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Uptake of and willingness to pay for health insurance in rural Senegal: a reinforcement effect

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ABSTRACT

Introduction Expanding health insurance is viewed as a core strategy for achieving universal health coverage. In Senegal, as in many other developing countries, this strategy has been implemented by creating community-based health insurance (CBHI) schemes with voluntary enrolment and a fixed premium paid by enrollees. Yet little is known about how the individuals' experience of CBHI enrolment further influences their willingness to pay (WTP). In this paper, we test the existence of a reinforcement effect between effective enrolment in a CBHI and WTP for health insurance by analysing their mutual relationship.

Methods We rely on primary survey data collected in 2019–2020 in the rural area of Niakhar in Senegal. We use an econometric methodology involving: (1) Heckman-type selection models to estimate the determinants of CBHI membership conditioned on awareness of health insurance, addressing the issue of sample selection due to differential awareness and (2) a simultaneous equation model to jointly estimate the uptake and WTP for health insurance, addressing the issue of endogeneity due to reverse causality between both variables. We also focus on the roles that informational and geographical barriers, as well as individual risk preference and trust, play in both outcomes.

Results The final sample includes 1607 individuals. Results show that WTP further increases with the individuals' direct experience in a CBHI scheme, despite an environment characterised by low enrolment rates. We also provide evidence for a U-shaped relationship between risk tolerance and WTP for health insurance.

Conclusion We provide novel evidence on a reinforcement effect of enrolment in a CBHI on WTP for health insurance, with the presence of a substantial consumer surplus among enrolled individuals at the actual premium. Our findings suggest that policies aiming at improving health insurance awareness should foster the demand for health insurance in rural Senegal.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Extending health insurance to the rural population is viewed as a core strategy for achieving universal health coverage in low- and middle-income countries.
⇒ In Senegal, as in other low-income countries, the main determinants of health insurance enrolment and willingness to pay (WTP) for health insurance are now well known.

WHAT THIS STUDY ADDS

⇒ We show that the individuals' experience of effective enrolment in a community-based health insurance (CBHI) scheme further increases their WTP for health insurance in rural Senegal, although in an environment characterised by low enrolment rates.
⇒ Our results suggest that the sustainability issues of the mutual health insurance system in Senegal are not attributable to a potential decline in consumer surplus, which could have resulted from a negative experience of CBHI members.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ Given the existence of a large consumer surplus from the mutual health insurance package, demand-side policies aiming at removing barriers to health insurance awareness should foster the demand for health insurance.

INTRODUCTION

Expanding health coverage in developing countries is essential to better address the health risk, and also to lower the financial risk related to healthcare. To contribute to achieving universal health coverage, mutual health insurance schemes, whether mandatory or voluntary, have been widely implemented in developing countries in the past decades.[1 2] In rural areas, this strategy has generally been implemented by setting up community-based health insurance (CBHI) organisations. However, enrolment rates in Senegalese CBHI schemes are still low,[3] as elsewhere in the developing world.[4] This raises the issue of the sustainability of the mutual health insurance system,[5 6] especially in relation to the experience of CBHI members. In Senegal, Mladovsky[7] showed that active community participation is correlated with remaining in the CBHI scheme, a relationship acting through intermediary outcomes including information, accountability, and trust.

There is a large body of literature on the determinants of health insurance enrolment[8–15] as well as the willingness to pay (WTP) for CBHI and its socioeconomic determinants[16–24] in West Africa. Little is known, however, on how WTP for health insurance and actual enrolment decisions interact with each other. Bonan *et al*[25] used a field experiment to elicit WTP for health microinsurance in Senegal and were the first to investigate the predictive power of WTP on the effective uptake of mutual health organisations' products, demonstrating that WTP was informative of individual behaviour regarding the purchase of health microinsurance products.

Nevertheless, to our knowledge, there is no evidence of the reverse relationship: how the individuals' experience of effective enrolment in a health insurance programme further influences their WTP. Our paper contributes to the literature on the demand for health insurance in developing countries by investigating this question using primary survey data collected in 2019–2020 in rural Senegal. More specifically, we jointly estimate the WTP for and the uptake of health microinsurance, attempting to address the issue of endogeneity due to reverse causality between both outcomes. Hence, our paper is an assessment, in the domain of health insurance, of the effect of individuals' prior direct experience with a good or service on WTP estimates. This literature, which has so far mainly focused on the demand for private (individual consumption)[26] and public goods,[27 28] tends to provide evidence for a positive effect of experience or familiarity, and endogenously acquired information,[27 28] on the economic agents' valuation for the good or public service considered.

This paper addresses the public health question of whether the sustainability issues of the mutual health insurance system in Senegal[5–7] and elsewhere in low-income countries[29] are due to a potentially negative experience of CBHI members.

