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Does household enrolment reduce adverse selection in a voluntary health insurance system? Evidence from the Ghanaian National Health Insurance System

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In August 2003, the Ghanaian Government made history by implementing the first National Health Insurance System (NHIS) in sub-Saharan Africa. Within 2 years, over one-third of the country had voluntarily enrolled in the NHIS. To discourage households from selectively enrolling their sickest (high-risk) members, the NHIS in the Nkoranza district offered premium waivers for all children under 18 in exchange for full household enrolment. This study aimed to test whether, despite this incentive, there is evidence suggestive of adverse selection. To accomplish this, we examined how the observed pay-off from insurance (odds and intensity of medical consumption) responds to changes in the family enrolment cost. If adverse selection were present, we would expect the odds and intensity of medical consumption to increase with family enrolment cost. A number of econometric tests were conducted using the claims database of the NHIS in Nkoranza. Households with full enrolment were analysed, for a total of 58 516 individuals from 12 515 households. Our results show that household enrolment cost is not correlated with (1) odds or intensity of inpatient use or (2) odds of adult outpatient use, and is weakly correlated with the intensity of outpatient use. We also find that household enrolment costs are positively correlated with the number of children in the household and the odds and intensity of outpatient use by children. Thus, we conclude that the child-premium waiver is an important incentive for household enrolment. This evidence suggests that adverse selection has effectively been contained, but not eliminated. We argue that since one of the main objectives of the NHIS was to increase use of necessary care, especially by children, our findings indicate a largely favourable policy outcome, but one that may carry negative financial consequences. Policy makers must balance the fiscal need to contain costs with the societal objective to cover vulnerable populations.

Keywords Adverse selection, health insurance, health financing, health economics

KEY MESSAGES

- The Ghanaian National Health Insurance System's policy of offering child premium waivers in exchange for full household enrolment has provided a strong incentive against households enrolling just their sickest members, and has largely contained, but not eliminated, adverse selection.
- Modest adverse selection is likely present, as willingness to pay for household insurance is correlated with the odds and intensity of child health service consumption, but since a key objective of the NHIS was to increase use of necessary care, especially by children, this type of adverse selection is a largely favourable policy outcome.
- Adverse selection in low-income countries may be a welfare-increasing outcome. Efforts to further contain adverse selection must balance the fiscal need to contain costs with the societal need to increase utilization of necessary health services.

Introduction

In August 2003, the Ghanaian Government made history by implementing the first National Health Insurance System (NHIS) in sub-Saharan Africa. Within 2 years, over one-third of the country had voluntarily enrolled in the NHIS. At the same time, the NHIS has struggled with serious questions of sustainability. Analysts have pointed to adverse selection as one of the prime reasons for the system's financial difficulties. As other African countries look to develop their own social insurance systems (Wagstaff 2007), the question of how to build on Ghana's experience is of critical importance.

The phenomenon of adverse selection exists when high-risk consumers, having more knowledge about their own health status than the insurer, select insurance that is priced for lower-risk consumers (Rothschild and Stiglitz 1976). This problem is particularly acute for voluntary systems with community-rated premiums where healthier consumers face higher premiums than they would if they were based on individual risk (Cutler and Zeckhauser 1997). If lower risk consumers respond to actuarially unfair prices by dropping out of the market, then the insurance fund is left with only high-risk members, thus making it financially vulnerable. This theoretical finding has been empirically validated robustly and internationally (Belli 2001; Jakab and Atim 2004).

In the Nkoranza district of Ghana, the managers of the NHIS were keenly aware of the perils of adverse selection, and sought to mitigate this phenomenon by building in incentives for households to enrol all members (Rajkotia 2007). Families were offered the benefit of premium waivers for all children under 18 if they chose to enrol as a family unit. Individuals who pay a payroll tax or contribute through their pensions as well as individuals who are deemed indigent all receive premium waivers. Households with premium waivers simply need to pay premiums for those who are not eligible for waivers to receive the child benefit.

Theoretically, household enrolment should reduce adverse selection in the insurance market by bringing into the insurance pool those who would not otherwise enrol. One study from micro-insurance in China demonstrates that this strategy works if properly enforced (Wang *et al*. 2006). Studies from community-based insurance funds in Africa also point to similar conclusions (Atim 1998; Diop 2005). However, the question of whether this strategy would work at a national level in a low-income country such as Ghana has not been tested.

