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The Effect of Insurance Enrollment on Maternal and Child Healthcare Use

The Case of Ghana

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INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

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ABSTRACT

Access to and use of health services are concerns in poor countries. If implemented correctly, health insurance may help solve these concerns. Due to selection and omitted variable bias, however, it is difficult to determine whether joining an insurance scheme improves medical care-seeking behaviors. This paper uses representative data for the whole country of Ghana and an instrumental variable approach to estimate the causal impact on healthcare use of participating in Ghana's National Health Insurance Scheme. Idiosyncratic variations in membership rules at the district level provide exogenous variation in enrollment. The instrument is the existence of nonstandard verification methods to allow enrollment of children. Using the 2008 Ghana Demographic and Health Survey and a census of all district insurance offices, this paper finds that insurance membership increases the probability of (1) seeking higher-quality (but no greater quantity of) maternal services and (2) parents' becoming more active users of child curative care. Instrumental variable estimates are larger than ordinary least squares ones, indicating that "compliers" have much higher returns to being insured than the average participant. Results are robust to several validity checks; this paper shows that the instrument is indeed idiosyncratic and proves that government officials did not establish less-cumbersome membership rules in districts with worse initial indicators.

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

JEL classification: D1; I1; O1

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1. INTRODUCTION

Access to and use of health services continue to pose problems for developing countries and are a serious concern because major illness is one of the most substantial and unpredictable shocks to economic well-being that most households will face. The costs associated with negative health shocks are twofold: (1) costs related to medical treatment and (2) costs related to a reduction in working ability. The importance of both costs can generate substantial welfare losses to households (Gertler and Gruber 2002; Wagstaff 2007). Families may be forced to sell productive assets or remove children from school, which can generate intergenerational poverty transmission.

Furthermore, delaying medical treatment or choosing self-treatment can generate serious health consequences (Hadley 2002). Particularly susceptible are young children. Biological insults during infancy can generate nutritional deficits and affect the development of diverse skills and biological processes, which, in turn, can determine cognitive outcomes in adulthood. Furthermore, negative health outcomes affect school attendance and child productivity (Miguel and Kremer 2004). These negative effects on cognitive abilities can potentially hinder a country's economic development due to the potential loss of human capital (Currie and Hyson 1999). If implemented correctly, health insurance systems could provide an effective solution to these various challenges (Brown, Bindman, and Lurie 1998; Gertler and Gruber 2002). This paper, which is the first to examine the causal impact on healthcare use of participation in Ghana's National Health Insurance Scheme (NHIS), uses representative data for the entire country and controls for the endogenous nature of insurance enrollment.

Although the literature on the impact of insurance coverage is quite extensive, it has mainly examined US evidence. Although US studies have effectively shown that membership in insurance schemes expands healthcare use, they have been less successful when assessing its impact on health outcomes (Currie and Gruber 1996; Aizer 2007; Card, Dobkin, and Maestas 2008; Finkelstein and McKnight 2008; Card, Dobkin, and Maestas 2009; Finkelstein et al. 2012). With few exceptions (King et al. 2009; Thornton et al. 2010; Asuming 2013), most studies for developing countries have not been able to tackle endogeneity and selection issues successfully (Acharya et al. 2013). Moreover, the findings in terms of increases in healthcare use due to scheme participation are not consistent.

This paper contributes to the health insurance literature in various ways. First, it provides causal evidence of the impact of health insurance participation on health behaviors. In contrast to other causal studies (King et al. 2009; Miller, Pinto, and Vera Hernández 2009; Thornton et al. 2010; Asuming 2013), this study estimates the impact of the NHIS on health behaviors by analyzing data that are representative for the whole country and that do not rely on a randomized controlled trial or a regression discontinuity design, both of which would limit the population analyzed to particular geographic areas or income groups. All previous studies looking into the Ghanaian scheme used limited data in terms of geographic coverage (Sulzbach 2008; Chankova et al. 2009; Mensah, Oppong, and Schmidt 2009; Mensah et al. 2010; Brugiavini and Pace 2010; Blanchet, Fink, and Osei-Akoto 2012; Asuming 2013). The results of this study can be more easily generalized to the entire population because the number of potential treatment locations, as well as locally available health resources, is representative of the entire country.

Second, this paper studies a wide range of outcomes, including the quality of prenatal care. To our knowledge, no study to date has analyzed the impact of the Ghanaian NHIS on the availability and take-up of higher-quality prenatal care.