Health coverage in rural Senegal

Over the past two decades, Senegal has implemented three main strategies to improve health coverage: reform the compulsory health insurance system for employees in the formal sector, consolidate the free healthcare programmes and develop the CBHI schemes.[3] Akin to other developing countries, the two latter complementary strategies have been viewed as a way to move towards universal health coverage by attempting to reach individuals in the informal sector and rural areas.

We will focus on how individuals are covered in rural areas. On the one hand, the health system provides free access to healthcare for certain groups of the population (eg, since 2014, for children aged less than 5 years) or certain medical acts (eg, since 2005–2006, for caesarean section deliveries). The implementation and effects of these free healthcare initiatives on health outcomes, health services utilisation or financial risks associated with healthcare have been largely studied in West and Central Africa,[30–32] including Senegal.[33–36]

On the other hand, the development or implementation of at least one CBHI in each rural community was ensured by a national strategy of universal health coverage framed in 2013 ('Plan stratégique de la Couverture Maladie Universelle').[3] Enrolment in a CBHI organisation is a voluntary decision, unlike in other countries where enrolment is mandatory (eg, in Ghana or Rwanda). Moreover, the system offers the possibility for each household member to enrol individually, without requiring the whole household to enrol (only a lump sum payment of 1000 CFA francs has to be made for a household to register with the CBHI organisation). Then, a fixed premium of 3500 CFA francs has to be paid per individual/year to benefit from the CBHI package (the Senegalese State subsidising the same amount, for a total of 7000 CFA francs per person/year). Enrolment may also be freely provided by the State for households eligible for the *Bourses de Sécurité Familiale* (BSF), a national cash-transfer programme targeting indigent households. However, this free CBHI enrolment is rarely applied in practice. Then, the beneficiaries' healthcare costs are covered at 50% (in private pharmacies) or 80% (in public facilities and for generic drugs). The benefits package includes primary care and preventive consultations, drugs, hospitalisations, deliveries, complementary examinations, special care and evacuations.

CBHI schemes generally cover healthcare only when two conditions are met: (1) beneficiaries must first obtain a so-called 'letter of guarantee' (*lettre de garantie* in French) at their CBHI and (2) beneficiaries can only seek care provided at local health facilities (often only one) which have an agreement with the CBHI. Authorities justify the use of this 'letter of guarantee' to prevent fraud and abuse, ensuring that only actual CBHI beneficiaries are covered when they seek care. With the presence of large geographical distances to the CBHI organisation or the affiliated health facility, these specificities of the Senegalese CBHI system can be easily seen as a barrier impeding the demand for health insurance in the region. This can be linked to the free healthcare programmes in Senegal, for instance, the Plan Sésame for individuals aged 60 and over, which requires a referral letter to access higher levels of care. Although the primary objective was to enhance efficiency, a recent study showed that these referral letters, among other techniques of control, eventually impeded utilisation within the programme.[37]

In 2023, a decade after the implementation of the national strategy on universal health coverage, only 4.1% of household members in a national survey were covered by a CBHI.[38] The latest national health accounts confirm the problems met by the 2013 reform: while voluntary prepayment represented only 6.8% of current expenditure in 2017, this figure fell to 5% in 2021.[39] In addition, the poorest have not improved their access to care and have not been protected from catastrophic expenditure.[36] As in other countries,[29] Senegalese CBHI, as well as higher-level mutual health insurance schemes, encounter a general issue of sustainability.[40]

Still little evidence on health insurance motives and behaviours

Our paper relates to the literature investigating health insurance-related choices under limited information. Consumers are likely to have difficulties making health insurance choices in a limited information environment.[41] Information frictions have been shown to distort health plan choices—for instance by inducing individuals to overestimate or underestimate the insurance value—thereby affecting insurance demand and coverage equilibrium.[41 42] Specifically, we account for the presence of heterogeneous levels of knowledge and awareness of health insurance schemes—often due to the presence of important informational barriers and first highlighted in rural West Africa in qualitative studies.[9 10] Interestingly, a series of randomised experiments in developing countries did not point to a significant impact of information provisioning and improving insurance literacy on households' health insurance purchasing decisions.[43–47] Within their randomised control trial in Burkina Faso, Bocoum *et al*[43] nonetheless showed that the knowledge and understanding of insurance principles appear as necessary but not sufficient for health insurance enrolment. In this regard, a sufficiently good level of knowledge and awareness of health insurance schemes was shown to be a precondition (necessary but not sufficient) for effective uptake in rural Senegal.[48] Hence, in this paper, we correct for awareness-based sample selection bias in our estimation of the demand and WTP for health insurance. A parallel can be drawn with the aforementioned literature on the effect of experience or familiarity with a good or service on demand. Insured individuals are likely to endogenously acquire information, which might further affect their WTP for health insurance and which has to be contrasted with the information exogenously provided within randomised experiments.[27 28]