This study aimed to test whether evidence suggestive of adverse selection is present in the Ghanaian NHIS despite incentives for household enrolment that were intended to counteract this phenomenon. To accomplish this, we examined how household and individual health-seeking behaviour is related to household enrolment costs. Specifically, we examined how these incentives are associated with the probability and intensity of household utilization of health services and the percentage of family members using services. While this does not provide direct evidence of adverse selection (which would require observation of those who chose not to enrol), it does provide information on whether the behaviour of those who are enrolled is consistent with adverse selection. The results of this study will lay the foundation for future work to test adverse selection directly, as well as inform Ghanaian policy makers on any early term corrections needed to increase the sustainability of the NHIS.

The Ghanaian NHIS

The Ghana NHIS is a national system with decentralized operations. Each district in Ghana has established its own insurance fund which is financed through a combination of central-level transfers and individual premiums. All formal sector employees and their dependants are automatically enrolled, and their premiums collected at the central level via payroll deductions. Others voluntarily enrol directly with the insurance fund. At the time of this study, district schemes were charging roughly US$8 per voluntarily enrolled person. Adults over 70, pensioners, individuals who pay a payroll tax and those deemed to be indigent are exempt from paying premiums. Enrolment into the NHIS can be done on an individual or a household basis.

There is no cost-sharing beyond the premiums; members do not pay any co-payments or deductibles. The National Health Insurance Act (NHIA) mandates a pre-defined benefits package that covers 95% of the disease burden in Ghana. Services covered include outpatient consultations, essential drugs, inpatient care and shared accommodation, maternity care (normal and caesarean delivery), eye care, dental care and emergency care. Excluded benefits include echocardiography, renal dialysis, heart and brain surgery, organ transplantation and HIV antiretroviral drugs.

At the time of this study, there was much heterogeneity in how each district was actually implementing the NHIS, despite national guidelines establishing norms and standards. This was especially pronounced for schemes that had been established prior to the formalization of the NHIS, such as the Nkoranza

Insurance Scheme. Established in 1992, the Nkoranza scheme received years of technical support from donors including United States Agency for International Development (USAID) and Danish International Development Agency (DANIDA), which led to mature policies and practices that were sometimes at odds with national guidelines (Atim and Sock 2000). One such practice, which led to the scheme's selection for this study, was the requirement that households enrol as a unit in order to receive premium waivers for children under 18 (Sulzbach *et al*. 2005). Under this policy, the total enrolment cost for a household is the sum of the premiums paid by non-exempt members.

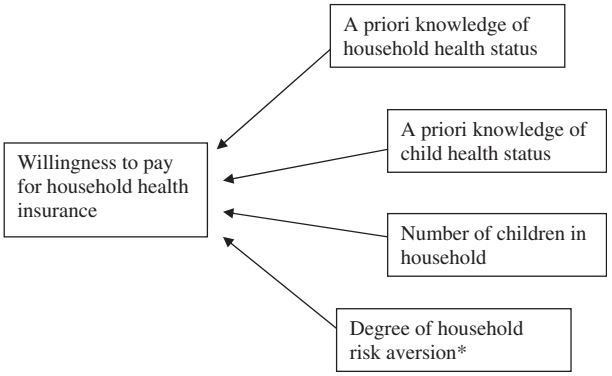

Figure 1 Conceptual framework: four factors influencing the willingness to pay for household health insurance. *Risk aversion was not tested empirically in our analysis due to data limitations.

Methods

Methodological framework

Economic theory predicts that an individual will choose to enrol in an insurance system if the expected benefits derived from insurance outweigh the costs of enrolment. The NHIS offers the same community-rated premium to all individuals in the country, regardless of age, sex or any other factor. Since the same premium is imposed on low- and high-risk people, the premiums of low risks exceed their actuarially fair level plus the risk premium they are willing to pay, while those of high risks are lower than their fair level plus the risk level they are willing to pay. Thus, to maximize household utility, rational households will selectively enrol those individual members whose expected benefit exceeds the premium.

To dissuade individual enrolment, the NHIS offers premium waivers for all children under 18 if the entire family unit enrols. The theory of demand for health insurance posits that people purchase health insurance to minimize the variability of unpredictable health expenditures. Thus, in addition to the benefit for children, insurance coverage for the entire family unit offers greater risk protection than selective enrolment of individuals. Taken together, utility maximizing households will enrol as a unit if the benefit of increased risk reduction and coverage for expected medical consumption for all members outweigh the cost of household enrolment. The more weight households give to risk reduction over a priori knowledge of family health risk, the less adverse selection will exist in the insurance pool.