To overcome the selection bias and omitted variable bias present in estimating the effect of joining a health insurance scheme on healthcare use and quality, this study uses an instrumental variable approach. The exogenous variation in the decision to join the NHIS comes from idiosyncratic variations in district-level membership rules, which may lead to reduced costs and less-cumbersome enrollment procedures and, hence, higher participation rates.

The main datasets 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 (DMHIS) in existence in 2008. This census, which contains district-level administrative data and which was carried out for the purpose of this study, allows for construction of the instrumental variable used in the paper. Local differences in labor market structures and the quantity and quality of healthcare delivery in each district are controlled for to prove that these factors are not driving the results.

Section 4 of this paper describes the robustness checks used to test the validity of the instrument. This section (1) provides evidence about the instrument's idiosyncratic nature; (2) confirms that district government officials did not establish less-cumbersome membership rules in districts that had worse initial health or social indicators; (3) estimates a placebo test that verifies that insurance enrollment had no effect on delivery or postnatal care in the absence of a DMHIS in the district at the time of delivery; and (4) shows that when an additional instrument (less strong but still valid) is included, the Hansen J-statistic confirms that the instruments are indeed exogenous.

This paper is divided into five sections. Following this introduction, Section 2 provides a background of the DMHIS operation. Section 3 describes the data used in the analysis and the estimation method chosen. As mentioned previously, Section 4 describes the robustness checks. Section 5 presents results, and Section 6 concludes the paper. Finally, the technical appendix provides a detailed review of previous literature on the impact of the NHIS, history of the NHIS, descriptive statistics of the data, the fee structure for the DMHIS, discussion of the observed relationship between healthcare use and the choice to be insured, and statistical issues found during estimation.

2. DISTRICT MUTUAL HEALTH INSURANCE SCHEMES

The NHIS operates Ghana's public healthcare system¹ and allows for the existence of three different kinds of insurance plans—DMHISs, private mutual insurance schemes, and private commercial insurance schemes. The benefits packages offered within these schemes are similar² and cover more than 95 percent of the disease conditions that afflict Ghanaians.

The most popular plan is the DMHIS, which operates in every district in Ghana. Together, the other insurance plans cover less than 1 percent of the insured population.³ Hence, in the rest of this paper, people referred to as being insured or covered by the NHIS are actually people who are insured exclusively by a DMHIS. Each DMHIS is responsible for establishing a district administration, enrolling and maintaining membership, collecting contributions from people who can pay, applying a means test to determine who is indigent, and processing claims from accredited facilities. The DMHISs do not run the healthcare providers, nor do they accredit these health facilities. The National Health Insurance Authority (NHIA), the central administrator of the scheme, is in charge of accrediting health facilities. 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. The technical appendix shows the geographical distribution of the DMHIS.

The 2003 act that established the NHIS created the DMHISs as autonomous entities. Section 54 of Act 650 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, and each has independent boards of directors. Another unintended consequence of this independence is that membership rules vary across different DMHISs. This study argues that this independence is a source of exogenous variation that could act as an instrumental variable for identifying parental participation in the NHIS.

¹ The Ghanaian healthcare 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).

² The technical appendix provides a list of benefits and excluded services.

³ The private mutual insurance schemes (also called community-based schemes) cover around 0.7 percent, and the private commercial insurance schemes cover 0.07 percent.

⁴ A beneficiary in one district who moves to another district can transfer his or her insurance policy and still be covered in the new district.

3. ESTIMATION METHODOLOGY

Data Sources

The 2008 GDHS is the main data source for this study. The survey, which was carried out by the Ghana Statistical Service and the Ghana Health Service, is a national survey designed to collect information on housing and household characteristics, education, maternal health and child health, nutrition, family planning, and gender. 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 region. The 2008 survey interviewed 11,778 households over three months, from early September to late November.

