789 (0.464–1.344)	−0.001 (−0.074–0.072)
Asset quintiles	2nd (ref=poorest)	+	0.863 (0.648–1.15)	0.05* (0.001–0.099)	0.909 (0.748–1.106)	−0.001 (−0.03–0.028)
	3rd (ref=poorest)	+	1.361* (1.04–1.782)	0.024 (−0.022–0.071)	0.988 (0.813–1.201)	0.013 (−0.016–0.042)
	4th (ref=poorest)	+	1.598*** (1.218–2.097)	0.046 (−0.001–0.094)	1.027 (0.839–1.256)	0.03* (0–0.06)
	Richest (ref=poorest)	+	1.647*** (1.262–2.149)	0.067** (0.022–0.113)	0.874 (0.716–1.068)	0.059*** (0.028–0.089)
Location	Urban (ref=rural)	+	1.232* (1.031–1.471)	−0.007 (−0.036–0.023)	1.431*** (1.25–1.638)	−0.006 (−0.026–0.015)
Illness or symptoms suffered	Non-communicable diseases (ref=communicable diseases)	+		0.076** (0.024–0.129)		0.11*** (0.074–0.147)
	Accident and injuries (ref=communicable diseases)	+	–	0.082* (0.009–0.155)	–	0.112*** (0.054–0.17)
	Maternal health problem and delivery care (ref=communicable diseases)	+	–	0.076 (−0.008–0.16)	–	0.117*** (0.049–0.185)
	Symptoms (ref=communicable diseases)	−	–	0.005 (−0.042–0.051)	–	−0.016 (−0.045–0.012)
	Other (ref=communicable diseases)	+	–	0.098*** (0.05–0.146)	–	0.128*** (0.093–0.163)
Inpatient care utilized	Yes (ref=no)	+	–	0.138*** (0.095–0.182)	–	0.17*** (0.131–0.209)
Constant			0.215*** (0.104–0.444)	2.085*** (1.956–2.213)	1.419 (0.818–2.461)	1.954*** (1.872–2.035)
n			5004	704	5004	1567
Likelihood Ratio (LR)$\chi^2(32)$			216	–	213.17	–
Probability>χ^2			0.000	–	0.000	–
Pseudo-R^2			0.0527	–	0.034	–
F(32, 877)			–	5.14	–	14.71
Probability>F			–	0.000	–	0.000
Adjusted R^2			–	0.197	–	0.2348

Significance levels *, ** and *** are 5%, 1% and 0.1%, respectively.

the scheme among workers who are better off.[45–47] Similar associations between asset quintiles and OOP healthcare payments were observed in a number of earlier studies in low-income settings.[37,40,48] A worker who suffered from a chronic illness spent 8.2% more OOP compared with a worker who suffered from a communicable disease in the last 90 days. This may be due to high treatment expenses for the chronic condition.[49]

The effects of health insurance on OOP healthcare payments are ambiguous in the literature, with some studies showing a negative relationship[50–53] and others finding a non-significant relationship.[48,54–58] Aji et al.[52] investigated the effect of three health insurance programmes (Askeskin, Askes and Jamsostek) on OOP expenditures in Indonesia. The authors found a decrease in OOP payments among enrollees in two programmes: 34% in Askeskin and 55% in Askes. The Jamsostek programme, however, did not show any significant relationship with OOP payments. The authors of the Indonesian study concluded that two large existing insurance programmes had the ability to reduce OOP spending, which was a direct function of their benefits packages and co-payment.[52] The findings from our current study were on the same line. A Chinese study examined the impact of health insurance on OOP payments for stroke and found that uninsured workers were seven times more likely to face a catastrophic economic burden due to acute stroke compared with insured enrollees, which implied that OOP healthcare payments were remarkably reduced among the insured patients.[53] A systematic review reported that CBHI and Social Health Insurance (SHI) increased service utilization and simultaneously secured financial risk protection for their members by reducing their OOP expenditures.[59] The same review stated that the CBHI scheme generates new resources for healthcare.[59] However, another review on the impact of SHI observed no remarkable evidence of an impact of insurance on utilization, protection from financial risk and health status, while a few insurance schemes found significant protection from high OOP expenditures.