Empirically, researchers commonly test for adverse selection by comparing and analysing medical consumption of insured and uninsured families. However, since our sample consists only of insured households, the utility of family enrolment is already greater than the utility of partial enrolment or of remaining uninsured. Since the cost of enrolment varies based on the number of premium-paying members in the household, we hypothesize that the pay-off from insurance related to consumption of health services will also vary proportionately if adverse selection is present. A positive relationship would be consistent with adverse selection (but could also have other explanations such as moral hazard, as discussed further in the limitations section). On the other hand, no relationship (the null hypothesis) would suggest that there is no evidence consistent with adverse selection.

We show this graphically in Figure 1. Economic theory indicates that the price that households have paid to enrol must be equal to or less than their willingness to pay for the health insurance package, thus the utility of enrolment (pay-off) is equal to or greater than the cost of enrolment. We hypothesize that the willingness to pay for family enrolment is a function of several factors. First, since household enrolment is rewarded with premium waivers for children under 18, the pay-off of the premium waiver increases as the number of children in the family increase. We hypothesize that households with a greater number of premium-paying members would have a stronger incentive to enrol if they have a larger number of children. As a result, we hypothesize that we will observe a positive correlation between the number of children and the number of premium-paying members in a given family if adverse selection were present. Second, the pay-off of insurance coverage increases as the expected consumption of medical services by the family increases. Thus, holding all other factors constant, if adverse selection were present we would expect to observe a greater share of the household using health services, as well as an overall increase in the probability and intensity of medical consumption by the household, as the number of premium-paying members increase. Third, we would expect the increased probability and intensity of medical consumption to be particularly pronounced for children, since one of the principle benefits of family enrolment is premium-waivers for children (a priori knowledge of child health status, as described in Figure 1).

Finally, the degree of risk aversion on the part of the household will also influence behaviour towards enrolment and the number of individuals to enrol. The more risk-averse the household, the greater the weight placed by that household on risk reduction over a priori knowledge of family health risk. If a positive correlation between risk aversion and willingness to pay were present, then this would provide evidence inconsistent with adverse selection. Unfortunately, our data do not quantitatively capture household risk aversion, thus we were unable to test its influence on enrolment behaviour.

Moral hazard could play a role in the increased probability of use at the individual and household level. However, the opportunity cost and transportation cost for care-seeking have been shown to represent significant barriers to service utilization (Buor 2003), thus mitigating (but not eliminating) the moral hazard effect in Ghana. Thus, taken together, pronounced correlations between willingness to pay and the three

tested elements described in Figure 1 would provide evidence supporting adverse selection.

Site selection

The Nkoranza district health insurance system was selected for this study for four reasons: (1) willingness and interest by the scheme management to undertake this study; (2) maturity of the scheme's claims management processes; (3) large number of enrolees; and (4) the scheme's policy to dissuade individual enrolment by offering premium waivers for all children under 18 if the entire family unit enrolled. Enforcement of this policy throughout the study period was observed and verified by the authors using three methods. First, the authors had direct and regular communication with the head of the district insurance system regarding the enforcement of this policy throughout the enrolment period. Second, the study team was based in the district during enrolment season, and personally sat in the enrolment office to observe and verify that child exemptions were only offered in exchange for full household enrolment, and that households that did not fully enrol were denied the child waiver. Third, the study team accompanied the district enrolment team to households during their random household enrolment verification visits, and observed denial of the child waiver due to non-compliance of the household enrolment rule. We concluded that, while there was some leakage due to some households hiding their total eligible population, there were adequate enforcement and verification procedures in place to ensure relatively consistent application of the household enrolment rule.

Data

Data on health services utilization was drawn from the enrolment and claims database in the Nkoranza district of Ghana. The dataset includes every claim processed since the inception of the district-wide insurance fund in August 2005 until July 2006. The insurance system offers voluntary coverage for 65 455 individuals, or 51% of the population of the Nkoranza district. Only individuals who enrolled as a part of their entire family unit were included in the analysis, which reduced the sample size by 6939 individuals. Thus, the final working dataset contained 58 516 individuals from 12 515 households.

The database contains basic socio-demographic information for each individual within a household, including premium payment status, type and amount of services used, diagnosis, provider characteristics and billed charges. The claims data also specifies whether an individual enrolled as part of a household unit or as an individual. The data include utilization from all participating health providers in the district, which comprise 10 public health clinics/posts and one mission district hospital. Though the data are longitudinally linked by individual, the dataset was collapsed into a cross-section for this analysis.