Lastly, we also present novel evidence on the role of individual preferences (in our case stated risk preference and generalised trust) on the WTP and demand for health microinsurance in developing countries, building on a growing literature.[25 44 49] Current evidence on the relationship between risk preference and the demand for health insurance is puzzling. In Senegal, Bonan *et al*[25] showed that more risk-averse household heads have a higher WTP for health microinsurance, in line with the standard expected utility model of choice under risk.[50 51] Bonan *et al*[44] found that risk aversion does not influence health insurance take-up. Dercon *et al*[49] uncovered a negative relationship between risk aversion and the demand for health insurance in rural Kenya, in a context where the population has limited trust in the health insurer. We believe our results would help clarify the role of individual preferences in the WTP and demand for health insurance.

METHODS

The CMUtuelleS survey

To investigate various dimensions of universal health coverage in Senegal, the CMUtuelleS cross-sectional survey was conducted between November 2019 and March 2020 in the rural area of Niakhar (Fatick region, Senegal),[36 48 52] an area with a long-standing activity in health and social science research.[53] The 203 km^2 Niakhar area has four main health facilities and two CBHI in which inhabitants may enrol depending on the location of their village. Stratified based on the health insurance status of their members, 1002 households were surveyed, representing about one-third of households in the area.

To have sufficient statistical power, a stratified survey was preferred over a general population survey due to the low health insurance enrolment rate in rural Senegal.[3] We conducted a preliminary study to identify individuals enrolled in a CBHI, merging the individuals' identifiers from the CBHI registers into the Niakhar Health and Demographic Surveillance System.[53] Households were then stratified into three groups: (A) households with at least one voluntarily insured individual, (B) households with at least one individual insured through the BSF national programme (and no voluntarily insured individuals) and (C) households with neither voluntarily nor subsidised insured individuals. Group (A) households were selected exhaustively due to their relatively small number (n=255), while households in the two other groups were randomly selected to have 300 households in each group (representing approximately 30% and 20% of the population in Groups (B) and (C), respectively). A household-level questionnaire was administered to the household head, or to the most knowledgeable proxy respondent in the household if the household head was missing. Then, an adult-level questionnaire was administered to up to two adults (≥ 15 years) in the household. In Group (A) households, the main CBHI-enrolled member was selected (the other potential CBHI-enrolled members being beneficiaries) and, if in a union, her/his partner. In Group (B), the main CBHI-enrolled adult was selected (ie, the one designated to receive the BSF cash transfer) and, if in a union, her/his partner. In Group (C), the household head was selected and, if in a union, her/his partner.

The final sample included 1002 households and 1787 adults. More households have been randomly selected to meet the objective of 300 households in Groups (B) and (C), as the repartition of households in each group slightly changed between the preliminary study and the survey. The survey was then matched with the Niakhar Health and Demographic Surveillance System to benefit from additional data on households' and individuals' sociodemographic characteristics (eg, Global Positioning System (GPS) coordinates).

A reflexivity statement on our international partnership between high-income and low- and middle-income countries is provided in online supplemental appendix A2. The Strengthening the Reporting of Observational Studies in Epidemiology checklist for observational studies is provided in online supplemental appendix A3.

Study population and variables

The present analysis is based on a sample of 1607 adults aged 15 years and older. The analysis was carried out at the individual level and not at the household level due to the individual nature of CBHI enrolment decisions. Individuals whose enrolment in a CBHI was assigned and fully subsidised by the government through the BSF programme (n=180 out of 1787 individuals) were excluded from the analysis, as they did not have to make any enrolment decision.

We present briefly the variables used in this study. A detailed description of the main variables of interest is provided in online supplemental appendix A4.

Awareness of CBHI is a binary variable distinguishing individuals with and without knowledge of the existence of CBHI schemes. This assessment was made by the interviewer based on a standardised interviewing procedure regarding the knowledge of CBHI existence and features.

Uptake of CBHI is a self-reported status as to whether the respondent is a member and/or beneficiary of a CBHI scheme. WTP for CBHI is the stated maximum annual premium an individual would pay to enrol in a CBHI. WTP was elicited using the open-ended approach (see the study by Chanel *et al*[54] for a review of WTP elicitation methods with a focus on health insurance).

Based on GPS coordinates, we calculate two geographical distance variables: the distance (in km) to the nearest CBHI, and the healthcare-seeking journey (in km) of a CBHI-enrolled patient, who has to travel an additional distance to obtain a 'letter of guarantee' and afterward has to seek care in a facility with which the CBHI has an agreement.

