The Effect of NHIS Parental Enrollment on Vaccine Utilization: Evidence from Ghana

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Abstract

Access to and utilization of health services continues to be concerns in poor countries such as Ghana. Particularly susceptible are young children, for whom negative health shocks can generate nutritional deficits and cognitive disabilities. If implemented correctly, health insurance systems may help solve this challenge. However it has been difficult to determine whether joining a health insurance scheme improves medical care-seeking behaviors because of selection bias and omitted variable bias. This paper examines how parental participation in the National Health Insurance Scheme (NHIS) affects vaccine utilization in Ghana, using an instrumental variable approach to estimate whether enrollment affects vaccine uptake. The exogenous variation in enrollment comes from variations in the membership rules in the District Mutual Health Insurance Schemes (DMHIS). The main data sets employed are the 2008 Ghana Demographic and Health Survey and a census of DMHIS in existence in 2008. The paper finds participation in the NHIS increases the probability of getting vaccinated. The instrumental variable estimations show positive and statistically significant coefficients. These estimates are bigger than the ones obtained using OLS regressions possibly indicating underlying heterogeneity in returns to NHIS participation. Finally, the paper explores channels through which NHIS enrollment increases vaccination rates.

Keywords: Health insurance, child health, heterogeneous treatment effects, Ghana.

JEL classification: D13; I13; J13

1. Introduction

Access to and utilization of health services continues to be 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, line 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 vaccines utilization in Ghana.

The only prior study to examine the impact of NHIS is Mensah et al. 2009 (also published as Mensah et al. 2010). They 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. To our knowledge, no study to date has analyzed the impact of the Ghanaian National Health Insurance Scheme on child vaccination.

According to the 2008 Citizens' Assessment of the National Health Insurance Scheme, membership in the NHIS has increased from 1,797,140 people in 2005 to 12,518,560 people in 2008. This number represents 61.3 percent of the 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 vaccinations 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).

However, selection bias and omitted variable bias have posed serious difficulties in identifying the effect of joining a health insurance scheme on child health care use. 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. To overcome this problem and estimate the causal impact of enrollment in the NHIS on vaccination use, 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.

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 is used to construct the instrumental variables chosen in this study.

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 and robustness checks. Section 5 concludes de 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

[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)

(SSNIT) Scheme, and, in addition, under 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-Wide (Public) 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 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.

[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).
[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.

District Mutual Health Insurance Schemes are distributed across the different regions in Ghana and have accredited 1,672 health facilities across the whole country as (see **Table 1)**. 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 2**).

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 population 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 Act which established the NHIS created autonomous District Mutual Health Insurance Schemes across the country. 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.

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 use 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 also 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. 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.

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 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 will focus on child health care utilization as the outcome of interest. Specifically we look at the choices made in order to prevent sickness such as vaccination (for yellow fever, polio, BCG, Measles, DTP3, HepB3, etc.)

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, 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 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

[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.

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 child health related behaviors and outcomes. 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; and 3) the renewal fees for children.

3.3 Specification

Our first stage equation is

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

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

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

where C_{ij} is a child 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. The standard errors are clustered at the district level to account for any variation within district. Descriptive statistics on covariates used in the analysis and outcomes analyzed can be found in **Table 3**. From this table it is clear that people who register in the DMHIS are different from people who do not.

4. Results and Discussion

4.1 Linear probability models for vaccination rates

The results for vaccination rates by type of vaccine are shown in **Table 4**. The odd columns show results without instrumenting participation in the NHIS. The even column provides second stage estimates where NHIS participation has been 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. 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, yellow fever, polio 1, DTP1/HepB1/influenza 1 and measles).

In simple OLS estimations, NHIS participation appears to have a positive and in most cases statistically significant effect on the likelihood of being vaccinated (except for DTP1/HepB1/Influenza 3 and Polio 2 where the effect is not statistically significant). Being registered in the NHIS increased the probability of receiving the BCG vaccine by 2.7 percentage points and the probability of receiving the DTP1/HepB1/Influenza 2 and 3 by 2.4 percent and 2.2 percent respectively. Similarly, participation in the NHIS increases the likelihood of getting the Polio 0 and Polio 2 vaccines by 6.2 percent and 0.6 percent, respectively.

The instrumental variable estimations also show positive and in all cases statistically significant coefficients, yet the magnitudes are much bigger. Participating in the NHIS increases the probability of being vaccinated against tuberculosis (BCG) by 16.8 percent, while it improves the probability of getting the DTP1/HepB1/Influenza 2 vaccine by 22.7 percent and the DTP1/HepB1/Influenza 3 vaccine by 26.1 percent. In addition, being registered in the NHIs increases the probability of receiving the Polio 0 and Polio 2 vaccines by 36.6 percent and 21.6 percent.