Catastrophic health expenditures in many countries occur due to high OOP health spending, which contributes to the challenges of financial protection.[3,48,60,61] The findings from this pilot study addressed the influence of the CBHI scheme on the financial protection dimension of UHC for low-income informal workers and their dependents. While UHC aims to increase the number of people covered through risk-pooling mechanisms (such as taxes and insurance), the pilot scheme gave an indication that by using labour cooperatives, more people can be brought under a risk-pooling mechanism and such people can benefit by getting access to better healthcare from MTPs at a lower OOP cost. The magnitude of the reduction in OOP healthcare payments through utilization of a health insurance scheme depends on the co-payment for different services in the benefits package offered by the scheme.[52] For instance, the benefits package of the LASP was mainly characterized by primary care, along with co-payments, as well as reimbursement of 4000 BDT for inpatient care per household per year.

CBHI schemes could be a potential mechanism for generating new resources for securing quality healthcare with financial protection in the journey towards UHC since the largest share of employment in the country is located in the informal sector of the economy. It might be reasonable to develop such schemes in existing cooperatives. In these cooperatives, this scheme can be built on the basis of solidarity among the current members. The existing infrastructure (e.g. management capacity, office space, field staff) of the cooperatives can facilitate implementation of the CBHI schemes as an add-on project. This will reduce costs to ongoing activities of the scheme. Cooperatives in Bangladesh are organized under the Department of Cooperatives in the Ministry of Local Government and Rural Development. Recent information showed that there are 1107 central cooperatives with 133 188 members and 163 408 primary cooperatives with 8.5 million members.[62] These cooperatives are not necessarily developed by informal workers. However, there are existing cooperatives of informal workers and there is a large scope for such workers to incorporate CBHI along with their prevailing economic activities (e.g. micro-credit, trading and landowning).

The healthcare financing strategy of Bangladesh strongly addressed the importance as well as the resilience of including informal workers in pre-payment schemes.[1] Our experience suggests that cooperatives appear to be a platform for economic benefits (e.g. micro-credit, savings) for informal low-income workers. It was observed that CBHI schemes suffer non-renewal or drop-out of enrollees, which challenges such schemes' financial sustainability.[63,64] The cooperatives, which are developed based on solidarity among members, in addition to careful designing of the scheme, may reduce the challenge of retention of members.[65,66] In the CBHI schemes operated by cooperatives, if workers do not get health benefits (if they do not get sick), they may benefit from other components of the cooperative (e.g. micro-credit and savings), which increases the possibility for more enrolment and retention of members. In this pilot scheme, we did not have the opportunity to test these assumptions because all enrollees were entitled to both health insurance and savings. Further research is required by offering different combinations of benefits (health insurance and/or savings and/or micro-credit and/or subsidies on food purchases) for designing the schemes. It is thus important to emphasize here that in progressing towards UHC, the use of cooperatives can be considered as a platform for developing CBHI schemes.

One possible limitation of this study was that we could not capture the seasonal variation in OOP payments of healthcare since the survey took place from April to June 2014. However, the use of a comparison group in the study from the same community and the use of PSM during analysis could minimize such bias. Another limitation was the potential for recall bias, as OOP payments–related information was collected using a self-reported questionnaire. We used a 3-month recall period, though earlier studies used recall periods of 1–12 months.[67–69] Further, the interviewers' bias can influence the response of the respondent. To mitigate this bias, we conducted training of the data collectors and supervisors on the survey tools and pilot interviews were then conducted to identify and resolve potential challenges prior to final data collection. We did not include income in the PSM model for two reasons. First, we included asset quintiles in the PSM model as an indicator of socio-economic status. Adding income in this model will generate a multicollinearity problem since income and asset quintiles are highly correlated. Second, the asset index is a better indicator of the socio-economic sta-

tus of the informal workers than income. This is because of fluctuations in income of different types informal workers by season.[19]

Conclusion

This study showed that enrollees in the CBHI scheme, piloted in a cooperative, had a significantly lower level of OOP healthcare payments for utilizing health services from MTPs. More research needs to be done to understand and estimate the incentives (e.g., co-payment size, reimbursement ceilings, waiting period before accessing benefits and non-health benefits) for designing the benefits package and insurance policy of the scheme. Considering the availability of the large number of cooperatives in Bangladesh, such CBHI schemes may contribute to bringing more informal sector workers and their dependents under health coverage with financial protection for achieving UHC.

Supplementary data

Supplementary data are available at International Health online (http://inthealth.oxfordjournals.org).

