The Effect of Parents' Insurance Enrollment on Health Care Utilization: Evidence from Ghana

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Abstract

Access to and utilization of health services are concerns in poor countries. If implemented correctly, health insurance systems may help solve this challenge. However it is difficult to determine whether joining an insurance scheme improves medical care-seeking behaviors because of selection and omitted variable bias. This paper examines how parental participation in the National Health Insurance Scheme (NHIS) affects health care utilization in Ghana, using an instrumental variable approach. The exogenous variation in enrollment comes from membership rules variations in the District Mutual Health Insurance Schemes (DMHIS). The data sets employed are the 2008 Demographic and Health Survey and a census of DMHIS in existence in 2008. We find insurance membership increases the probability of: i) seeking higher quality but no greater quantity of prenatal services and ii) parents becoming more active users of child curative and preventive care. IV estimates are larger than OLS ones indicating underlying heterogeneity in returns to NHIS participation. Results obtained are not modified after introducing both, barriers affecting children's access to health care in 2008, as well as challenges to participation in the DMHIS.

Keywords: Health insurance; child and maternal health; heterogeneous treatment effects; Ghana.

JEL classification: D1; I1; O1

1. Introduction

Access to and utilization of health services continue to pose problems for poor countries such as Ghana. Delaying medical treatment or choosing self-treatment can generate serious health consequences (Hadley 2002). Particularly susceptible are young children for whom negative health shocks can generate nutritional deficits and, in time, cognitive disabilities. If implemented correctly, health insurance systems could provide an effective solution to this challenge (Brown et al. 1998; Gertler and Gruber 2002). This paper examines the impact of parental participation in the National Health Insurance Scheme (NHIS) on child health care utilization and the quantity and quality of prenatal care in Ghana.

The only two prior studies to examine the impact of the NHIS are Mensah et al. 2009 (also published as Mensah et al. 2010) and Blanchet et al. 2012. The first study found that pregnant women who participate in the scheme enjoy reduced incidence of birth complications and are more likely to receive prenatal care, deliver at a hospital, and be attended by a trained health professional during birth. The second paper stated that insurance members have a higher probability of obtaining prescriptions, visiting clinics and seeking formal health care when sick. Yet both these studies used very limited data in terms of their geographic coverage. The first one looks at the impact on only on 4 districts and the second one only in the Accra Metropolitan Area. To our knowledge, no study to date has analyzed the impact of the Ghanaian National Health Insurance Scheme on child health care utilization or on the quality of prenatal care received by mothers. Furthermore this is the first attempt to look at the impact of the scheme using information from the whole country.

According to the 2008 Citizens' Assessment of the National Health Insurance Scheme, membership in the NHIS increased from 1,797,140 people in 2005 to 12,518,560 people in 2008. This number represents 61.3 percent of Ghana's population. In addition, children younger than 18 comprise 50 percent of NHIS members which makes this group a relevant unit of analysis.

This study mainly analyzes health care practices for children under five, because early health care experiences are particularly important for future skill development and establishment of mental potential (Knudsen et al. 2006 and Heckman 2007). Strong economic productivity in adulthood has been shown to be correlated to outcomes of child health (Case et al. 2002; Currie and Stabile 2003; Case et al. 2005; Alderman et al. 2006; Oreopoulos et al. 2008). Moreover, in the aggregate, lower human capital will result in sluggish economic development (Strauss and Thomas 1998).

Selection bias and omitted variable bias have posed serious difficulties in identifying the effect of joining a health insurance scheme on health care use and quality. The decision to join a health insurance scheme is determined by unobserved factors, and these same factors might simultaneously be affecting the level of health care use and its quality. To overcome this problem and estimate the causal impact of enrollment in the NHIS on health care use and quality, we use an instrumental variable approach. The exogenous variation in the decision to join the NHIS comes from variations in the membership rules in the District mutual health insurance schemes. For example districts that had lower renewal fees than others might have had higher participating rates.

The main data sets employed in this study are the 2008 Ghana Demographic and Health Survey (GDHS) as well as a census of all the District Mutual Health Insurance Schemes in existence in 2008. This census containing administrative data at the district level was carried out for the purpose of this study and allows us to construct the instrumental variables used the paper. We test the exogeneity of the instruments by providing evidence to show government officials in the different DMHIS did not choose to establish their membership rules to make them less stringent in districts that had: lower child health care utilization rates or maternal health care quality or higher poverty, malaria or fertility rates.

This paper is divided into five sections. Following this introduction, Section two provides a background of the National Health Insurance Scheme operation. Section three describes the data used in the analysis and the estimation method chosen. This is followed by Section four which presents results, a discussion of the findings and a test of the validity of the instrument chosen. Section 5 concludes the paper.

2. Ghana's National Health Insurance Scheme

From the colonial era through the 1970s, Ghana's governments tried various policies to render health care financing sustainable in the country (Abuosi 2004). Prior to 1989, health facilities were allowed to keep some of the fees collected to improve upon their services (Baah 1994). After 1989, the health institutions were authorized to keep all fees collected to facilitate capitalization for the so-called "Cash and Carry" scheme for drug purchases and supply. This scheme was implemented in 1992 and is formally known as the Revolving Drug Fund (Yevutsey and Aikins 2010).

Under the cash-and-carry system, health professionals only attended to patient needs after initial payment for the service was made. Even patients who had been brought into the hospital on emergencies had to pay at every point of service delivery. This resulted in unnecessary suffering and death, leading to public outcry for the scheme to be scrapped (Agbeve, 1997).

In 2003 the National Health Insurance Act (Act 560) was passed. This act created Ghana's National Health Insurance Scheme (NHIS), whose mission is "to ensure equitable universal access for all residents of Ghana to an acceptable quality of essential health services without out-of-pocket payment being required at the point of service use" (Ghana Ministry of Health, 2004). The scheme became operational in 2004 (Hsiao and Shaw 2007).

The new system establishes that people pay an annual fee according to their income[1]. The government subsidizes pensioners under the Social Security and National Insurance Trust (SSNIT) Scheme, and, in addition, under the NHIS, subsidizes the old (70+), core indigent populations, and the children and dependents below 18 of parents that participate in the system.

This scheme operates Ghana's public health care system[2] and allows the existence of three different kinds of insurance plans (District Mutual Health Insurance Schemes, private mutual insurance schemes and private commercial insurance schemes). Within these schemes the benefits package offered is very similar. Yet each District Mutual Health Insurance Scheme can choose to provide supplementary benefits. The basic package consists of (1) coverage of all

[1] Workers in the formal sector contribute 2.5% of their contribution to the Social Security and National Insurance Trust (SSNIT) with annual premiums ranging from GHc 7.2 ($8) to GHc 48 ($54) (Frempong et al. 2009)
[2] The Ghanaian health care system can be divided into four main groups of delivery systems: public, private-for-profit, private-not-for-profit, and traditional (Salisu and Prinz 2009).

costs, including food, associated with out-patient department and admission treatment, (2) full payment for medicine included in an approved list, and (3) payments for referrals in an approved list (Salisu and Prinz 2009). Specifically, it covers oral health, eye care, emergencies, and maternity care, including prenatal care, normal delivery, and some complicated deliveries, as well as treatment for malaria, diarrhea, upper respiratory tract infections, skin diseases, hypertension, asthma and diabetes[3] (Mensah et al. 2009). A more extensive list of benefits as well as of excluded services is provided in Appendix A.1.