We also include a general measure of stated risk preference (a qualitative scale ranging from 0 'not at all willing to take risks' to 10 'very willing to take risks')[55] and a binary measure of stated trust in others (ie, generalised trust).[56]

Other variables include the number of adult equivalents in the household, monthly consumption expenditures per adult equivalent, the perception of healthcare quality, self-assessed health, sex, marital status, age and formal education level.

Detailed definitions and summary statistics of the variables used are given in online supplemental appendices A5 and A6, respectively. Summary statistics stratified by health insurance status are provided in online supplemental appendix A7. Online supplemental appendix A8 depicts the density of the WTP for health insurance in CFA francs, both in level and in log, among individuals aware of CBHI schemes, and by individual health insurance status. Data are weighted using sampling weights to be representative of the study area.

Only 33% of the population knows of the existence of CBHI schemes, and 5% are enrolled in a CBHI. Interestingly, the mean WTP for CBHI is 3865 CFA francs, higher than the actual premium of 3500 CFA francs. The mean monthly consumption expenditures per adult equivalent (in CFA francs) is 16 860 CFA francs (US$29.3, year 2020 values). The annual CBHI premium thus represents 1.7% of the average annual consumption expenditures per adult equivalent in the Niakhar area.

Econometric model

Our objective is to consistently estimate both the 'uptake of' and 'WTP for' health insurance, and their mutual relationship. We also address the issue of sample selection due to differential health insurance awareness—which is a precondition for effective uptake—using a Heckman-type selection model.[57] We address the issue of endogeneity due to potential reverse causality between the uptake and WTP for health insurance, using a simultaneous equation model.[58]

Online supplemental appendix A9 provides a complete description of the econometric methodology.

RESULTS

Results of the first-step probit selection equation are provided in online supplemental appendix A10 (coefficient estimates and marginal effects on the probability of awareness). A 1 km increase in distance to the nearest CBHI reduces the probability of awareness by 2.7 percentage points. Wealth is positively associated with awareness. Poorer self-assessed health increases the probability of being aware of available CBHI schemes by 16.6 percentage points. Women have a 13.6 percentage point lower CBHI-awareness probability. Being 1 year older is associated with a 0.5 percentage point lower probability of being aware of CBHI schemes, and there is a marked positive gradient between formal education level and CBHI awareness.

Table 1 provides the results of the second-step simultaneous-equation estimation of CBHI uptake and WTP. The system is estimated on the subsample of individuals aware of existing CBHI schemes. The estimated correlation coefficient between the two equations is negative and significant (atanhrho = −0.869; $p<0.01$), indicating the presence of unobserved factors influencing the demand for health insurance which are negatively correlated with unobserved factors influencing the WTP. Hence, estimating the two equations separately would yield biased and inconsistent estimates.

For each equation, results are presented both as structural estimates and as reduced-form marginal effects of all exogenous variables. As both the demand and WTP estimates are based on limited information, relying on the reduced-form equations containing all our independent variables allows us to make predictions (see Roodman[58] and online supplemental appendix A9). The reduced-form estimates can be considered as the total effects of exogenous variables on the jointly dependent variables. This allows us to assess the importance and magnitude of the effects on both outcome variables.

As expected, a higher WTP for CBHI is associated with a higher uptake probability. More importantly, results point to a plausible increase in WTP with the individuals'

Table 1 Simultaneous-equation system: regression results

	Uptake of health insurance		Willingness to pay for health insurance (in log)	
	Probit model		Linear model	
	Structural estimates	Reduced-form marginal effects	Structural estimates	Reduced-form marginal effects
Uptake of health insurance (ref.=Non-enrolled) Enrolled			0.345** (0.14)	
Willingness to pay for health insurance (in log)	0.566** (0.26)			
Monthly consumption expenditures per adult equivalent (in log)	−6.529** (2.88)	0.120** (0.06)	4.387*** (1.54)	0.242*** (0.07)
Squared monthly consumption expenditures per adult equivalent (in log)	0.348** (0.15)		−0.220*** (0.08)	
Number of adult equivalents in the household	0.022** (0.01)	0.007** (0.00)	−0.009 (0.01)	−0.002 (0.00)
Level of formal education (ref.=None)				
Primary	0.452* (0.25)	0.205** (0.08)	0.108 (0.08)	0.327*** (0.11)
Middle school or higher	1.452** (0.57)	0.561*** (0.14)	0.077 (0.12)	0.718*** (0.25)
Sex (ref.=Man) Woman	−0.033 (0.24)	−0.049 (0.08)	−0.155* (0.08)	−0.207* (0.11)
Marital status (ref.=In a union) Not in a union	0.214 (0.23)	0.095 (0.08)	0.017 (0.11)	0.113 (0.11)
Age	−0.125*** (0.02)	−0.009*** (0.00)	0.044** (0.02)	−0.009** (0.00)
Age (squared)	0.001*** (0.00)		−0.000** (0.00)	
Self-assessed health (ref.=Excellent/very good) Poorer health	0.347 (0.28)	0.176* (0.09)	0.201*** (0.06)	0.398*** (0.12)
Healthcare seeking journey of the enrolled (in km)	−0.140*** (0.05)	−0.058*** (0.02)		−0.060** (0.02)
Inverse Mills Ratio (from the selection equation)	1.545** (0.79)	0.638** (0.29)		0.663* (0.34)
Trust (ref.=No) Yes		0.053** (0.02)	0.226*** (0.05)	0.281*** (0.05)
Risk tolerance		0.002 (0.00)	−0.073** (0.03)	0.011 (0.01)
Risk tolerance (squared)			0.007*** (0.00)	
Perception of healthcare quality		−0.040* (0.02)	−0.173*** (0.04)	−0.215*** (0.05)
Constant	27.309* (13.96)		−14.365* (7.62)	
Model statistics				
No. of observations	709			
Log pseudolikelihood	−1023.47			
Wald χ^2 (df) Prob > χ^2	90.88 (26) 0.0000			
Atanhrho	−0.869*** (0.32)			