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 self-select out of health insurance schemes, but at the same time, the might be the kind of parent that would participate more actively in preventive health care activities, such as vaccinations campaigns. Similarly, parents whose children are frailer due to the parents' lack of investment in goods to improve their health capital (such as vaccinations) could decide to enroll

more frequently in the health insurance scheme to provide their children with more curative care (adverse selection). If these biases are not accounted for the impact of participating in a health insurance scheme would be greatly underestimated.

The existence of self-selection and adverse selection means there is underlying heterogeneity in returns to NHIS participation. The IV estimates are so much bigger than the OLS estimates because what the IV estimates calculate are local average treatment effects (LATE) in contrast to average treatment effects (ATE). The membership regulations instruments provide no information about the effects of NHIS participation on children whose parents' decision to join NHIS was unaffected by membership rules variances. 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. The IV estimation measures the impact of participating in the NHIS on the vaccination rate of the children of these "compliers". If these "compliers" have much higher returns to participating in the NHIS then our IV estimates might be upward-biases of 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 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. This is probably the case for parents with frailer children who will definitely be more active users of both preventive and curative care if they have access to health insurance.

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 impacted by changes in membership rules than to calculate the average marginal return for the whole population.

4.2 Channels through which NHIS participation increase vaccination rates

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[7] through static and outreach programs, backed with mop-up vaccinations. 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 find it easier to receive the required vaccinations. To test these hypotheses, we first estimate the impact of participating in the NHIS on other health care practices such as delivering at a health facility (either public or private), and giving the child anti-malaria medication when suffering fever or cough. Second, we evaluate the impact of NHIS membership on the probability of seeking medical treatment when the child suffers from fever or cough. The results both for OLS and IV estimations are found in **Table 5**[8].

[7] 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.

[8] For estimations with a smaller sample size we chose a different set of instruments. The renewal fee for children was excluded and instead the existence of a verification method (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) was used. This was done in order to have the strongest set of instruments possible.

As in **Table 4** the odd columns show results without instrumenting participation in the NHIS, while the even column provides second-stage estimates. 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. Again, the instrumental variable estimations show much bigger coefficients than the OLS estimations and are statistically significant in all cases. These results reinforce the hypothesis of the existence of a downward bias when endogeneity is not taken into account. Participating in the NHIS increases the likelihood of delivering at a health facility by 38.3 percent, it improves the probability of receiving malaria medication by 36.1 percent and of seeking medical treatment when suffering fever or cough by 52.4 percent. 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 one percent of mothers who are members of the NHIS deliver in health facilities in contrast to 44 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. Finally, 61 percent of NHIS members seek medical treatment for their children, while only 33 percent of members do so. Membership in the NHIS is definitely changing health related behaviors that were expected to change with participation. Especially interesting are the unintended positive consequences of participating in the scheme such as higher vaccination rates at different ages.

4.3 Assessing the instrument's strength and validity

According to the first stage regressions parameters (see **Table 6**) 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[9]. 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).

In addition, in order to ensure that the instruments are not correlated with the error term, 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

[9] 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.

correctly excluded from the estimated equation. The over-identification test is accepted in all cases.

Despite the fact that the instruments pass the over identification test, it could still be argued that they are not exogenous. If government officials in the different DMHIS chose to establish their membership rules to make them less stringent in districts that had lower vaccination rates before the creation of these offices, then the exogeneity assumption will not hold. This is highly unlikely, since 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. Yet others could claim that vaccination rates could be positively correlated with other health care behaviors that could indeed have been hypothesized to change after the introduction of the NHIS: for example, child delivery at health facilities, and seeking professional medical treatment when the child is sick. In theory, government officials could have established more relaxed membership rules in districts with worse indicators for these kinds of health behaviors. 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. To test these various hypotheses we use the 2003 data set and the membership rules for 2008. We run separate regressions for each instrument chosen on each of the vaccination rates examined in the paper as well as on the probability of not delivering at home and on the probability of seeking advice or treatment from a health facility or provider once the child has experienced fever or cough. 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 none of the 2003 vaccination rates or the

2003 health behaviors has statistically significant impacts on any membership rules. There is one single exception: the BCG vaccination rate has a statistically significant impact (only at the 10% level) on the probability of the existence of an exception for children born out of wedlock. Yet the coefficient has the opposite sign from the one expected (it is positive) and it is quite small. 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 to increase 6.4 percent[10]. 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[11]. The results were very similar to the ones obtained using only one control[12]. These results reassure us that the instruments chosen are indeed exogenous.

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 vaccine utilization in Ghana. This is the first attempt to look into this particular outcome. This study overcomes the difficulties in identifying the effect of joining a health insurance scheme on child health care utilization by using an instrumental variables approach. The exogenous variation in the decision to join the National

[10] This increase amounts to less than 15 percent of one standard deviation of the membership rule.
[11] The only controls not included were the number of facilities per 100,000 people in each region and the population level in each region (in millions) since they were not available for 2003.
[12] 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.