Tests for adverse selection

Number of children

Our first test for adverse selection is a simple test for correlation between the number of children and the percentage of premium-paying members in a family. This analysis aims to directly test whether households factor the reward of premium waivers for children into their expected pay-off from household enrolment. If the premium waivers were a factor, then we would expect the number of children in a household to increase with household enrolment cost.

We used a Poisson regression to test the relationship between the number of children in a household and the total family premium. Other household regressors included the fraction of elderly members, fraction of female members, gender of the household head, occupation of the household head and a dummy to indicate whether the household head was premium exempt. To control for family size interaction effects, the analysis was conducted separately for all family sizes ranging from two members to eight or more members.

Household utilization of health services

In our second test for adverse selection, we examined the relationship between the percentage of premium-paying adults in the household and the utilization of health services. A positive correlation would suggest the presence of adverse selection.

Three components of utilization were examined: the probability of any use, total family expenditures conditioned on any use, and total number of family visits to a health facility conditioned on any use. The probability of any use was modelled using a logistic regression. The main variable of interest was the percentage of premium-paying adults in the household. Since the probability of any use is a function of the joint probability that at least one member of the family will use services, the regression model also included family size in the specification. Other regressors included the fraction of the household that was elderly, the fraction of the household that was female, the gender of the household head, and a dummy to indicate whether the household head was premium exempt.

Total family expenditures were modelled using a generalized linear model (GLM) configured with a gamma distribution and a log link. This configuration of the GLM is widely used to model health expenditures. The same explanatory variables were used as in the logistic regression, and the data were restricted to those families who had used health services.

Annual number of visits by the household was modelled using a negative binomial regression. This model is preferred to other count models such as the Poisson because it allows for over-dispersion. The model had the same specification as the logistic and GLM regressions, and was applied to those families who had used health services.

Distribution of care-seekers

In our third test for adverse selection, we examined the relationship between the percentage of household members who use services and the percentage of premium-paying adults in the household. A positive correlation would suggest the presence of adverse selection.

We used a two-part model to test the relationship between the percentage of health care users within a household and the percentage of premium paying adults. Part one was a probit model with an identical specification as in the above subsection. Ordinary least squares (OLS) regression with robust

standard errors was used for the second part of the two-part model. Other regressors included family size, the fraction of the household that was elderly, the fraction of the household that was female, the gender of the household head, and a dummy to indicate whether the household head was premium exempt.

Medical consumption by sub-group

Our fourth test for adverse selection examines the utilization patterns of four sub-groups within a family unit: children under 18, adults, elderly (70 years or older) and household heads. As mentioned above, one of the principle benefits of household enrolment is premium waivers for children. Thus, if adverse selection were present in this market, we would expect to observe increased consumption of health services by children under 18, but not by any other sub-group, as the percentage of premium paying members in the household increases.

For each sub-group, three components of utilization were examined: the probability of any use, total annual expenditures conditioned on any use and total number of visits conditioned on any use. The probability of any use was modelled using a logistic regression. Annual expenditures were modelled using a GLM configured with a gamma distribution and a log link. Annual frequency was modelled using a negative binomial regression. The analysis was conducted separately for both inpatient and outpatient expenditures.

For all regressions, the main variable of interest was the percentage of premium-paying adults in the household. Other regressors included age, gender, family size, fraction of household that was elderly, fraction of the household that was female, gender of the household head, and a dummy to indicate whether the household head was premium exempt. Occupation was also included for adults, and relationship to household head was included for all individuals who were not household heads.

Table 1 Household characteristics ($n = 12\,515$)

Characteristic	%/mean
Demographics	
Mean percentage of cash payers	37.53%
Mean percentage of females	55.57%
Mean family size	4.67 ± 2.19
Mean number of exempt children	2.7 ± 1.64
Mean family age (years)	21.89 ± 8.37
Health services utilization	
Percentage of families with no use	21.87%
Mean percentage of non-users within family	58.77%
Mean annual number of visits	4.08 ± 4.63
Mean annual cost (US$)	14.84 ± 22.85

Results

Descriptive analysis

Tables 1 and 2 describe the sample used for this analysis. Nearly 60% of family members within a household did not use any health services. All families in our sample received free enrolment for their children, which make up more than half the households' members. On average, families had a total of 4.08 visits to a health provider per year, which corresponds to slightly less than 1 visit per individual.