*p<0.1, **p<0.05, ***p<0.01.
Regressions are weighted using sampling weights to account for choice-based stratified samples. SEs in parentheses (clustered at the household level to account for intrahousehold correlation, and calculated based on 1000 bootstrap replications of the full system of equations). Atanhrho is the arc-hyperbolic tangent of the correlation coefficient.

experience in a CBHI organisation. Specifically, being enrolled in a CBHI increases the maximum amount individuals will be willing to pay for the same benefits package and under the same contract conditions by 41.2% (ie, $(e^{0.345} - 1) \times 100$) compared with non-enrolled individuals, while accounting for the effect of WTP on uptake. Thus, results suggest the existence of a substantial consumer surplus,[59] defined as the difference between a utility-maximising individual's WTP and the actual price.

Wealth is positively associated with both CBHI WTP (concave relationship) and uptake (convex relationship). An additional adult equivalent in the household increases the individuals' probability of health insurance uptake by 0.7 percentage points, yet without influencing their WTP. After having found a gradient between formal education and CBHI awareness, results show the presence of a gradient between formal education level and both CBHI uptake and WTP (through the effect of uptake on WTP). The probability of CBHI uptake and WTP decreases with age, with a lower (larger) decrease in uptake (WTP) as age increases.

Having poorer self-assessed health is associated with having a 48.9% (ie, $(e^{0.398} - 1) \times 100$) higher WTP for health insurance and with a 17.6 percentage point higher probability of CBHI uptake (through the effect of self-assessed health on WTP).

After having shown that the distance to the nearest CBHI reduces the probability of CBHI awareness, results indicate that the geographical distance exerts an additional constraint by further reducing health insurance uptake. A 1 km increase in the healthcare-seeking journey of a CBHI-enrolled patient decreases the uptake probability of CBHI-aware individuals by 5.8 percentage points. This double geographical constraint is illustrated in figure 1A depicts the predicted probabilities of CBHI awareness across the range of distance to the nearest CBHI (obtained from the first-step regression), and figure 1B shows the CBHI-aware individuals' predicted uptake probabilities across the range of the healthcare-seeking journey of a CBHI-enrolled patient (obtained from the second-step regression).

The coefficient on the IMR is significantly different from zero ($\lambda = 1.545$, $p<0.05$). Hence, we cannot reject the assumption of the existence of a selection bias due to differential awareness of existing CBHI schemes in the area.[60] This justifies the estimation of the probability of the selection process in the first step and its inclusion in the second-step estimation.

Individuals' preference measures are strongly associated with WTP. Generalised trust is associated with a higher WTP for CBHI. Having declared that most people can be trusted (compared with having declared that one cannot be too careful in dealing with people) is associated with a 32.4% (ie, $(e^{0.281} - 1) \times 100$) increase in WTP. This further increases actual uptake (through the effect on WTP) by 5.3 percentage points.

There is no significant average marginal effect of individual risk preference on WTP. Nevertheless, results support the existence of a non-linear relationship. This is depicted in figure 2, which shows the linear predictions of the log of WTP across the risk preference distribution. There is a U-shaped relationship between risk tolerance and WTP for health insurance.

Finally, the lower the individuals' perception of healthcare quality (encompassing nine dimensions about the health facility that they visit the most frequently), the lower their WTP for health insurance. This further reduces the probability of CBHI uptake, yet only through the effect on WTP.