The most popular plan is the District Mutual Health Insurance Scheme, which operates in every district in Ghana. Any resident in Ghana can register under this scheme[4]. This insurance scheme is the only one that receives a subsidy from the National Health Insurance Fund and is the one analyzed in this paper.

Under this scheme, children under 18 whose parents or guardians are contributors are not required to pay premiums, but they must be registered to obtain coverage. In addition, Ghanaian residents who are 70 years old and above, as well as the core poor populations are exempted from contributing. There is no limit on what NHIS pay in medical bills as long as the care is within the provision of the benefit package. Finally, there are no co-payments, co-insurance or deductibles.

The District Mutual Health Insurance Schemes are distributed across the different regions in Ghana and by 2008 had accredited 1,672 health facilities across the whole country (see **Table A1**

[3] Over 95% of disease conditions that afflict Ghanaians are covered by the NHIS.
[4] A beneficiary in one district who moves to another district can transfer his/her insurance policy and still be covered in the new district.

in the appendix**)**. Similarly, the enrollment rate varies across regions with the lowest membership rates in the Central region and the highest in the Upper West region (see **Table A2** in the appendix).

The Act which established the NHIS created the District Mutual Health Insurance Schemes as autonomous entities. Section 54 of Act 650 (2003) specifically states: "A scheme shall have a governing body which shall be responsible for the policies of the scheme and appointment of the employees". As a result, each scheme in each district is completely independent of any other in the country with independent boards of directors; schemes do not pool risks together in any way. Another unintended consequence of this independence is that membership rules vary across different District Mutual Health Insurance Schemes. This source of exogenous variation could act as an instrumental variable for identification of parental participation in the NHIS. Membership rules such as the amount of money paid to renew insurance cards both for adults and children vary across districts. Districts with higher renewal fees would probably discourage participation of marginal participants. Similarly, the existence, in certain districts, of exceptions that allow children to benefit from the NHIS without both their parents being registered could increase child participation in the scheme in such districts.

3. Estimation Methodology

3.1 Data Sources

The 2008 Ghana Demographic and Health Surveys (GDHS) is the main data source for this study. This survey is carried out by the Ghana Statistical Service and the Ghana Health Service. It is a national survey designed to collect information on housing and household characteristics,

education, maternal health and child health, nutrition, family planning, gender, and knowledge and behavior related to HIV/AIDS. It covers all regions in Ghana and uses a two-stage sample based on the 2000 Population and Housing Census to produce separate estimates for key indicators for each of these regions. The 2008 survey interviewed a total of 11,778 households during a period of three months, from early September to late November 2008.

The other data source used in this study is a census of all the District Mutual Health Insurance Schemes in existence in 2008. This census was designed and carried out for this particular study. When the law was approved there were 110 districts; however, according to the 2009 National Health Insurance Authority Annual Report, 145 district mutual health insurance schemes (DMHIS) were licensed by 2008. The census contains information on the membership rules in each of these 145 District Mutual Health Insurance Schemes (DMHIS) for the years 2006, 2007 and 2008. For example it collected information on the verification methods employed by the DMHIS to ensure that parents were registered in the NHIS in order for their children to benefit. It also registers the existence of exceptions that allowed children to benefit from the NHIS without their parents being registered. Similarly, it has information on the annual and renewal fees for non-exempt adults and on the waiting periods for both adults and children when registering. This survey also collected information on the barriers affecting children's access to health care in 2008 as well as on challenges that the DMHIS faced in 2008 and that could have affected participation in the scheme.

In addition, this census collected district-level information on health services delivery in the community during 2008 (presence of health facilities and qualified health personnel, as well as

distance and travelling time to health facilities and providers). It is important to control for these community-level variables, since, despite the availability of a health insurance program, families might not decide to join the scheme if they perceive the services they could access through this system as deficient. This may be the case when health facilities are too far to access or are of poor quality due to the lack of qualified health personnel or medical supplies. Simultaneously, the lack of high quality medical attention would reduce the likelihood of parents' taking a child to a health center, regardless of health insurance registration status.

Finally, our analysis uses information on the number of health facilities accredited by region in 2008. These data were obtained from the National Health Insurance Authority 2009 Annual Report (Frempong et al. 2009).

This paper focuses on three main types of outcomes: (i) curative child health care utilization, (ii) quantity and quality of maternal health services received and (iii) preventive child health care utilization. The first item includes if mothers chose to deliver at a health facility, if they treat their children with antimalarial medication when they are sick with either a fever or cough and if they seek advice from a health provider when their children experience a fever or cough. The second category comprises the number of antenatal visits, if pregnant women were told about pregnancy complications during prenatal visits, and if they had urine and blood samples taken during pregnancy. Finally the last type looks at the choices made in order to prevent sickness such as vaccination rates (for yellow fever, polio 0, BCG, DPT/HepB/ Influenza 2, etc.) and if the child slept under a mosquito bed net (either an insecticide treated net or an untreated net) the previous night.

3.2 Identification Strategy

One of the main difficulties in identifying the effect of joining a health insurance scheme on medical help-seeking behavior is selection bias or omitted variable bias. Omitted variable bias is an issue because people who participate less in formal health insurance systems may do so because, for example, of wealth, which in turn could affect child health care use. In addition, geographical differences could account for serious divergences in enrollment rates as well as in health-related behaviors and child health outcomes. Hence it is important to control for as many confounding factors as possible. To address this concern we include a range of covariates as controls: child ($X_t{}^c$), parent (X_t^M), household (X_t^H) and community characteristics (X_t^R). These covariates include child's gender and age, if the child was a twin, mother's age and educational attainment, mother's time constraints for childcare characterized by the number of children born in the last 5 years, the number of living children older than 5, whether the mother is currently pregnant, and whether the mother is currently working. Similarly, we control for the sex of the household head, the household's wealth level[5], the place of residence[6], community characteristics such as the number of facilities per 100,000 people in each region, the population level in each region (in millions), and a dummy representing whether the household belongs to one of the three poorest regions in Ghana (Northern, Upper East and Upper West).

Nonetheless, time-variant and invariant characteristics that are not observed, and that cannot directly be controlled for, remain a concern. The decision to join a health insurance scheme is

[5] Household wealth was chosen for this study instead of individual income because income data is not available in the DHS survey. The survey has a wealth indicator based on a series of household characteristics (flooring, walls and ceiling materials, ownership of goods, toilet facilities, and type of cooking fuel, and such).
[6] The categories include 1) capital or large city, 2) small city, 3) town and 4) countryside.

determined by unobserved factors that could simultaneously impact the health care utilization level chosen for the child. For example, the household level of risk aversion could induce parents to choose to enroll in a health insurance plan and also affect their ability to care for their child. Moreover, a household could decide to spend more or less in health inputs (such as health insurance) according to the health capital of their children. Parents with healthier children could participate less (self-select out) or more (favorable selection) in health insurance schemes. Conversely, parents with frailer children could decide to enroll more frequently (adverse selection). This incentive creates reverse causality. This endogeneity problem should be addressed.