Table 2 presents a descriptive analysis of sub-groups within the household. Surprisingly, the annual cost of elderly members is lower than that of prime age adults and household heads, corresponding to the finding that these two groups had a lower proportion of non-users than the elderly population. Forty per cent of the households in our sample are headed by a female, and nearly 80% of the elderly population is female. Compared with adults of prime age, household heads are significantly older ($P < 0.01$), have significantly more annual visits ($P < 0.05$) and higher annual costs $P < 0.05$). Sixty-six per cent of children under 18 never used health services, the highest among the sub-populations compared. The majority of adults and household heads are informal workers. The histogram in Figure 2

Table 2 Individual characteristics, by sub-group

Individual characteristics	Household heads ($n = 12\,515$)	Prime age adults ($n = 11\,098$)	Children under 18 ($n = 32\,744$)	Elderly ($n = 668$)
Demographics				
Mean age (years)	43.34 ± 14.73	31.83 ± 11.26	8.80 ± 4.98	78.10 ± 6.57
Percentage female	44.96%	42.68%	48.52%	79.19%
Occupation				
Student	0.31%	23.56%		
Informal worker	91.06%	72.67%		
Formal worker	7.95%	2.31%		
Unemployed	0.69%	1.45%		
Health services utilization				
Percentage with no use	51.44%	52.41%	66.67%	60.48%
Mean annual number of visits	1.28 ± 2.00	1.17 ± 1.84	0.62 ± 1.18	1.14 ± 2.15
Mean annual cost (US$)	7.79 ± 26.19	7.22 ± 24.67	2.68 ± 12.96	6.99 ± 23.08

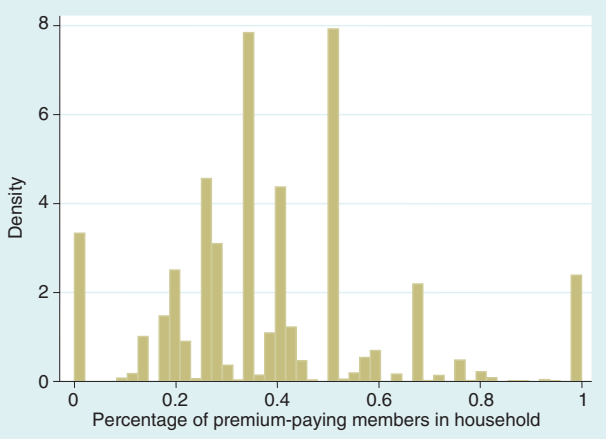

Figure 2 Distribution of the percentage of premium-paying members

Table 3 Insurance pool composition ($n = 64\,859$)

Characteristic	
Demographics	
Average age	24.16 ± 20.22
Percentage female	52.86%
Method of premium payment	
Cash	38.58%
Payroll tax	2.90%
Under 18 (exempt)	52.91%
Indigent (exempt)	0.38%
Pensioner (exempt)	0.15%
Health services utilization	
Percentage of insurance pool with no use	60.15%
Mean annual number of visits	0.90 ± 1.63
Mean annual cost ($)	5.03 ± 20.60

shows that the percentage of premium-paying members in a household is widely distributed.

Table 3 describes the overall insurance pool. The majority of the individuals in the insurance pool are children under 18 who have received premium waivers (52.91%), thus explaining the low average age of beneficiaries (24.16). The majority of prime-age adults were not eligible for waivers and paid their premiums with cash (38.58%), while a small minority were automatically and involuntarily enrolled through payroll tax deductions (2.90%).

Econometric results

Family-level analysis

Table 4 presents the results from the family-level analysis of health services utilization. Families with a greater share of premium-paying members are more likely to have at least one member who uses health services [odds ratio (OR) = 1.014, $P < 0.01$]. Families with a greater share of premium-paying members also have a greater share of individuals who use health services, have higher annual expenditures (US$0.008, $P < 0.01$) and more visits [incidence rate ratio (IRR) = 1.004, $P < 0.01$]. The number of children under 18 in a household is positively correlated with the total family premium (IRR = 1.056, $P < 0.01$) (Table 5).

Table 4 Family utilization of health care services

	Probability of use (OR)	Expenditure (US$)	Frequency (IRR)	Share of family using services
% premium payers	1.014***	0.008***	1.004***	1.141***
	(0.00)	(0.00)	(0.00)	(0.02)
% elderly in family	1.005**	0.001	1.003**	0.958
	(0.00)	(0.00)	(0.00)	(0.03)
% females in family	1.003***	0.001**	1.001**	1.066***
	(0.00)	(0.00)	(0.00)	(0.01)
Head paid premium? (1 = yes)	0.643***	−0.450***	0.843***	0.020***
	(0.05)	(0.04)	(0.02)	(0.02)
Female-headed household? (1 = yes)	1.264***	0.080****	1.009	6.732***
	(0.07)	(0.03)	(0.02)	(4.19)
Size of family	1.334***	0.137***	1.129***	0.047***
	(0.02)	(0.01)	(0.01)	(0.01)
n	12 515	9717	9717	9717

Notes: *$P < 0.1$; **$P < 0.05$; ***$P < 0.01$.