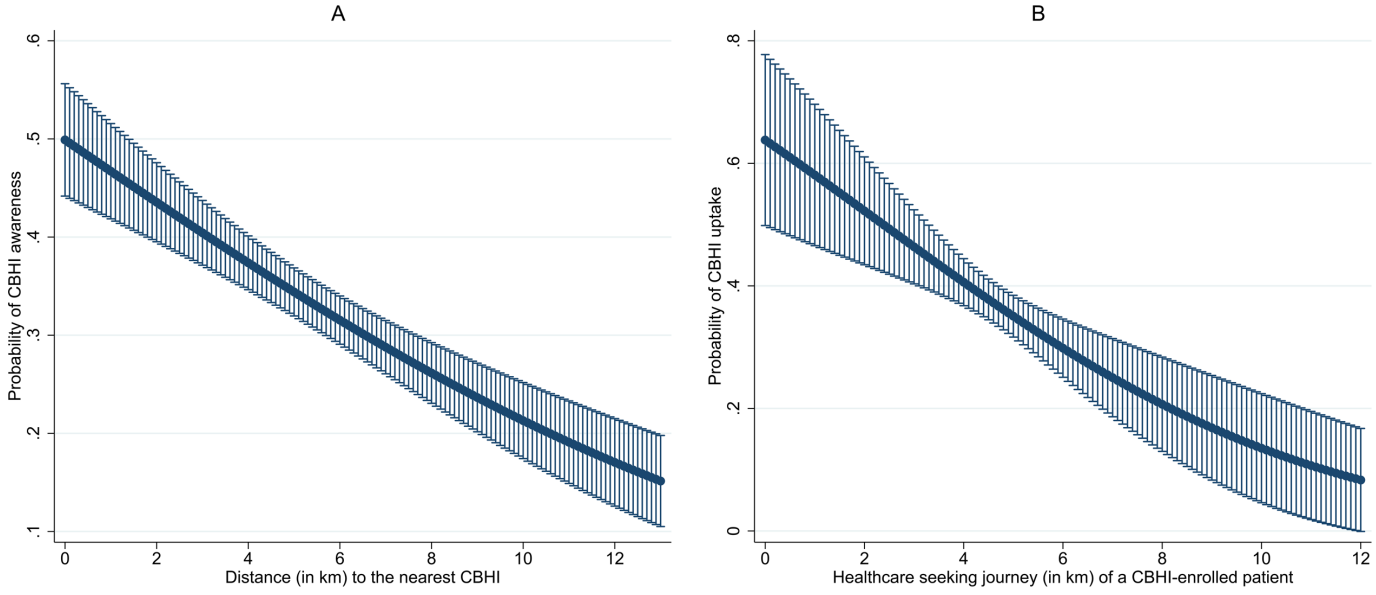

Figure 1 Geographical distances and predicted probabilities of CBHI awareness and uptake. (A) Predicted probabilities of CBHI awareness (with 95% bootstrap CIs) across the range of distance to the nearest CBHI (obtained from the first-step regression). (B) Predicted probabilities of CBHI uptake (with 95% bootstrap CIs) across the range of the healthcare-seeking journey of a CBHI-enrolled patient (obtained from the second-step regression). CBHI, community-based health insurance.

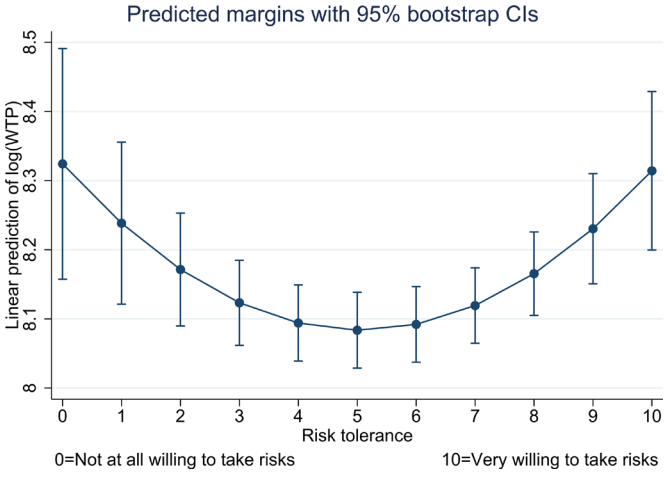

Figure 2 Linear predictions of the log of WTP across the risk preference distribution (obtained from the second-step regression). WTP, willingness to pay.