We use an instrumental variable approach to identify the causal impact of enrollment in the NHIS on maternal and child health related behaviors. The exogenous variation in the decision to join the National Health Insurance system comes from variations in the membership rules in the District Mutual Health Insurance Schemes. We would expect parental participation to be higher in districts where membership rules are less stringent or more straightforward. The membership rules chosen as instrumental variables were all in force in 2008. These include: 1) the existence of an exception that allowed children born out of wedlock to benefit from the NHIS without their parents paying to be registered; 2) the renewal fees for non-exempt adults; 3) the renewal fees for children; and 4) the existence of non-standard verification methods (these are verification methods other than asking to see the parent's membership card or looking up their information in the system to ensure the parents were registered in the NHIS in order for their children to benefit).

3.3 Testing the instruments' exogeneity

At the beginning of the national health insurance scheme operation, given the decentralized approach adopted, districts had complete freedom to establish their membership rules. These rules were idiosyncratic to each district since they did not follow any official pattern or mandate. Yet, it could still be argued that under certain circumstances the instruments chosen could not be exogenous. If government officials in the different DMHIS chose to establish their membership rules to make them less stringent in districts that had lower child health care utilization rates or lower maternal health care quantity and quality before the creation of these offices, then the exogeneity assumption will not hold. In theory, government officials could have established more relaxed membership rules in districts with worse social indicators (such as higher poverty rates, malaria rates or fertility rates) or worse health care behaviors (such as lower rates of delivery at health facilities, and of seeking professional medical treatment when the child is sick). This is less likely, for preventive health care indicators. Vaccinations were provided for free before the creation of the NHIS, so, *a priori*, officials probably did not assume that vaccination rates would be modified by the introduction of the insurance scheme. Similarly, the cost of mosquito bed nets is not covered by the NHIS so, *a priori*, there should not have been any incentive by government officials to manipulate DMHIS rules to benefit district with lower adoption rates.

To test these various hypotheses we use the 2003 DHS data as well as the membership rules for 2008. The best health indicators available in Ghana at the time the NHIS was created and before the district rules were actually established are the ones in the DHS 2003. First we run separate regressions for each instrument chosen on each of the outcomes examined in the paper. In an

initial estimation the only control we use is a dummy that is equal to one if the household belongs to one of the three poorest regions in Ghana. We cluster the standard errors at the district level. We find that almost none of the 2003 curative child health practices, maternal health practices or preventive health practices have statistically significant impacts on any membership rules. There are only three exceptions: the probability of getting a urine sample taken during pregnancy, the BCG vaccination rate and the probability that a child slept under a mosquito net the night before. Getting a urine sample taken during pregnancy has a statistically significant (only at the 10% level), yet very small impact on the level of the renewal fee for adults. The probability of having a urine sample taken during pregnancy would have had to change from zero to one in a district for the renewal fee for adults to increase by 10 percent. Similarly, the BCG vaccination rate would have had to change from zero to one in a district for the probability of the existence of the exception for children born out of wedlock to increase 6.4 percent (with a statistical significant at the 10% level). This last coefficient is not only quite small but also has the opposite sign from the one expected (it is positive). Finally the likelihood that a child sleeps under a mosquito net has a statistically significant effect on the renewal fees for both children and adults. Yet again the magnitudes of the coefficients are small. The probability of sleeping under a mosquito net would have had to change from zero to one in a district for the renewal fee for adults to increase by 11 percent and for the renewal fees for children to increase by 16 percent. To further test these hypotheses, we run regressions of each instrument chosen on each of the outcome's variables plus all the controls used in the main estimations[7]. The results were very similar to the ones obtained using only one control[8].

[7]The only controls not included were the number of facilities per 100,000 people in each region and the population

Second, using data at the district level, we run separate regressions for each instrument chosen on i) the incidence of children under 5 suffering from a fever (a proxy for malaria for children younger than five years of age), ii) fertility rates in the district and iii) wealth levels. We only control for belonging to one of the three poorest regions in Ghana. Again there was no impact of these indicators on the membership rules chosen. These results reassure us that the instruments chosen are indeed exogenous.

3.4 Addressing statistical issues

It should be mentioned that when dealing with dichotomous variables in both the first and the second stages of the IV estimation, the standard estimation techniques (2SLS) could not be appropriate. Extending ordinary least squares to a linear probability model produces inefficient estimates with heteroscedastic standard errors. Furthermore functional form problems are created since linear and additive specifications are imposed on non-linear relationships (Timpone 2001).Yet, moving from linear probability models to maximum likelihood estimators in order to address endogeneity issues can result in further complexity and no much gain for the researcher. Following the maximum likelihood approach, the reduce form equation in the first stage is estimated using a Probit model and the untransformed predicted z-value form this stage replaces the endogenous explanatory variable in the second stage (Timpone 2001). The

level in each region (in millions) since they were not available for 2003.

[8] Again, we found that BCG vaccination rates had a statistically significant impact on the existence of an exception, but as before, the significance level was low, the sign of the coefficient was the opposite from the one expected, and the size of the coefficient was very small (0.067). By adding these controls, the zero vaccination rate for polio also became marginally significant in the regression for the level of the renewal fee for adults. Yet again, the coefficient had the "wrong" sign (negative) and it was very small. The zero vaccination rate for polio would have had to increase from zero to one in a district for the renewal fees for adults to decrease by 9.6 percent. Finally the probability of sleeping under a mosquito net is statistically significant only for the renewal fees for children and the coefficient is even smaller than before.

second stage is also estimated using a Probit model since the dependent variables is likewise dichotomous. Using this two stage approach consistent estimates will be obtained for the second stage, however the parameters will require re-scaling transformations for substantive interpretation. More importantly, the standard errors will be incorrect and correcting them is in fact exceedingly challenging (Timpone 2001). Given these limitations, linear probability models have been the method endorsed and implemented in the literature (Timpone 2001).

Hence we decided to use a linear probability model for both stages and correct the estimates using weighted least squares in order to address the heroscedasticity that is created.

3.5 Specification

Our first stage equation is

$$I_{ij} = \rho_0 + \rho_1 Z_{1j} + \rho_2 Z_{2j} + \rho_3 Z_{3j} + \rho_4 X_{ij}^{\ c} + \rho_5 X_{ij}^{\ M} + \rho_6 X_{ij}^{\ H} + \rho_7 X_{j}^{\ R} + \varepsilon_{ij} \qquad (1)$$

I_{ij} is a dummy indicating whether mother i is registered in the District Mutual Health Insurance Scheme in district j, while Z_{1j} to Z_{3j} are the different membership rules established by the DMHIS in district j. We also control for other community characteristics, as well as for child, mother and household characteristics.