Results shown are from a two part model (TPM). Part one of the TPM was a logistic regression to predict probability of use. Part two of the TPM for expenditures was a generalized linear model with log link and gamma distribution. Part two of the TPM for annual utilization frequency was a negative binomial regression. Part two of the TPM for family share was an ordinary least squares regression. Results from the logistic and negative binomial regression are exponentiated and presented as odds ratio and incidence rate ratios, respectively.

Sub-group analysis

The results from our analysis on the utilization patterns of sub-groups within the household add further insight to our family-level findings (Tables 6, 7 and 8). We find that as the fraction of premium-paying members increases in a household, children are the only sub-group that is more likely to use outpatient health services (OR = 1.008, $P < 0.01$). Outpatient utilization by adults, household heads and the elderly is not correlated with the fraction of premium-paying members in the household. Conversely, outpatient utilization intensity, measured by annual expenditures and frequency, modestly increases for all four sub-groups as the fraction of premium-paying members increases. We find that the probability and intensity of inpatient use is not sensitive to the fraction of premium-paying members in the household for any of the sub-groups analysed (Tables 9, 10 and 11).

Limitations

It is important to understand the limitations of our study. The majority of premium-paying adults in the NHIS are informal workers. Thus, it is possible that latent characteristics of informal workers are also influencing the utilization behaviours of our sample. We attempted to correct for this bias using the instrumental variables approach; however, no valid instruments

Table 5 Correlation between number of children in household and family premium (incidence rate ratios)

	Family size = 3	Family size = 4	Family size = 5	Family size = 6	Family size = 7	Family size = 8+
Total family premium	1.009***	1.063***	1.056***	1.086***	1.106***	1.196***
	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
% female	0.918***	1.002	0.998	0.994	0.987	0.937
	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.05)
Female-headed household (1 = yes)	1.230***	1.099***	1.071***	1.016	1.016	0.969
	(0.05)	(0.02)	(0.02)	(0.01)	(0.01)	(0.02)
Household head paid cash (1 = yes)	1.850***	1.450***	1.371***	1.261***	1.225***	1.135***
	(0.11)	(0.05)	(0.04)	(0.03)	(0.03)	(0.04)
Occupation of household head						
Student	ref.	ref.	ref.	ref.	ref.	ref.
Informal worker	0.933	0.966	0.828	0.945	1.075*	0.491
	(0.06)	(0.06)	(0.10)	(0.07)	(0.04)	(0.25)
Formal worker	1.349***	1.105	0.871	1.032	1.052	0.490
	(0.11)	(0.07)	(0.11)	(0.07)	(0.05)	(0.24)
Unemployed	0.734***	0.687***	0.731**	0.993	1.163***	0.554
	(0.08)	(0.10)	(0.11)	(0.08)	(0.06)	(0.28)
n	2490	2370	1963	1573	1043	1250

Notes: *$P < 0.1$; **$P < 0.05$; ***$P < 0.01$.
Results presented are from Poisson regression. Results are exponentiated and presented as incidence rate ratios.

Table 6 Probability of outpatient services use (odds ratios)

	Household heads	Adults	Under 18s	Elderly
% premium payers	1.002	1.000	1.008***	0.993
	(0.00)	(0.00)	(0.00)	(0.01)
Age	1.014***	1.007***	0.750***	0.999
	(0.00)	(0.00)	(0.01)	(0.01)
Gender (1 = female)	2.284***	2.164***	0.991	1.572*
	(0.10)	(0.12)	(0.02)	(0.40)
Sex of household head (1 = female)	n.a.	0.921	0.825***	1.307
		(0.06)	(0.04)	(0.24)
n	11 501	11 067	32 503	550

Notes: *$P < 0.1$, **$P < 0.05$, ***$P < 0.01$.
Results are from part one of a two part model (TPM). Logistic regression was used and results are exponentiated and presented as odds ratios.

were present in our data. Second, since our data comprises only insured households, our analyses focus on care-seeking behaviour and spending after becoming insured rather than on a comparison of individual characteristics of the insured and uninsured, thus making it difficult to disentangle moral hazard from adverse selection. That said, the opportunity cost and transportation cost for care-seeking have been shown to represent significant barriers to service utilization (Buor 2003), thus mitigating (but not eliminating) the moral hazard effect in Ghana. Moreover, our battery of tests attempt to investigate adverse selection from a range of different angles. Thus, taken together, pronounced correlations between willingness to pay and the three elements described in Figure 1 would provide reasonable supporting evidence of adverse selection.