Authors' contributors: JAMK and SA conceptualized the research idea and were responsible for the study design, literature search, data extraction and analysis, data interpretation and writing the manuscript. MS, ARS, SC, MHR, ZI, CR and LWN contributed to writing, reviewing and revising the manuscript. All authors read and approved the final manuscript.

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References

1 Health Economics Unit. Expanding social protection for health. healthcare financing strategy 2012–2032. Dhaka: Ministry of Health and Welfare; 2012.
2 Ministry of Health and Welfare. Bangladesh national health accounts 1997–2012. Dhaka: Ministry of Health and Welfare; 2015.
3 Van Doorslaer E, O'Donnell O, Rannan-Eliya RP, *et al*. Catastrophic payments for healthcare in Asia. Health Econ. 2007;16(11):1159–84.
4 Hwang SW, Ueng JJM, Chiu S, *et al*. Universal health insurance and healthcare access for homeless persons. Am J Public Health. 2010;100(8):1454–61.
5 Donnell OO. Access to healthcare in developing countries: breaking down demand side barriers. Cad Saude Publica. 2007;23(12):2820–34.
6 World Health Organization. World health report 2010. Health systems financing: the path to universal coverage. Geneva: World Health Organization; 2010.
7 United Nations. Transforming our world: the 2030 agenda for sustainable development. New York: United Nations; 2015.
8 Khan JAM, Mahumud RA. Is healthcare a 'necessity' or 'luxury'? An empirical evidence from public and private sector analyses of South-East Asian countries? Health Econ Rev. 2015;5:3.
9 Parmar D, Souares A, de Allegri M, Savadogo G, Sauerborn R. Adverse selection in a community-based health insurance scheme in rural Africa: implications for introducing targeted subsidies. BMC Health Serv Res. 2012;12:181.
10 Wang H, Zhang L, Yip W, Hsiao W. Adverse selection in a voluntary rural mutual healthcare health insurance scheme in China. Soc Sci Med. 2006;63(5):1236–45.
11 Ahmed S, Sarker AAR, Sultana M, *et al*. Adverse selection in community based health insurance among informal workers in Bangladesh: an EQ-5D assessment. Int J Environ Res Public Health. 2018;15(2):242.
12 Vargas V, Begum T, Ahmed S, Smith O. Fiscal space for health in Bangladesh. Washington, DC: World Bank; 2016.
13 Akazili J. Equity in healthcare financing in Ghana. Cape Town: University of Cape Town; 2010.
14 Devadasan N, Nandraj M. Planning and implementing health insurance programmes in India: an operational guide. Bangalore: Institute of Public Health; 2006.
15 Khan JA, Ahmed S. Impact of educational intervention on willingness-to-pay for health insurance: a study of informal sector workers in urban Bangladesh. Health Econ Rev. 2013;3:12.
16 World Health Organization. Service delivery and safety. Quality in universal health coverage. http://www.who.int/servicedeliverysafety/areas/qhc/en/ (accessed 16 April 2018).
17 Hussmanns R. Developments in the design and implementation of informal sector and similar surveys – a review of national practices and experiences. Sixteenth International Conference of Labour Statisticians, Geneva; 1998.
18 Ahmed S, Hoque ME, Sarker AR, *et al*. Willingness-to-pay for community-based health insurance among informal workers in urban Bangladesh. PLoS One. 2016;11(2):e0148211.
19 Asian Development Bank. The informal sector and informal employment in Bangladesh. Mandaluyong City: Asian Development Bank; 2010.
20 Bangladesh Bureau of Statistics. Population and housing census 2011. Dhaka: Bangladesh Bureau of Statistics; 2011.
21 Dror DM, Soriano ES, Lorenzo ME, Sarol JN, Azcuna RS, Koren R. Field based evidence of enhanced healthcare utilization among persons insured by micro health insurance units in Philippines. Health Policy. 2005;73(3):263–71.
22 Ury HK, Fleiss JL. On approximate sample sizes for comparing two independent proportions with the use of Yates' correction. Biometrics. 1980;36(2):347–51.
23 Casagrande JT, Pike MC. An improved approximate formula for calculating sample sizes for comparing two binomial distributions. Biometrics. 1978;34(3):483–6.
24 Jones SR. An introduction to power and sample size estimation. Emerg Med J. 2003;20(5):453–8.
25 Ahmed SM, Adams AM, Chowdhury M, Bhuiya A. Changing health-seeking behaviour in Matlab, Bangladesh: do development interventions matter? Health Policy Plan. 2003;18(3):306–15.
26 Ahmed SM, Tomson G, Petzold M, Kabir ZN. Socioeconomic status overrides age and gender in determining health-seeking