Our second stage equation is

$$C_{ij} = \beta_0 + \beta_1 I_{ij} + \beta_2 X_{ij}^{\ c} + \beta_3 X_{ij}^{\ M} + \beta_4 X_{ij}^{\ H} + \beta_5 X_{j}^{\ R} + \mu_{ij} \qquad (2)$$

where C_{ij} is a child or maternal health care utilization choice, and (μ_{ij}) are a set of unobserved attributes related to both the mother and the child such as resilience, maternal risk aversion, initiative and determination. Robust standard errors are calculated which are then clustered at the district level to account for any variation within district. Descriptive statistics on covariates and outcomes used in the analysis can be found in **Table 1**. Panel A in **Table 1** presents the covariates for mothers (and their children) that are registered in the DMHIS in 2008 and mothers that are not. Panel B shows the outcome variables for both groups in 2008 as well as the value of these variables in 2003. From this table it is clear that people who register in the DMHIS are different from people who do not and that there have been considerable improvements in health care access since the creation of the NHIS.

4. Results and Discussion

4.1 Linear probability models for curative child health care use and maternal health care quantity and quality

We first estimate the impact of participating in the NHIS on health care practices such as delivering at a health facility (either public or private), giving the child anti-malaria medication when suffering fever or cough and seeking medical treatment when the child suffers from fever or cough. The results both for OLS and IV estimations are found in **Table 2**. The odd columns show results without instrumenting participation in the NHIS, while the even column provides second-stage estimates. For the outcome variable "delivery at a health facility" the NHIS participation is instrumented using the following membership rules: 1) the existence of an exception for children born out of wedlock, 2) the renewal fees for non-exempt adults, and 3)

the renewal fees for children. For the other estimations which have a different sample size we choose a different set of instruments. The renewal fee for children is excluded and instead the existence of a non-standard verification method is used. This is done in order to have the strongest set of instruments possible.

The dependent variable in columns 1 and 2 is the probability of not delivering children at home (that is, of delivering in any kind of health facility). In columns 3 and 4 the dependent variable is the probability of receiving treatment with any anti-malarial medication while sick with either fever or cough. Finally, for columns 5 and 6, the dependent variable is the probability of seeking advice or treatment from a health facility or provider once the child has experienced fever or cough. In simple OLS estimations, NHIS participation appears to have a positive and in most cases a statistically significant effect on the likelihood of these positive health care behaviors (the exception being taking anti-malaria medication when sick). Being registered in the NHIS increases the probability of delivering at a health facility by 19.2 percentage points, raises the probability of giving malaria medication to a sick child by 4.4 percent and increases the likelihood of seeking medical treatment for sick children by 22.5 percent, respectively.

The instrumental variable estimations also show positive and in all cases statistically significant coefficients, yet the magnitudes are larger. Participating in the NHIS increases the likelihood of delivering at a health facility by 32.2 percent, it improves the probability of receiving malaria medication by 33.4 percent and of seeking medical treatment when suffering fever or cough by 42.3 percent. These results point to the existence of a downward bias when endogeneity is not taken into account.

The second set of estimations we perform is related to the quantity and quality of health care received by pregnant women. We estimate the impact of participating in the NHIS on the number of prenatal care visits sought by women, on the likelihood of pregnant women being told about pregnancy complications during prenatal visits, and on the probability that they had urine and blood samples taken during pregnancy.

The results both for OLS and IV estimations are found in **Table 3**. As in **Table 2** the odd columns show results without instrumenting participation in the NHIS. For the outcome variables related to the number of prenatal visits, and the urine or blood samples taken during pregnancy the NHIS participation is instrumented using 1) the existence of an exception for children born out of wedlock, 2) the renewal fees for non-exempt adults, and 3) the renewal fees for children. For the outcome variable "told about pregnancy complications" we again choose a different set of instruments. The existence of an exception for children born out of wedlock is excluded and instead the existence of a non-standard verification method is chosen.

The dependent variable in columns 1 and 2 is the number of prenatal visits sought during the pregnancy, columns' 3 and 4 dependent variable is the probability of being told about pregnancy complications during prenatal visits, while columns 5 and 6 have as a dependent variable the probability of having a urine sample taken during pregnancy. Similarly, columns 7 and 8 have as a dependent variable the probability of having a blood sample taken during pregnancy.

For all the OLS estimations, NHIS participation appears to have a positive and statistically significant effect on the likelihood of receiving higher quantity and quality maternal health care services. The instrumental variable estimations similarly displays positive and in most cases

statistically significant coefficients, yet the magnitudes are much greater. The exception of statistical significance is the number of prenatal visits sought, which is not altered by being a member of the NHIS. In contrast, participating in the NHIS increases the likelihood of being told about pregnancy complications by 41.6 percent, and it improves the probability of having a urine sample taken and a blood sample taken by 33.3 percent and 34.6 percent, respectively. These estimates should be analyzed in contrast to the actual likelihood of these behaviors for people who do or do not participate in the NHIS. Seventy four percent of mothers who are members of the NHIS deliver in health facilities in contrast to 45 percent of non-members. Similarly, only 27 percent of non-members got malaria medicine for their sick children compared to 37 percent of NHIS participants. Sixty one percent of NHIS members seek medical treatment for their children, while only 33 percent of non-members do so. Moreover, 79 percent of women who are members of the NHIS were told about pregnancy complication compared to 65 percent of non-members. Finally, 85 percent of non-members had either their urine or blood taken during pregnancy in contrast to 92 and 95 percent, respectively, of NHIS participants. Membership in the NHIS is definitely changing health related behaviors that were expected to change with participation. Yet what are especially interesting are the unintended positive consequences of participating in the scheme such as higher vaccination rates at different ages.

4.2 Linear probability models for preventive child health care use

It is not immediately clear why participation in the NHIS should increase vaccination rates. Immunizations were provided free in Ghana for many years before the NHIS was created. Since 1991, the Expanded Program on Immunization (EPI) has delivered routine immunization for

free[9] through static and outreach programs, backed with mop-up vaccinations. Similarly, the purchase of mosquito bed nets is not covered under the benefits package offered by the NHIS. Yet it is possible that when other curative services become available for free due to participation in the NHIS, parents become more proactive towards other kinds of health care utilization practices. Similarly, parents who are taking their children more often to health centers when they are sick, due to their membership in the NHIS, might take advantage of other services offered in the health facilities. In particular, parents who take a child to a health facility for curative care might also take with them the child's siblings (since they probably cannot stay home alone) which might increase the probability of these other children getting vaccinated. In the same way, when parents attend health facilities they might get exposed to information about the benefits of sleeping under bed nets and they might have easier access to these.

The results for vaccination rates by type of vaccine are shown in **Table 4**. As in previous tables the odd columns show results without instrumenting participation in the NHIS. The even column provides second stage estimates. In the case of all vaccination rates, NHIS participation has been instrumented using the: 1) the existence of an exception for children born out of wedlock, 2) the renewal fees for non-exempt adults, and 3) the renewal fees for children. Not presented in this table are results for vaccines for which participation in the NHIS did not have a statistically significant impact with either an OLS model or an IV regression (for example, measles and polio 1, 2 and 3). **Table 4** also includes results for the probability that a child slept under a mosquito bed net the previous night. For this outcome variable the existence of an

[9] Currently they provide vaccines for nine preventable diseases: BCG, measles, diphtheria-Pertussis-tetanus (DPT) and polio, tetanus toxoid, yellow fever, Hepatitis B and Haemophilus influenza type b.

exception for children born out of wedlock is excluded as an instrument and instead the existence of a non-standard verification method is introduced.