Health Insurance system comes from variations in the membership rules in the District Mutual Health Insurance Schemes. Using this identification strategy, we found that participation in the NHIS increases the probability of getting vaccinated. The instrumental variable estimations show positive and statistically significant coefficients which are much bigger than the ones obtained using OLS regressions. 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 parents taking their children to health facilities more often for curative care. Once they are in the health facility, it is much easier for them to take advantage of preventive care such as vaccination campaigns. This is a particularly relevant finding since preventive care is more cost-effective than curative care.

Future research could focus on analyzing the quality of health care services used by members of the NHIS. 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.

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Tables

Table 1: 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 2: 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 3: Descriptive statistics by insurance participation

	Not registered in the DMHIS		Registered in the DMHIS			
	N	Mean	N	Mean	Diff	P-value
Child characteristics						
Gender (male)	1681	0.49	1107	0.53	-0.04	0.04**
Age (in years)	1681	1.96	1107	1.85	0.11	0.05**
Maternal characteristics						
Mother's educational attainment	1681	1.31	1107	1.92	-0.61	0.00***
Currently pregnant	1681	0.08	1107	0.08	-0.00	0.86
Children born in the last 5 years	1681	1.64	1107	1.55	0.09	0.00***
Living children older than 5	1681	1.78	1107	1.63	0.14	0.04**
Age (in years)	1681	29.71	1107	30.41	-0.67	0.01**
Currently working	1681	0.86	1107	0.89	-0.02	0.09*
Household characteristics						
Household head is male	1681	0.73	1107	0.76	-0.02	0.17
Wealth Index	1681	-45131	1107	-2407	-42724	0.00***
Community characteristics						
Type of place of residence (from less to more urban)	1681	0.80	1107	1.03	0.23	0.00***
Population in millions (region)	1681	2.20	1107	2.12	0.08	0.02**
# of facilities per 100,000 people (region)	1681	7.88	1107	7.90	-0.01	0.91
Dummy for poor regions	1681	0.32	1107	0.34	-0.02	0.27
Vaccination rates						
BCG	1672	0.90	1101	0.95	-0.05	0.00***
DPT/HepB/ Influenza 2	1670	0.83	1098	0.87	-0.04	0.00***
DPT/HepB/ Influenza 3	1670	0.74	1098	0.78	-0.05	0.01***
Polio 0	1678	0.58	1105	0.71	-0.13	0.00***
Polio 2	1676	0.83	1104	0.85	-0.022	0.11

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

Table 4: OLS and IV Estimation-Impact of NHIS participation on vaccination rates

Vaccination	BCG		DPT/HepB/ Influenza 2		DPT/HepB/ Influenza 3		Polio 0		Polio 2	
	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(7)	(8)
NHIS	0.027	0.168	0.024	0.227	0.022	0.261	0.062	0.366	0.006	0.216
Participation	(0.011)**	(0.076)**	(0.014)*	(0.111)**	(0.021)	(0.141)*	(0.022)***	(0.215)*	(0.016)	(0.119)*
Other Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
N	2770	2770	2765	2765	2765	2765	2780	2780	2777	2777
R^2	0.052		0.060		0.061		0.136	0.052	0.054	

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 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: the existence of an exception for children born out of wedlock; 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: OLS and IV Estimation-Impact of NHIS participation on other child health care utilization choices

Vaccination	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	0.175	0.383	0.044	0.361	0.224	0.524
	(0.022)***	(0.140)***	(0.033)	(0.137)***	(0.035)***	(0.170)***
Other Controls	YES	YES	YES	YES	YES	YES
N	2779	2779	820	820	820	820
R^2	0.298	0.261	0.065		0.125	0.048

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.

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

Dependent variable:	Second stage variable					
Covered by NHIS	DPT/HepB/ Influenza	BCG	Polio 0	Polio 2	Delivery at health facility	Seek medical treatment
Existence of an exception for children born out of wedlock	0.119 (0.022)***	0.121 (0.022)***	0.123 (0.022)***	0.123 (0.022)***	0.120 (0.022)***	0.181 (0.041)***
Renewal fees for non-exempt adults	-0.005 (0.001)***	-0.005 (0.001)***	-0.005 (0.001)***	-0.005 (0.001)***	-0.005 (0.001)***	-0.006 (0.002)***
Renewal fees for children	-0.033 (0.007)***	-0.033 (0.007)***	-0.033 (0.007)***	-0.034 (0.007)***	-0.036 (0.007)***	
Existence of non-standard verification method						-0.192 (0.048)***
Other Controls	YES	YES	YES	YES	YES	YES
N	2765	2770	2780	2777	2779	820
Partial R^2 of excluded instrument	0.024	0.024	0.024	0.024	0.025	0.063
F-test for weak identification	22.03	22.29	22.86	22.94	23.25	18.01
Hansen J statistic χ^2 P-value	0.287[1]	0.814	0.136	0.976	0.339	0.374

Source: DHS 2008 and DMHIS 2008 Census.

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

[1] Every figure is identical between the estimation for DPT/HepB/ Influenza 2 and 3 with exception of the Hansen J statistic. We report the lowest value of both.

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).