Discussion

The results of this study provide evidence that the design of the Ghanaian National Health Insurance System has largely contained, but not eliminated, adverse selection. The designers of the NHIS posited that by offering premium waivers for children in exchange for household enrolment, households would be incentivized to enrol all members, not just the most high-risk, i.e. most sickly, members (Rajkotia 2007). The results of our econometric tests are consistent with this hypothesis; we find that most medical consumption is not substantially correlated with household enrolment costs.

A deeper examination of health service utilization patterns further substantiates our conclusion. First, we find no correlation between inpatient use (a service shown to have inelastic demand, thus most often used by the genuinely ill) and household enrolment cost in any of the sub-groups analysed. Thus, our results suggest that the pay-off from insurance for enrolled households is not a function of consuming medical services for their sickest members. Second, we find that the probability of seeking health care by household heads, adults and the elderly is not correlated with household enrolment costs. This also suggests that the pay-off for households from household insurance is not a function of accessing care for their sickest members (adverse selection) or using care they otherwise would not (moral hazard). Taken together, these findings suggest that the NHIS has successfully contained adverse selection.

Table 7 Annual outpatient expenditure conditioned on positive use (US$)

	Household heads	Adults	Under 18s	Elderly
% premium payers	0.004***	0.004***	0.004***	0.003*
	(0.00)	(0.00)	(0.00)	(0.00)
Age	0.013***	0.011***	−0.155***	
	(0.00)	(0.00)	(0.01)	
Gender (1 = female)	0.365***	0.319***	0.003	0.069
	(0.04)	(0.06)	(0.02)	(0.23)
Sex of household head (1 = female)		−0.055	−0.015	0.050
		(0.05)	(0.04)	(0.18)
n	5609	5218	10 740	260

Notes: *$P < 0.1$, **$P < 0.05$, ***$P < 0.01$.

Results are from part two of a two part model (TPM) for expenditures. A generalized linear model with gamma distribution and log link was used, and results are presented in US dollars.

Table 8 Annual outpatient frequency conditioned on positive use (incidence rate ratios)

	Household heads	Adults	Under 18s	Elderly
% premium payers	1.002***	1.001*	1.001**	1.001*
	(0.00)	(0.00)	(0.00)	(0.00)
Age	1.009***	1.004***	0.900***	
	(0.00)	(0.00)	(0.00)	
Gender (1 = female)	1.303***	1.192***	0.992	1.163
	(0.03)	(0.04)	(0.01)	(0.17)
Sex of household head (1 = female)		0.960	0.995	1.115
		(0.03)	(0.02)	(0.13)
n	5609	5218	10 740	260

Notes: *$P < 0.1$, **$P < 0.05$, ***$P < 0.01$.

Results are from part two of a two part model (TPM) for annual utilization frequency. Negative binomial regression was used, and results are exponentiated and presented as incidence rate ratios.

We argue that this success is largely a function of the child waivers. Our findings suggest that the reward of free enrolment for children serves as the most important pay-off for households enrolled in the NHIS. We find that children under 18 were the only sub-group that had an increase in the probability of seeking outpatient care as the percentage of premium payers increased. Our finding that the willingness to pay for household insurance is correlated with the odds and intensity of child health service consumption is suggestive of the modest adverse selection or moral hazard still present in the system. In addition, we find that the number of children in an enrolled household is significantly and positively correlated to the total family premium. Taken together, these results suggest that the coverage of children is an important element in the household's pay-off from enrolling in health insurance as a unit.

While our results are consistent with the conclusion that the design of the NHIS has averted serious adverse selection, our

Table 9 Probability of inpatient services use (odds ratios)

	Household heads	Adults	Under 18s	Elderly
% premium payers	0.999	1.000	0.995	1.010
	(0.00)	(0.00)	(0.00)	(0.02)
Age	0.985**	0.962***	0.698***	0.944
	(0.01)	(0.01)	(0.03)	(0.05)
Gender (1 = female)	1.799***	3.475***	0.954	1.047
	(0.25)	(0.78)	(0.12)	(0.83)
Sex of household head (1 = female)		0.945	0.986	1.037
		(0.17)	(0.14)	(0.53)
n	11 501	11 067	32 305	550

Notes: *$P < 0.1$, **$P < 0.05$, ***$P < 0.01$.