In simple OLS estimations, NHIS participation has a positive and in most cases statistically significant effect on the likelihood of children benefiting from these preventive health care practices (except for yellow fever vaccination where the effect is not statistically significant). As in the previous tables the instrumental variable estimations show larger coefficients than the OLS estimations and are statistically significant in all cases. Participating in the NHIS increases the probability of receiving the Polio 0 vaccine by 38.7 percent, the likelihood of being vaccinated against tuberculosis (BCG) by 15.3 percent, the probability of getting the DTP2/HepB2/Influenza 2 vaccine by 21.4 percent and the likelihood of obtaining the yellow fever vaccine by 21.8 percent. In addition, being registered in the NHIS improves the chances of child sleeping under a mosquito bed net by 37.1 percent.

4.3 Discussion of the findings

The results found in this section are consistent with coefficients biased downwards in the initial estimations. Parents with healthier children (due to higher investments in their children's health capital) could decide to enroll less frequently in health insurance schemes (self-select out), and at the same time, they might be the kind of parent that would participate more actively in curative and preventive health care activities. Similarly, parents whose children are frailer could participate more of health insurance schemes since they could get higher returns from being active participants, but they are probably too the kind of parents that do not invest enough in goods to improve their children's health capital (adverse selection). If these biases are not

accounted for the impact of participating in a health insurance scheme would be greatly underestimated.

The IV estimates are substantially larger than the OLS estimates due, in principle, to the existence of adverse selection which means there is underlying heterogeneity in returns to NHIS participation. Furthermore, the IV estimates calculate local average treatment effects (LATE) in contrast to the OLS estimates which provide average treatment effects (ATE). LATE can be differ drastically from ATE since according to Angrist (2006), the IV estimates capture the causal impact of treatment on the treated without being confounded by non-compliance or selection bias. The membership regulations instruments provide no information about the effects of NHIS participation on children whose parents' decision to join the NHIS was unaffected by membership rules variances. These are likely parents that to begin with had positive health behaviors[10]. On the other hand, a subgroup of parents did decide to participate in the NHIS merely because the membership rules in their district were less stringent, but would not have participated otherwise. These are probably parents that are not so keen on health practices. The IV estimation measures the impact of participating in the NHIS on the health care utilization rates of these "compliers". ATE is a weighted average of the effect on both the always-takers and the compliers, while LATE only provides information about the compliers (Angrist 2006, Angrist and Pischke 2009). If these compliers have much higher returns to participating in the NHIS then our IV estimates might be larger than the average marginal return to NHIS membership. Changes in membership rules are more likely to affect the insurance participation choices of people who would otherwise have much lower probabilities of becoming members. If

[10] The same arguments can be made for pregnant women who seek higher quality of maternal health services.

the main reason that these parents have low participation rates is because of higher-than-average cost of membership rather than because of lower-than-average returns to participation, then the "local average treatment effect" will be above the average marginal return to NHIS participation in the population as a whole.

Table A3 in the Appendix provides information to support this hypothesis. We analyze compliers characteristics for the samples of three outcome variables that have particularly large IV coefficients in comparison to their OLS counterparts (taking anti-malarial medication, having a urine sample taken, and getting vaccinated against yellow fever). The sample sizes are 820, 1670 and 2765 observations, respectively. Column 1 shows the mean for the population of the characteristic at the left. The ratios in column 2 to column 5 give the relative likelihood that compliers have the characteristics indicated at left for each instrumental variable used.

Compliers are much more likely to have children born out of wedlock and who are frailer at birth[11]. Parents of children born out of wedlock probably have a higher cost of becoming members of the NHIS since they only have one income to cover the costs of raising a child. Hence, reductions to membership costs and easier access would motivate these parents much more than the average parent to enroll and take advantage of the health services provided by the system. Similarly, a frailer baby would benefit much more from both preventive and curative care if his/her parents have access to health insurance, which means they would be much more active users of these services.

[11] We define a child as being frail at birth if he/she had a low birth weight (weighed less than 2500 grams) or if she/he was described as smaller than average or very small at birth.

In addition, compliers have a higher likelihood of living in a district with lower levels of education and a higher reliance on traditional medicine. Hence they would probably be less eager consumers of professional health services unless prompted by easier access to insurance services. When services become "free" after enrolling in the NHIS they might be more prone than the average parent to try these services to test their effectiveness.

Finally, compliers are more likely to live in districts with poor road networks. With access to health insurance parents can afford more expensive health facilities closer to home and do not need to travel to look for cheaper options. Hence parents who live in areas with particularly bad transportation networks might value access to health insurance much more than the average parent and use health services more frequently.

4.4 Assessing the instrument's strength and validity

According to the first stage regressions parameters (see **Table 5**) our instruments are relevant for all specifications. They are significant at a 1% level and display a non-immaterial effect on the probability of being covered by the NHIS. The existence of an exception that allowed children born out of wedlock to benefit from the NHIS increases the probability of parents being registered; in contrast, higher renewal fees for either children or adults decrease the likelihood of being covered. Finally, the existence of alternative verification methods which could make the enrollment process more cumbersome decrease the probability of registration. Examples of other verification methods include parents having to be present to register their children, and parents being asked to show their receipt.

Moreover, we assess the strength of the instrument using the first-stage F statistic. If the instruments are weak, the standard IV point estimates would be unreliable as well as the ensuing hypothesis tests[12]. The null hypothesis is that the instrument is weak. For all the estimations, the F statistic (at a 5% significance level) of the set of instruments chosen ensured that the maximal bias of the IV estimator relative to OLS was no bigger than 5%. This fits the definition of a strong instrument according to Stock et al. (2002)[13].

Finally, it could be argued that the results are biased by the existence of district characteristics that determine both membership rules and health care seeking behaviors. Higher barriers to health care access in a district as well as greater challenges to participate in a DMHIS could also imply lower health care utilization rates. To discard such a hypothesis we test that the results obtained are not affected after introducing both, barriers affecting children's access to health care in 2008, as well as challenges to participation in the DMHIS. The results are shown in **Table 6**. The four covariates chosen as additional controls are: (i) the lack of health care facilities and providers of high quality in the district; (ii) the existence of a poor road network in the district; (iii) the high prevalence of divorce or single parenthood in the district; and (iv) the low levels of education in the district as well as the preference for traditional medicine or self-medication. The new estimations include all previous controls. Of the district characteristics added the only

[12] A set of instruments is defined as being weak if the concentration parameter is small enough that inferences based on conventional normal approximating distributions are misleading. The concentration parameter is a unit-less measure of the strength of the instruments (Stock et al. 2002). One measure of whether a set of instruments is strong is whether the concentration parameter is sufficiently large.