DISCUSSION

Effect of experience on the WTP for health insurance

Our study confirms the predictive power of WTP on actual enrolment, as first highlighted by Bonan *et al*[25] also in Senegal. Furthermore, we unveil a paradoxical situation where enrolment in health insurance schemes is still low (as observed elsewhere[4 29]), combined with the presence of a substantial consumer surplus among enrolled individuals at the actual premium. There seems to be a self-reinforcing effect of enrolment, with the value assigned to health insurance increasing with its uptake. This finding relates to that of the literature investigating the effect of experience or familiarity with a public good on its demand, which tends to show that expected WTP values are increasing in the level of (endogenous) experience[27] or familiarity[28] with the good or service considered. It would follow from this literature that the positive effect of experience in a CBHI on the WTP for health insurance is partly determined by the endogenous acquisition of information. This is consistent with the fact that, in our paper, although the demand and WTP for health insurance are estimated on a subsample of individuals aware of the existence of CBHI schemes, CBHI-enrolled individuals exhibit considerably higher levels of knowledge of health insurance schemes than non-enrolled ones (for instance, the proportion of individuals having a 'good' knowledge of CBHI schemes is 25.3% and 64.4% in the group of non-enrolled and enrolled individuals, respectively). Also note that the effect of endogenously acquired information has to be contrasted with that of exogenously provided information, which has been shown to have no significant impact on the demand for health insurance in developing countries.[43–47]

The demand for health insurance under limited information

Our findings resonate with those from the recent literature investigating the role of demand frictions—including the extent of consumers' limited information—on the demand for health insurance. These demand frictions induce the WTP for health insurance to be biased upward (with respect to its *true* value) for individuals purchasing insurance, and downward for the uninsured.[61]

Handel *et al*[42] develop a general health insurance market model in which limited information may lead to frictions that distort consumer plan choices. Their findings point to a large mean impact of consumer choice frictions on WTP for health insurance, inducing consumers to purchase more generous coverage. It follows that policies aiming at reducing consumer information frictions (ie, helping consumers make better plan choices by better informing them on their underlying value from insurance) would reduce the demand for insurance and exacerbate adverse selection (with an overall welfare-reducing effect). This is partly due to the presence of high mean and variance of costs to the insurer, and low mean and variance of estimated surplus from incremental risk protection. Interestingly, however, reducing the variance of frictions can increase insurance demand in different insurance environments, namely when mean consumer surplus from risk protection, and consequently equilibrium coverage, are relatively high. Since our results reveal the presence of a substantial consumer surplus from CBHI, we might expect friction-reducing policies to have positive impacts on the demand for health insurance. Also note that this framework involves the availability of a large range of health insurance plans, which is not yet the case in rural West Africa.

Individual preferences and the demand for health insurance

Until recently, the role of individual preferences had often been overlooked in studies on the demand for health insurance in West Africa. Our finding of a positive association between generalised trust and the WTP for health insurance follows economic intuition. Nevertheless, although a negative relationship between risk tolerance and the WTP for health insurance would be expected under normal market conditions, our results point to a U-shaped relationship (see figure 2), suggesting that both risk-averse and risk-tolerant individuals are likely to have a higher WTP for health insurance compared with risk-neutral individuals.

The first study investigating the predictive power of WTP for microinsurance products on actual uptake was that of Bonan *et al*[25] in Senegal. Besides showing that WTP had a positive impact on actual uptake, the authors also show that risk-averse heads of households had a higher WTP, consistent with the expected a priori relationship. Of note, their analysis was conducted in an area where CBHI organisations are well established and have a long-standing activity (hence with likely higher levels of health insurance awareness), and risk aversion was defined as a dummy variable distinguishing strongly risk-averse household heads from others—thus without the possibility to test for non-linearities in the relationship between risk aversion and WTP. In another study using the same data, Bonan *et al*[44] found that risk aversion did not influence uptake.

In a recent study on households' health insurance enrolment and portfolio allocation decisions in China, Li *et al*[62] provided evidence for an association between enrolling in a health insurance scheme and owning risky assets, as also shown in Goldman and Maestas[63] and Christelis *et al*[64] in the USA in the Medicare context. Li *et al*[62] further show that this association is dependent on households' stated risk preference. Namely, for households with high risk tolerance, participating in a health insurance scheme, which reduces their exposure to medical expenditure risk, is associated with having a higher willingness to take financial risks. On the other hand, participating in a health insurance scheme does not lead to a substitution between medical expenditure risk and financial risk for households with high risk aversion.