Results are from part one of a two part model (TPM). Logistic regression was used and results are exponentiated and presented as odds ratios.

Table 10 Annual inpatient expenditure conditioned on positive use (US$)

	Household heads	Adults	Under 18s	Elderly
% premium payers	0.003	−0.002	0.006	−0.011
	(0.00)	(0.00)	(0.00)	(0.01)
Age	0.002	0.004	0.053	
	(0.00)	(0.01)	(0.05)	
Gender (1 = female)	0.025	−0.022	−0.214*	−0.074
	(0.12)	(0.18)	(0.12)	(0.33)
Sex of household head (1 = female)		0.083	0.032	−0.762
		(0.18)	(0.12)	(0.49)
n	270	339	260	15

Notes: *$P < 0.1$, **$P < 0.05$, ***$P < 0.01$.

Results are from part two of a two part model (TPM) for expenditures. A generalized linear model with gamma distribution and log link was used, and results are presented in US dollars.

Table 11 Annual inpatient frequency conditioned on positive use (incidence rate ratios)

	Household heads	Adults	Under 18s	Elderly
% premium payers	0.99	1.001	0.989	1.017
	(0.00)	(0.00)	(0.01)	(0.02)
Age	0.980***	0.959***	0.787***	
	(0.01)	(0.01)	(0.05)	
Gender (1 = female)	1.344**	2.806***	1.022	1.801
	(0.20)	(0.76)	(0.15)	(1.94)
Sex of household head (1 = female)		0.890	0.848	1.527
		(0.18)	(0.15)	(0.93)
n	5609	5218	10 740	260

Notes: *$P < 0.1$, **$P < 0.05$, ***$P < 0.01$.

Results are from part two of a two part model (TPM) for annual utilization frequency. Negative binomial regression was used, and results are exponentiated and presented as incidence rate ratios.

data show that there is some correlation between the intensity of outpatient use by care seekers and the share of premium-paying members in the household. The magnitude of this correlation, however, is very modest, and could be due to a range of factors including moral hazard. Whether or not this is mild adverse selection, we argue that without the enticement of premium waivers for children under 18, families would choose to enrol only their high-risk members, and thus the observed correlation would be far more pronounced. In other words, by introducing modest adverse selection through the child waivers, we argue that far more serious adverse selection related to all sub-groups has largely been contained.

Our conclusion that adverse selection has largely been contained, but not necessarily eliminated, in the Ghanaian NHIS, a voluntary health insurance system, is a laudable accomplishment for Ghana. According to Cutler, 'Almost all health insurance systems where individuals are allowed choice of insurance have experienced adverse selection' (Cutler 1996). That said, issues of financial sustainability continue to plague the NHIS (Ledger 2006), and have put considerable pressure on policy makers to make fiscal refinements. As policy makers consider whether to pursue reforms that would further contain adverse selection, it is important that they assess whether the elements that constitute a household's pay-off undermine the social objectives of a national health insurance system. We have shown that increased access to and intensity of outpatient health services for children are the main benefits that constitute a household's pay-off for family enrolment. Policy makers should welcome these findings, as increased use by children was an important goal of the insurance programme (Rajkotia 2007). We have also shown that increased utilization of outpatient services by care-seeking adults modestly factors into the pay-off for household enrolment. If this is the result of greater use of preventive care and necessary elective care for those who would otherwise remain under-treated, then policy makers should welcome these findings as well.

Along the same lines, some economists argue that 'moral hazard' can be welfare-increasing if the health services consumed by an insured individual would also be purchased by that individual if she were uninsured, but had greater income (Nyman 2004). In low-income countries such as Ghana, it has routinely been found that the cost of health care is an impediment to use, leaving many untreated or under-treated (Nyonator and Kutzin 1999). Thus, since health care is a normal good, it is possible that the households in our study would consume health services at least at the same level as we observed in this study were they to have greater income. However, if the increased intensity of service consumption that we observe is the result of frivolous use of services that would not otherwise be consumed, then policy makers should assess options to curb demand such as copayments or deductibles. Policy makers must consider if these options would reduce a household's expected pay-off and demand for insurance, and ultimately be worth the societal cost of reduced child health service consumption.

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Conflict of interest

None declared.

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