[13] In addition, as a partial test of the exogeneity of the instruments, we use the Hansen's J test. The joint null hypothesis is that the instruments are valid instruments, that is, that they are uncorrelated with the error term, and that the excluded instruments are correctly excluded from the estimated equation. The over-identification test is easily accepted in all cases with one exception. For the outcome variable defined as the probability of receiving treatment with any anti-malarial medication while sick, the Hansen J-statistic χ^2 P-value is just under 10%. These results are available upon request.

ones that were statistically significant in the first stage were the dummy indicating a low quantity or quality of health care in the district (for the following 2nd stage variables: polio 0, BCG, DPT/H/I 2, yellow fever vaccine and mosquito net) and the dummy indicating a district with low education levels and reliance on traditional medicine (for the following 2nd stage variables: antimalarial medication, seek medical treatment, BCG, DPT/H/I 2, yellow fever vaccine and mosquito net). Yet, none of these variables were statistically significant in the 2nd stage for the outcome variables mentioned. Moreover the coefficients have not change dramatically in either statistical significance or magnitude after introducing these controls. The largest variation in the size of a coefficient was experienced by the impact of participating in the NHIS on the probability of seeking medical treatment. The coefficient increased by 17%. Yet most of the coefficients (over 60%) vary by 10 percent or less. Finally only one coefficient stopped being statistically significant (the one for the Polio 0 vaccine) while two other coefficients became more statistically significant (the ones for DPT/H/I 2 and the yellow fever vaccine). These results confirm that the IV coefficients are not biased.

5. Conclusion

The main objective of this research paper is to look at the impact of parental participation in the National Health Insurance Scheme (NHIS) on both curative and preventive health care utilization in Ghana. This is the first attempt to look into these particular outcomes. This study overcomes the difficulties in identifying the effect of joining a health insurance scheme on child and maternal health care utilization by using an instrumental variable approach. The exogenous variation in the decision to join the National Health Insurance system comes from variations in

the membership rules in the District Mutual Health Insurance Schemes. We test the exogeneity of the instruments by providing evidence to show government officials in the different DMHIS did not choose to establish their membership rules to make them less stringent in districts that had: lower child health care utilization rates or maternal health care quality or higher poverty, malaria or fertility rates.

Using this identification strategy, we find that participation in the NHIS increases the probability of seeking both curative and preventive health care. The instrumental variable estimations show positive and statistically significant coefficients which are much bigger than the ones obtained using OLS regressions. The only exception is the number of prenatal care visits sought which appears not to be altered by participating in the NHIS. This is not an unexpected result since in Ghana, even before the creation of the NHIS the average number of prenatal visits was quite high for developing country standards. The World Health Organization (WHO) (Berg 1995) recommendations in terms of frequency of prenatal care visits are four visits per pregnancy. This is below the average number of prenatal visits, even for uninsured women in Ghana, who seek prenatal care over five times during their pregnancies. It appears that participating in the NHIS improves maternal care not through increases in quantity of care but of quality of care.

The rest of the results are consistent with coefficients biased downwards in the initial estimations. If these biases are not accounted for, the impact of participating in a health insurance scheme would be greatly underestimated. We show that being registered in the DMHIS increases the probability of seeking higher quality maternal health care as well as the

likelihood that parents take their children to health facilities more often for both curative and preventive care. This last result is a particularly relevant finding since preventive care is more cost-effective than curative care.

This paper calculates local average treatment effects (LATE) in contrast to average treatment effects (ATE). Since "compliers" have much higher returns to participating in the NHIS, IV estimates are much larger than the average marginal return to NHIS membership. This is not a shortcoming of this paper, because, for policy evaluation purposes, it might be more relevant to calculate the average return to NHIS participation for the group who will be most impacted by changes in membership rules than to calculate the average marginal return for the whole population.

Future research could focus on analyzing other aspects of the quality of health care services used by members of the NHIS, especially for children. This will allow us to evaluate if the creation of the NHIS has increased not only the quantity of care utilization but also the quality of the services provided for all its beneficiaries.

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Table 1: Descriptive statistics by insurance participation

Panel A: Control variables for DHS 2008

	Not registered in the DMHIS		Registered in the DMHIS			
	N	Mean	N	Mean	Diff	P-value
Child and maternal characteristics						
Gender (male)	1681	0.49	1107	0.53	-0.04	0.04**
Child's age (in years)	1681	1.96	1107	1.85	0.11	0.05**
Child is a twin	1808	0.04	1178	0.05	-0.01	0.39
Mother's educational attainment	1808	1.29	1175	1.90	-0.60	0.00***
Currently pregnant	1681	0.08	1107	0.08	0.00	0.86
Children born in the last 5 years	1808	1.67	1178	1.57	0.11	0.00***
Living children older than 5	1808	1.75	1178	1.61	0.15	0.03**
Mother's age (in years)	1808	29.84	1178	30.44	-0.60	0.02**
Currently working	1808	0.86	1178	0.88	-0.02	0.09*
Household and community characteristics						
Household head is male	1808	0.73	1178	0.75	-0.02	0.20
Wealth Index	1808	-45869	1178	-1957	-43912	0.00***
Type of place of residence (from less to more urban)	1808	0.79	1178	1.03	-0.23	0.00***
Population in millions (region)	1808	2.20	1178	2.10	0.10	0.00***
# of facilities per 100,000 people (region)	1808	7.86	1178	7.92	-0.06	0.61
Distance from district to nearest doctor (km)	1808	4.48	1178	3.30	1.18	0.03**
Distance from district to nearest private hospital (km)	1808	21.89	1178	17.92	3.97	0.02**
Dummy for poor regions	1808	0.33	1178	0.35	-0.02	0.26

Panel B: Outcome variables for DHS 2008 compared to DHS 2003

	Not registered in the DMHIS		Registered in the DMHIS				2003	
	N	Mean	N	Mean	Diff	P-value	N	Mean
Curative child health care								
Delivery at health facility	1357	0.45	909	0.74	-0.29	0.00***	3820	0.49
Anti-malarial medication taken for fever/cough	494	0.27	326	0.37	-0.10	0.00***	732	0.66
Seek medical treatment when child has fever/cough	494	0.33	326	0.61	-0.28	0.00***	1104	0.42
Quantity and quality of maternal health care								
Number of prenatal visits	992	5.21	707	6.49	-1.28	0.00***	2663	5.24
Told about pregnancy complications	962	0.65	705	0.74	-0.08	0.00***	2552	0.59
Urine sample taken during pregnancy	965	0.85	706	0.92	-0.07	0.00***	2555	0.81
Blood sample taken during pregnancy	965	0.85	706	0.95	-0.10	0.00***	2555	0.83
Preventive child health care								
Polio 0 rate	1552	0.59	1029	0.72	-0.13	0.00***	3521	0.46
BCG rate	1672	0.90	1101	0.95	-0.05	0.00***	3504	0.86
DPT/HepB/ Influenza 2 rate	1670	0.83	1098	0.87	-0.04	0.00***	3495	0.78
Yellow fever vaccine rate	1665	0.71	1103	0.74	-0.02	0.24	3875	0.61
Child slept under mosquito net	1808	0.45	1178	0.51	-0.06	0.00***	3413	0.17

Source: DHS 2003 and 2008, P-values are reported from t-test on the equality of means for each variable. * p<.10; ** p<.05; *** p<.01

Table 2: OLS and IV Estimation-Impact of NHIS participation on child health care practices

Child health care utilization	Delivery at health facility		Anti-malarial medication taken		Seek medical treatment	
	OLS	IV	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)	(5)	(6)
NHIS Participation	0.192	0.322	0.044	0.334	0.225	0.423
	(0.023)***	(0.156)**	(0.033)	(0.158)**	(0.035)***	(0.187)**
Other Controls	YES	YES	YES	YES	YES	YES
N	2133	2133	820	820	820	820
R^2	0.303	0.288	0.063		0.125	0.092

Source: DHS 2008 and DMHIS 2008 Census.