The other data source used in this study is a 2008 census of all the DMHISs in existence at that time. The census was designed and carried out for this particular study. When the law was approved, there were 110 districts; however, according to the NHIA's *2009 Annual Report*, 145 districts existed in 2008, and 145 DMHISs were licensed by 2008. The census contains information on the membership rules in each DMHIS for 2006, 2007, and 2008, including information on the annual and renewal fees for nonexempt adults and on the verification methods employed by the DMHIS to ensure that parents were registered in the NHIS so their children could benefit. The census also collected district-level information for 2008 on the barriers affecting children's access to healthcare; the challenges faced by the DMHIS that could have affected participation in the scheme; and health services delivery in the community. Given that we obtained the NHIA's support and authorization to gather this information, the response rate in the survey was 100 percent. Finally, density of health supply services by region was measured as the number of health facilities accredited by region per 100,000 people in 2008 (National Health Insurance Authority 2009).

Outcomes Analyzed

This paper focuses on two main types of outcomes: (1) quantity and quality of maternal health services received and (2) curative child healthcare used. The first item includes the number of antenatal visits a woman had, whether pregnant women were told about pregnancy complications during prenatal visits, whether they had urine and blood samples taken during pregnancy, whether they delivered at a health facility, and whether they had a postnatal checkup.⁵ These outcomes cover all aspects of maternal care. The second category includes whether children younger than five years old suffered a fever or cough in the previous two weeks, whether parents treat their children with antimalarial medication when the children are sick with either a fever or cough, and whether parents get medical treatment when their children experience a fever or cough. *Medical treatment* implies going to a formal facility or health provider (either public or private) instead of seeking help from a drug peddler, traditional practitioner, or shop or not seeking help at all. This study analyzes malaria-related child healthcare-seeking behaviors instead of other health conditions because malaria is the most common cause of outpatient visits in Ghana (Asuming 2013).

This study mainly analyzes healthcare practices for children under five years because early healthcare experiences are particularly important for future skill development, establishment of mental potential, and strong economic productivity in adulthood (Knudsen et al. 2006; Heckman 2007; Maluccio et al. 2009; Case, Lubotsky, and Paxson 2002; Currie and Stabile 2003; Case, Fertig, and Paxson 2005; Alderman, Hoddinott, and Kinsey 2006; Hoddinott et al. 2008; Oreopoulos et al. 2008).

Not all observations in the sample were used to analyze these outcomes given the restrictions imposed by the dates the DMHISs were created in each district. Specifically, only prenatal care variables of women who live in districts where DMHISs were created at least four months before those women gave birth were analyzed, which ensures that the existence of health insurance in their district was

⁵ The outcomes of whether a woman was weighed while pregnant or whether her blood pressure was taken during pregnancy are not included, because almost all women in the sample (97 percent) received these services.

relevant to their choice of prenatal care.⁶ Similarly, when looking at the probability of delivering at a health facility and getting postnatal checkups, this study only analyzed women whose children were born after the DMHIS was created in their district.⁷ The technical appendix provides descriptive statistics of all data used in the estimations, including these outcome variables.

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 for various reasons—because of wealth, for example. This, in turn, could affect child healthcare use. In fact, participation in the NHIS has been shown to be strongly and positively correlated with socioeconomic status (Jehu-Appiah et al. 2011). 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, this study includes a range of covariates, including child's gender and age,⁸ whether the child was a twin,⁹ mother's age and educational attainment,¹⁰ whether the mother is married, whether the mother is Christian or Moslem, the mother's knowledge of childcare and her time constraints for childcare characterized by the number of children born in the past five years, and the number of living children older than five years.¹¹ Similarly, the study controls for the sex of the household head, the household's wealth level,¹² the place of residence,¹³ the population level in each region (in millions), a dummy representing whether the household belongs to one of the three poorest regions in Ghana (Northern, Upper East, and Upper West), and a dummy for living in the region where the national capital is located (where more health services can be accessed).

In addition to these controls, Nketiah-Amponsah (2009) and Acharya et al. (2013) mentioned a wide array of barriers to accessing healthcare that could also hinder participation in an insurance scheme: distance to nearest health facility, quality of care, and lack of knowledge or skills to deal with the insurance scheme, among others. 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, which may be the case when health facilities are too far to access or are of poor quality due to a 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. Similarly, districts with worse health outcomes or higher levels of poverty could have worse human resources in their DMHIS (untrained or simply understaffed), which could disincentivize enrollment.

Hence, this study also controls for a dummy equal to one if the DMHIS had untrained personnel or if it was understaffed; the distance from the district to the nearest doctor and the nearest government

⁶ This study tested whether the results were sensitive to the four-month threshold; the study found no significant differences for a range of plus or minus five months.