behaviour in rural Bangladesh. Bull World Health Org. 2005;83(2): 109–17.
27 van Doorslaer E, O'Donnell O, Rannan-Eliya RP, *et al*. Effect of payments for healthcare on poverty estimates in 11 countries in Asia: an analysis of household survey data. Lancet. 2006;368(9544): 1357–64.
28 O'Donnell O, van Doorslaer E, Wagstaff A, Lindelow M. Analyzing health equity using household survey data: a guide to techniques and their implementation. Washington, DC: World Bank; 2008.
29 Vyas S, Kumaranayake L. Constructing socio-economic status indices: how to use principal components analysis. Health Policy Plan. 2006;21(6):459–68.
30 Wagstaff A, Lindelow M, Jun G, Ling X, Juncheng Q. Extending health insurance to the rural population: an impact evaluation of China's new cooperative medical scheme. J Health Econ. 2009;28(1): 1–19.
31 Rosenbaum PR, Rubin DB. The central role of the propensity score in observational studies for causal effects. Biometrika. 1983;70(1):41–55.
32 Morgan CJ. Reducing bias using propensity score matching. J Nucl Cardiol. 2018;25(2):404–6.
33 Austin PC. Optimal caliper widths for propensity-score matching when estimating differences in means and differences in proportions in observational studies. Pharm Stat. 2011;10(2):150–61.
34 Okunade AA, Suraratdecha C, Benson DA. Determinants of Thailand household healthcare expenditure: the relevance of permanent resources and other correlates. Health Econ. 2010;19(3):365–76.
35 Jones A. A double-hurdle model of cigarette consumption. J Appl Econ. 1989;4(1):23–39.
36 Jones AM. Health econometrics. In: Culyer A, Newhouse J, editors. Handbook of health economics, vol. 6. Amsterdam: Elsevier North-Holland; 2000.
37 Rahman MM, Gilmour S, Saito E, Sultana P, Shibuya K. Health-related financial catastrophe, inequality and chronic illness in Bangladesh. PLoS One. 2013;8(2):e56873.
38 Cragg J. Some statistical models for limited dependent variables with application to the demand for durable goods. Econometrica 1971;39(5):829–44.
39 Farewell VT, Long DL, Tom BDM, Yiu S, Su L. Two-part and related regression models for longitudinal data. Annu Rev Stat Applic. 2017;4:283–315.
40 Mahumud RA, Sarker AR, Sultana M, Islam Z, Khan J, Morton A. Distribution and determinants of out-of-pocket healthcare expenditures in Bangladesh. J Prev Med Public Health. 2017;50(2):91–9.
41 Ekman B. The impact of health insurance on outpatient utilization and expenditure: evidence from one middle-income country using national household survey data. Health Res Policy Syst. 2007;5(6).
42 Chaudhuri A, Roy K. Changes in out-of-pocket payments for healthcare in Vietnam and its impact on equity in payments, 1992–2002. Health Policy. 2008;88(1):38–48.
43 Bourne PA. Self-rated health and health conditions of married and unmarried men in Jamaica. N Am J Med Sci. 2009;1(7):345–52.
44 IMA J, van der Meer JBW, Mackenbach JP. Marital status and healthcare utilization. Int J Epidemiol. 1995;24(3):569–75.
45 Ahmed S, Sarker AR, Sultana M, *et al*. The impact of community-based health insurance on the utilization of medically trained healthcare providers among informal workers in Bangladesh. PLoS One. 2018;13(7):e0200265.
46 Khan JAM, Ahmed S, MacLennan M, Sarker AR, Sultana M, Rahman H. Benefit incidence analysis of healthcare in Bangladesh – equity matters for universal health coverage. Health Policy Plan. 2017;32(3):359–65.
47 Rahman A, Nisha MK, Begum T, Ahmed S, Alam N, Anwar I. Trends, determinants and inequities of 4+ ANC utilisation in Bangladesh. J Health Popul Nutr. 2017;36:2.
48 Ahmed S, Szabo S, Nilsen K. Catastrophic healthcare expenditure and impoverishment in tropical deltas: evidence from the Mekong Delta region. Int J Equity Health. 2018;17:53.
49 Rahman MM, Gilmour S, Saito E, Sultana P, Shibuya K. Health-related financial catastrophe, inequality and chronic illness in Bangladesh. PLoS One. 2013;8(2):e56873.