Contracting a health insurance policy may be paradoxically perceived as detaining a risky asset in a setting where the perceived risk of default of the insurer may be high. This may be particularly true in areas where health insurance organisations have been implemented only recently. Our findings may be related to those of Dercon *et al*,[49] who analysed the relationship between risk aversion and the demand for health insurance using field and laboratory-experimental data from a randomised controlled trial in rural Kenya. The authors showed that, surprisingly, risk aversion may be negatively associated with health insurance demand in settings where trust in insurance schemes is limited (due to misperceptions of health insurance product attributes). Also importantly, their findings show relatively low health insurance uptake. Returning to our results, we explore this pathway by looking at the correlation between risk aversion and WTP depending on the individuals' perception of the functioning of the CBHI organisation. For individuals having a negative perception of the functioning of the CBHI organisation, there is indeed a positive correlation between risk tolerance and WTP for health insurance ($\rho = 0.1836$, $p<0.1$). This is not found for individuals having a positive perception of the health insurer. Overall, our findings based on real-world data seem to corroborate those in Dercon *et al*,[49] yet with the noticeable difference that, in our study, risk preference does not seem to directly influence health insurance take-up, but only WTP. In our study's real-world setting, this might be due to the presence of a unique CBHI scheme with a fixed premium fixed by the Senegalese state and with important access barriers. We argue that the effect of our stated preference measures on the WTP for health insurance is a realistic approximation of individuals' actual health insurance take-up in the absence of informational, geographical or other forms of barriers.

Study limitations

Our study has several limitations. First, the dynamics of health insurance WTP and uptake decisions are not fully considered due to the cross-sectional nature of the data. The mutual influence of consumers' experience of health insurance and WTP for health insurance is by definition a dynamic process. Drop-out of the CBHI, mainly associated with poor quality of care in the contracted health services and with households' lack of financial resources, was shown to be an important issue in Guinea-Conakry,[65] and drop-out rates have been reported to be high in Burkina Faso,[66] although both studies were conducted only 2 years after the implementation of the CBHI. In Senegal, Mladovsky[7] showed that active community participation is correlated with remaining in the scheme, a relationship acting through intermediary outcomes including information, accountability and trust. As our study does not capture individuals who dropped out of the CBHI, our estimate of the effect of enrolment on WTP might be biased upward. We recommend further studies to incorporate this dimension into their work.

Second, WTP elicited using an open-ended question may lead to more zero responses if respondents expect their true WTP to be lower than the actual premium.[67] Also, we cannot rule out the potential presence of an anchoring bias in the elicited WTP (ie, when answers are influenced by arbitrary anchor values, see the study by Wilson *et al*[68]). Although the open-ended elicitation method is known to minimise anchoring or starting-point bias compared with other methods such as dichotomous choice, bidding game or payment card, anchoring is nevertheless likely in our study, as the respondents' WTP is elicited for a product that has a known price. Hence, in our case, the drawback would be that the elicited WTP of an individual more aware of the existing health insurance scheme differs from that of an individual less aware of the scheme. However, we expect this potential anchoring bias to be minimised as: (1) the standardised procedure to elicit WTP guarantees that all individuals declared their WTP after being sufficiently well informed about the existing CBHI scheme, and (2) the econometric modelling restricts the WTP estimation to the subpopulation of individuals sufficiently well aware of the health insurance scheme.

CONCLUSIONS

We attempted to contribute to the literature on health coverage in developing countries by examining the mutual relationship between health microinsurance enrolment decisions and WTP, using primary survey data collected in rural Senegal and accounting for the roles of informational and geographical barriers, as well as individual preferences and perceptions. Our findings have implications with regard to the sustainability of the mutual health insurance system, which is of critical importance for the future of universal health coverage in the region.[29 40]

First, we provide evidence for the presence of a substantial consumer surplus from the health insurance package among CBHI members, although in an environment characterised by low enrolment rates. There seems to be a positive effect of the users' direct experience in a CBHI scheme on their intrinsic valuation of this type

of healthcare coverage. This indicates that the issue of sustainability is not linked to a reduction in consumer surplus resulting from a potentially negative experience of CBHI members, such as dissatisfaction with reimbursement rates or the actual functioning of the CBHI.

Second, we confirm the existence of a weak and somewhat inconsistent willingness to initially join the CBHI (with a non-linear relationship between risk tolerance and WTP), likely explained by individuals' heterogeneous perceptions of the health insurer, the presence of a unique CBHI scheme with a fixed premium fixed by the Senegalese state, and the presence of important geographical and informational barriers.

In light of the literature on information frictions and the demand for health insurance,[42] our findings may suggest that demand-side policies aiming at reducing consumer information frictions should foster the demand for health insurance in rural Senegal, a setting characterised by limited information on many dimensions relevant to health insurance choice combined with a large estimated consumer surplus from risk protection.

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Contributors BV, M-a-QB and SB conceptualised the study and contributed to data collection. M-a-QB performed the econometric analysis and drafted the first version of the manuscript. CS was in charge of the Niakhar Health and Demographic Surveillance System. All authors contributed to revising the manuscript, agreed to be responsible for all aspects of the work and approved the final version for submission. The guarantor (M-a-QB) accepts full responsibility for the finished work, had access to the data and controlled the decision to publish.

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