⁷ Pregnant women were exempted from paying premiums from July 2008; the GDHS survey took place between September and November 2008. Hence, this study only used the estimation of women who gave birth before this date. Yet the change in the law should not affect an analysis of the whole sample because most women (93 percent) for which we have both insurance and prenatal care information gave birth by July 2008. Indeed, we tested whether including women who gave birth after July 2008 changed the results, and it did not.

⁸ These two covariates are relevant for curative care and preventive care but not for maternal care.

⁹ This is a relevant covariate for maternal care and preventive care but not for curative care.

¹⁰ Mother's educational attainment is defined as a categorical variable: no education = 0, incomplete primary = 1, complete primary = 2, incomplete secondary = 3, complete secondary = 4, and higher than secondary = 5.

¹¹ This study omits controls for whether the mother is currently pregnant and whether the mother is currently working, since those controls could be endogenous.

¹² Household wealth was chosen for this study, instead of individual income, because income data are not available in the GDHS survey. However, the survey does include a wealth indicator based on a series of household characteristics (flooring, wall and ceiling materials, ownership of goods, toilet facilities, type of cooking fuel, and so on).

¹³ This dummy defines the area as urban or rural.

hospital (in kilometers); the number of health facilities accredited in each district in 2007 and 2008; the number of health facilities per 100,000 people in each region; a lack of high-quality healthcare facilities and providers in the district; the existence of poor road networks in the district; a high prevalence of divorce or single parenthood in the district; low levels of education in the district; and the preference for traditional medicine or self-medication in the district. Finally, to control for the labor market structure, this study looks at the percentage of partners in the region who are self-employed in the agricultural sector in order to control for the uncertainty in incomes in the region. Time-variant and invariant characteristics that are not observed, and that cannot be controlled for directly, remain a concern.

The observed relationship between the healthcare use level (C_t) and the choice to be insured (I_t) in a heterogeneous (in μ_t) population can be depicted as:

$$\frac{dC_t}{dI_t} = F_I + F_\mu \frac{d\mu_t}{dI_t}. \quad (1)$$

In other words, what we observe is not the causal or structural relationship between insurance membership and healthcare use (F_I). Component $F_\mu(d\mu_t/dI_t)$ will differ from zero if the decision to join a health insurance scheme is determined by unobserved factors that could simultaneously affect the healthcare use level chosen for the child and mother. In developing countries, different selection processes can bias this observed relationship. Pregnant women with riskier behaviors or less knowledge of pregnancy (first-time mothers) could enroll less frequently in insurance schemes ($d\mu_t/dI_t < 0$), though they could still be aware of their own frailty or be afraid of the unknown and hence request more prenatal care (both in quantity and quality) than the average woman ($F_\mu > 0$). Similarly, parents with children with lower health capital usually do not prioritize preventive healthcare behaviors such as enrolling in a health insurance scheme ($d\mu_t/dI_t < 0$). Yet the parents with frailer children would probably need to take their children more often to the doctor for curative care ($F_\mu > 0$). In contrast, parents who have healthier children and, in general, have better preventative care could enroll more often in health insurance schemes ($d\mu_t/dI_t > 0$). Health insurance enrollment is, indeed, often higher among wealthier households, which tend to be healthier. Yet these wealthier parents could take their children less often to the doctor when sick, because they know of their child's inherent strength (confidence selection = $F_\mu < 0$). Similarly, healthier pregnant women (due to less riskier behaviors) or women with more experience with pregnancy could be more prone to self-select into health insurance schemes (to avoid risks) and yet use prenatal and postnatal services less often because they might feel they do not need those services as much. This combination creates reverse causality and will end up generating a negative bias when estimating the relationship between insurance participation and health behaviors using ordinary least squares (OLS).

Hence, the need to use an instrumental variable (IV) approach to identify the causal impact of insurance enrollment on maternal and child health-related behaviors. The exogenous variation in the decision to join the insurance scheme comes from idiosyncratic variations in the DMHIS membership rules. Parental participation is higher in districts where fees are lower. (The technical appendix includes a detailed description of the fee structure for the DMHIS.) In addition to direct costs, the easiness of verifying the existence of a membership adds to how cumbersome the enrollment process is. The existence of nonstandard verification methods could disincentivize enrollment. (These nonstandard verification methods include anything other than asking to see the parent's membership card or looking up their information in the system to ensure they are registered in the NHIS in order for their children to benefit.) Examples of other verification methods include parents' having to be present to register their children and parents' being asked to show their receipt. This membership rule is used as this study's instrumental variable. According to the DMHIS census, 18 percent of DMHISs analyzed in this study reported having nonstandard verification methods (with a standard deviation of 38 percent). Even though these verification methods are only directly related to a child's insurance status, they are relevant to maternal insurance membership because women are aware that when they enroll in this insurance scheme, all their children under 18 years will be insured for free. Hence, a motivation for these women to enroll in the insurance scheme is to provide access to their children.