50 Dror D, Chakraborty A, Majumdar A, Panda P, Koren R. Impact of community-based health insurance in rural India on self-medication & financial protection of the insured. Indian J Med Res. 2016;143(6):809–20.
51 Xie B, Huo M, Wang Z, *et al*. Impact of the new cooperative medical scheme on the trend of catastrophic health expenditure in Chinese rural households: results from nationally representative surveys from 2003 to 2013. BMJ Open. 2018;8(2):e019442.
52 Aji B, De Allegri M, Souares A, Sauerborn R. The impact of health insurance programs on out-of-pocket expenditures in Indonesia: an increase or a decrease? Int J Environ Res Public Health. 2013;10(7):2995–3013.
53 Heeley E, Anderson CS, Huang Y, *et al*. Role of health insurance in averting economic hardship in families after acute stroke in China. Stroke. 2009;40(6):2149–56.
54 Wang Y, Jiang Y, Li Y, Wang X, Ma C, Ma S. Health insurance utilization and its impact: observations from the middle-aged and elderly in China. PLoS One. 2013;8(12):e80978.
55 Philip NE, Kannan S, Sarma SP. Utilization of comprehensive health insurance scheme, Kerala: a comparative study of insured and uninsured below-poverty-line households. Asia Pacific J Public Health. 2015;28(1 Suppl):77S–85S.
56 Mebratie A, Sparrow R, Debebe Z, Ejigie DA, Alemu G, Bedi AS. The impact of Ethiopia's pilot community based health insurance scheme on healthcare utilization and cost of care. ISS Working Paper Series/Geberal Series, vol. 593. Amsterdam: International Institute of Social Studies of Erasmus University; 2014. http://repub.eur.nl/pub/77021/. Accessed 18th October 2018.
57 Ekman B. Community-based health insurance in low-income countries: a systematic review of the evidence. Health Policy Plan. 2004;19(5):249–70.
58 Raza WA, Van De Poel E, Bedi A, Rutten F. Impact of community-based health insurance on access and financial protection: evidence from three randomized control trials in rural India. Health Econ. 2016;25(6):675–87.
59 Spaan E, Mathijssen J, Tromp N, McBain F, ten Have A, Baltussen R. The impact of health insurance in Africa and Asia: a systematic review. Bull World Health Org. 2012;90(9):685–92.
60 Khan JAM, Ahmed S, Evans TG. Catastrophic healthcare expenditure and poverty related to out-of-pocket payments for healthcare in Bangladesh–an estimation of financial risk protection of universal health coverage. Health Policy Plan. 2017;32(8):1102–10.
61 Wagstaff A, van Doorslaer E. Catastrophe and impoverishment in paying for healthcare: with applications to Vietnam 1993–1998. Health Econ. 2003;12(11):921–34.
62 Local Government and Rural Development (LGRD). Department of Cooperatives in the Ministry of Local Government nd Rural Development of Bangladesh. http://www.coop.gov.bd/ [accessed 6 December 2012].
63 Mebratie AD, Sparrow R, Yilma Z, Alemu G, Bedi AS. Dropping out of Ethiopia's community-based health insurance scheme. Health Policy Plan. 2015;30(10):1296–306.
64 Panda P, Chakraborty A, Raza W, Bedi AS. Renewing membership in three community-based health insurance schemes in rural India. Health Policy Plan. 2016;31(10):1433–44.
65 Dror DM, Koren R, Ost A, Binnendijk E, Vellakkal S, Danis M. Health insurance benefit packages prioritized by low-income clients in India: three criteria to estimate effectiveness of choice. Soc Sci Med. 2007;64(4):884–96.

66 Sarker AR, Sultana M, Mahumud RA. Cooperative societies: a sustainable platform for promoting universal health coverage in Bangladesh. BMJ Glob Health. 2016;1:e000052.
67 Lu C, Chin B, Li G, Murray CJL. Limitations of methods for measuring out-of-pocket and catastrophic private health expenditures. Bull World Health Org. 2009;87(3):238–44.
68 Bose M, Dutta A. Inequity in hospitalization care: a study on utilization of healthcare services in West Bengal, India. Int J Health Policy Manag. 2015;4(1):29–38.
69 Ranson MK. The impact of SEWA's medical insurance fund on hospital utilization and expenditure: a household survey. Washington, DC: International Bank for Reconstruction and Development; 2016.