Note: The estimations include the following controls: child's gender and age, mother's age and educational attainment, the number of children born in the last 5 years, the number of living children older than 5, whether the mother is currently pregnant and whether she is currently working, sex of the household head, the household's wealth level, the place of residence, the population level in each region (in millions), and a dummy if the household belongs to one of the three poorest regions in Ghana. Finally, following Nketiah-Amponsah (2009), we also control for the distance from the district to the nearest doctor and the nearest private hospital (in km) as well as the number of facilities per 100,000 people in each region. The first 2 estimations (delivery at a health facility) also include as a control if the child was a twin, but do not include a control for whether the mother is currently pregnant.

Instruments chosen for specification 2: the existence of an exception for children born out of wedlock; the renewal fees for non-exempt adults and the renewal fees for children. Instruments chosen for specification 4 and 6: the existence of an exception for children born out of wedlock; the existence of non-standard verification method and the renewal fees for non-exempt adults.

Robust standard errors clustered by district level in parentheses, * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 3: OLS and IV Estimation-Impact of NHIS participation on quantity and quality of maternal health care practices

Maternal health care	Number of prenatal care visits		Told about pregnancy complications		Urine sample taken during pregnancy		Blood sample taken during pregnancy	
	OLS	IV	OLS	IV	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
NHIS Participation	0.698	0.059	0.042	0.416	0.053	0.333	0.085	0.346
	(0.177)	(1.144)	(0.025)*	(0.192)**	(0.017)***	(0.121)***	(0.019)***	(0.108)***
Other Controls	YES	YES	YES	YES	YES	YES	YES	YES
N	1698	1698	1666	1666	1670	1670	1670	1670
R^2	0.183	0.175	0.078		0.213	0.052	0.165	0.014

Source: DHS 2008 and DMHIS 2008 Census.

Note: The estimations include the following controls: if the child was a twin, mother's age and educational attainment, the number of children born in the last 5 years, the number of living children older than 5, whether the mother is currently working, sex of the household head, the household's wealth level, the place of residence, the population level in each region (in millions), and a dummy if the household belongs to one of the three poorest regions in Ghana, the distance from the district to the nearest doctor and the nearest private hospital (in km) as well as the number of facilities per 100,000 people in each region.
Instruments chosen for all specifications except 3 and 4: the existence of an exception for children born out of wedlock; the renewal fees for non-exempt adults and the renewal fees for children. Instruments chosen for specifications 3 and 4: the existence of a non-standard verification method; the renewal fees for non-exempt adults and the renewal fees for children.
Robust standard errors clustered by district level in parentheses, * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 4: OLS and IV Estimation-Impact of NHIS participation on preventive child health care practices

Preventive child health care practices	Vaccination rates								Child slept under a mosquito bed net	
	Polio 0		BCG		DPT/HepB/ Influenza 2		Yellow fever vaccine			
	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
NHIS	0.064	0.387	0.027	0.153	0.024	0.214	0.015	0.218	0.063	0.371
Participation	(0.022)***	(0.214)*	(0.011)**	(0.079)*	(0.014)*	(0.115)*	(0.018)	(0.128)*	(0.025)**	(0.175)**
Other Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
N	2578	2578	2770	2770	2765	2765	2765	2765	2785	2785
R^2	0.132	0.034	0.052	0.006	0.060	0.001	0.280	0.236	0.077	

Source: DHS 2008 and DMHIS 2008 Census.

Note: The estimations include the following controls: child's gender and age, mother's age and educational attainment, the number of children born in the last 5 years, the number of living children older than 5, whether the mother is currently pregnant (with exception of the estimations for Polio 0) and whether she is currently working, sex of the household head, the household's wealth level, the place of residence, the number of facilities per 100,000 people in each region, the population level in each region (in millions), and a dummy if the household belongs to one of the three poorest regions in Ghana. Instruments chosen for all specifications except 9 and 10: the existence of an exception for children born out of wedlock; the renewal fees for non-exempt adults and the renewal fees for children. Instruments chosen for specifications 9 and 10: the existence of a non-standard verification method; the renewal fees for non-exempt adults and the renewal fees for children.
Robust standard errors clustered by district level in parentheses, * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 5: First stage estimation - Impact of membership rules on the probability of being covered by the NHIS

Dependent variable:	Covered by NHIS							
	Sample defined by the availability of the second stage variable							
	Seek medical treatment /malaria medicine	Delivery at health facility	Pregnancy complica-tions	Urine/Blood sample / # of prenatal visits	Polio 0	BCG	DPT/H/I 2/ Yellow fever	Mosquito net
Existence of an exception for children born out of wedlock	0.101 (0.037)***	0.110 (0.023)***		0.119 (0.027)***	0.117 (0.021)***	0.096 (0.020)***	0.094 (0.020)***	
Renewal fees for non-exempt adults	-0.008 (0.002)***	-0.005 (0.001)***	-0.003 (0.001)***	-0.006 (0.001)***	-0.005 (0.001)***	-0.005 (0.001)***	-0.005 (0.001)***	-0.003 (0.001)***
Renewal fees for children		-0.029 (0.008)***	-0.030 (0.009)***	-0.030 (0.009)***	-0.027 (0.007)***	-0.028 (0.007)***	-0.028 (0.007)***	-0.027 (0.007)***
Existence of non-standard verification method	-0.175 (0.047)***		-0.178 (0.032)***					-0.168 (0.025)***
Other Controls	YES	YES	YES	YES	YES	YES	YES	YES
N	820	2133	1666	1670	2578	2770	2765	2785
Partial R^2 of excluded instrument	0.053	0.023	0.031	0.026	0.023	0.020	0.020	0.029
F-test for weak identification	14.75	16.28	17.68	14.47	20.41	19.05	18.82	27.40
Hansen J statistic χ^2 P-value	0.544	0.439	0.650	0.454	0.148	0.545	0.296	0.804

Source: DHS 2008 and DMHIS 2008 Census.

Note: The estimations include all controls included in the 2nd stage estimation.

[1] The first stage figures are very similar for the estimations for DPT/HepB/ Influenza 2 and Yellow Fever, for the estimations for blood and urine sample taken during pregnancy and number or prenatal visits and for the estimations for malaria medication and seek medical treatment. In all the cases we reported the lowest F-statistic as well as the lowest Hansen J statistic χ^2 P-value.

Standard errors in parentheses, * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 6: Impact of NHIS participation on health care practices after controlling for challenges faced by DMHIS

Panel A: Dependent variables are curative child and maternal health care practices

Child and maternal health care practices	Delivery at health facility	Anti-malarial medication	Seek medical treatment	Pregnancy complications	Urine sample	Blood sample
NHIS	0.308	0.376	0.496	0.400	0.316	0.346
Participation	(0.145)**	(0.157)**	(0.189)**	(0.193)**	(0.113)***	(0.098)***
Low quality/quantity	0.023	0.063	0.094	-0.024	-0.04	-0.048
health care	(0.029)	(0.064)	(0.057)	(0.036)	(0.036)	(0.032)
Poor road network	-0.041	-0.085	-0.119	-0.046	-0.041	-0.027
	(0.035)	(0.062)	(0.058)**	(0.040)	(0.029)	(0.027)
High rate divorce	0.053	-0.027	-0.014	-0.019	-0.02	-0.023
/single parenthood	(0.034)	(0.162)	(0.225)	(0.087)	(0.031)	(0.020)
Lack of education/ preference	-0.095	0.033	-0.01	-0.014	0.006	0.052
for traditional medicine	(0.034)***	(0.047)	(0.051)	(0.040)	(0.039)	(0.030)*
Other Controls	YES	YES	YES	YES	YES	YES
N	2133	820	820	1666	1670	1670
R^2	0.296		0.071		0.077	0.022
% change in coefficient	-4%	13%	17%	-4%	-5%	0%

Panel B: Dependent variables are preventive child health care practices

Preventive child health care practices	Polio 0	BCG	DPT/H/I 2	Yellow fever vaccine	Mosquito net
NHIS	0.360	0.138	0.243	0.246	0.375
Participation	(0.223)	(0.080)*	(0.114)**	(0.120)**	(0.172)**
Low quality/quantity	0.01	-0.012	-0.028	-0.024	0.050
health care	(0.045)	(0.019)	(0.020)	(0.026)	(0.043)
Poor road network	-0.111	-0.016	-0.008	-0.006	-0.040
	(0.058)*	(0.020)	(0.021)	(0.027)	(0.050)
High rate divorce	-0.135	-0.038	0.051	0.047	0.104
/single parenthood	(0.068)*	(0.028)	(0.023)**	(0.055)	(0.150)
Lack of education/ preference	0.072	0.002	0.024	0.019	0.039
for traditional medicine	(0.046)	(0.018)	(0.024)	(0.029)	(0.048)
Other Controls	YES	YES	YES	YES	YES
N	2578	2770	2765	2765	2785
R^2	0.059	0.018		0.224	
% change in coefficient	-7%	-10%	14%	13%	1%

Source: DHS 2008 and DMHIS 2008 Census.

Note: The estimation for number of prenatal visits was not included since the coefficient continues to be not statistically significant.
The estimations include all previous controls. Of the new district characteristics added the only ones that were statistically significant in the first stage were the dummy indicating a low quantity or quality of health care in the district (for the following 2nd stage variables: polio 0, BCG, DPT/H/I 2, yellow fever vaccine and mosquito net) and the dummy indicating a district with low education levels and reliance on traditional medicine (for the following 2nd stage variables: antimalarial medication, seek medical treatment, BCG, DPT/H/I 2, yellow fever vaccine and mosquito net).
Robust standard errors clustered by district level in parentheses, * significant at 10%; ** significant at 5%; *** significant at 1%.

Appendix

A.1. Benefits of Health Insurance

Beneficiaries are given cards which can be used to seek treatment in any hospital in the country. Bills are sent to the scheme provider for payment. Furthermore, portability allows an NHIS member to access services outside his or her district.

The following minimum services are provided:

1. Outpatient services: general and specialist consultations reviews, general and specialist diagnostic testing including laboratory, X-rays, ultrasound scanning, medicines on the NHIS medicine list, surgical operations such as hernia repair and physiotherapy.

2. In-patient services: general and specialist in-patient care, diagnostic tests, medication that are prescribed on the NHIS medicines list, blood and blood products, surgical operations, in-patient physiotherapy, accommodation in the general ward and feeding.

3. Oral health: pain relief (tooth extraction, temporary incision and drainage), dental restoration (simple amalgam, filling, temporary dressing).

4. Maternal care: antenatal, deliveries, caesarian section, post-natal care.

5. Emergencies: these refer to crises in health situations that demand urgent attention such as medical emergencies, surgical emergencies, pediatric emergencies, obstetric and gynecological emergencies and road traffic accidents.

The following services are excluded:

1. Appliance and prostheses, including optical aids, heart aids, orthopedic aids, dentures, etc.

2. Cosmetic surgeries and aesthetic treatment.

3. Anti-retroviral drugs for HIV.
4. Assisted reproduction and gynecological hormone replacement therapy.
5. Echocardiography.
6. Photography.
7. Angiography.
8. Dialysis for chronic renal failure.
9. Organ transplants.
10. All drugs not listed on the NHIS list.
11. Heart and brain surgery other than those resulting from accidents.
12. Cancer treatment other than breast and cervical.
13. Mortuary services.
14. Diagnosis and treatment abroad.
15. Medical examinations for purposes other than treatment in accredited health facilities (for example, visa applications, education, institutional, driving license, etc.)
16. VIP ward (accommodation).

Appendix Tables

Table A1: District Mutual Health Insurance Schemes and facilities accredited by region in 2008

Region	No. schemes	No. of Facilities Accredited	No. of Facilities per 100,000
Ashanti	24	534	13.7
Brong Ahafo	19	71	3.6
Central	13	98	5.7
Eastern	17	158	7.0
Greater Accra	10	266	8.5
Northern	18	81	4.1
Upper East	6	53	5.3
Upper West	8	69	11.3
Volta	15	138	7.9
Western	15	204	9.8
Total	**145**	**1672**	**8.2**

Source: National Health Insurance Authority 2009 Annual Report (Frempong et al. 2009)

Table A2: NHIS membership by region in 2008

Region	% Insured (with valid card)	% Registered (no valid card)	% Not registered
Ashanti	45.2	11.9	42.9
Brong Ahafo	49.0	10.5	40.5
Central	38.9	6.3	54.8
Eastern	53.5	3.8	42.8
Greater Accra	40.0	3.3	56.7
Northern	39.6	16.2	44.2
Upper East	54.7	1.3	44.0
Upper West	60.7	7.8	31.5
Volta	58.5	2.7	38.8
Western	58.3	3.6	38.1
Total	**47.9**	**7.7**	**44.5**

Source: 2008 Citizens' Assessment of the National Health Insurance Scheme.

Table A3: Complier characteristics ratios for different subsamples and for each instrument

Outcome Variable	Variable (x1i)	$P[x_{1i}=1]$	$P[x_{1i}=1 \mid C_{1i} > C_{0i}] / P[x_{1i}=1]$			
			Exception for children born out of wedlock	Renewal fees for non-exempt adults	Renewal fees for children	Non-standard verification method
		(1)	(2)	(3)	(4)	(5)
Anti-malarial medication	Child born out of wedlock	0.26				1.41
	Child considered frail at birth	0.18		1.70		1.60
	District with low education levels and reliance on traditional medicine	0.17		1.15		
	Poor road network	0.24	-1.59			2.05
Urine sample	Child born out of wedlock	0.27			1.91	
	Child considered frail at birth	0.18	1.04			
	District with low education levels and reliance on traditional medicine	0.17		1.27	1.84	
	Poor road network	0.24		1.56		
Yellow Fever vaccine	Child born out of wedlock	0.24			1.77	
	Child considered frail at birth	0.18			1.25	
	District with low education levels and reliance on traditional medicine	0.18		1.21		
	Poor road network	0.24		1.71		

Source: DHS 2008 and DMHIS 2008 Census.

Note: The estimations include all previous controls. Only the ratios for statistically significant coefficients are presented.