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 because they did not follow any official pattern or mandate. This study argues that the variation in verification methods, after controlling for all the variables mentioned earlier, does not reflect the initial policymakers' hypothesized objective function and could have been related to other time-varying idiosyncratic shocks at the district level. Yet, it could still be argued that under certain circumstances, membership rules could not be exogenous instruments. Section 4 provides evidence against this statement.

Specification

The first-stage equation is

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

where I_{ij} is a dummy indicating whether mother i is registered in the DMHIS in district j , and Z_{1j} is the choice of verification methods established by the DMHIS in district j . This equation also controls for other community characteristics (X_j^R), as well as for child (X_{ij}^c), mother (X_{ij}^M), and household (X_{ij}^H) characteristics.

The second-stage equation is

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

where C_{ij} is a child or maternal healthcare use choice, and μ_{ij} is a set of unobserved attributes related to both the mother and the child. These unobserved attributes include resilience, maternal risk aversion, initiative, and determination. Robust standard errors are calculated and are then clustered at the district level to account for any variation within each district.

4. ROBUSTNESS CHECKS

This section provides a series of robustness checks to ensure that membership rules are indeed a strong and exogenous instrument. First, the hypothesis that disruptions in the governance of the DMHIS did indeed generate idiosyncratic variations is tested. Second, we check that government officials in the different DMHISs did not establish more relaxed membership rules in districts with initial worse social indicators.¹⁴ Moreover, a placebo test is conducted to calculate the likelihood of women delivering at a health facility and getting postnatal checkups for births that occurred before the creation of a DMHIS in their districts. In addition, the instrument's strength is assessed using the first-stage F-statistic. Finally, we test that the results obtained are robust to including an additional instrument. A discussion of additional statistical issues related to sample selection and the use of dichotomous variables in both the first and second stages of the IV estimation can be found in the technical appendix.

The Idiosyncratic Nature of the Instrument Chosen

The random variation in verification methods could be explained by a much-extended phenomenon across years and districts in Ghana—that is, the constant subdivision of districts. As mentioned when discussing the data, 110 districts existed in 2003. By 2008, however, 145 were in existence. Every time a district splits, a new DMHIS has to open in the new district. These disruptions in the governance of the DMHISs could generate idiosyncratic variations. We test the hypothesis that the instrument chosen is idiosyncratic by regressing the existence of a nonstandard verification method in 2008 on a series of controls, including a dummy equal to one if the district originally belonged to a bigger district. To ensure that the choice of instrument was indeed exogenous, this study included controls for other DMHIS characteristics that could affect not only the chosen IV but also other healthcare behaviors. The standard errors were then clustered at the district level.

As can be seen in Table 4.1, the only variables that are correlated with the choice of a nonstandard verification method are the population size in the region, the fact that the DMHIS belongs to the Greater Accra region, and, most important, the fact that the DMHIS is located in a district that used to be part of a bigger district. Being located in a previously subdivided district increases the probability of having nonstandard verification methods by 14.6 percent. However, other membership rules, such as the annual premium, are not correlated with the choice of verification methods.

The division of districts could also have affected the delivery of healthcare services. Hence, as mentioned previously, controls are included in the estimations of both the quality of healthcare services delivered in the district and the number of healthcare facilities accredited per district in 2007 and in 2008. Furthermore, the disruption in the public health sector was probably less significant than the one that occurred in the DMHIS, because the government health service delivery structure is supported by a robust nongovernmental sector (that is, the Christian Health Association), which provides preventive and curative services, as well as by a private healthcare sector, which provides some emergency services. In addition, the delivery of health programs in Ghana is organized by the Ghana Health Services at a higher level than the district level.

¹⁴ Such indicators include lower child healthcare use rates or maternal healthcare quality, lower maternal education levels, or higher-poverty malaria or fertility rates.

Table 4.1 Impact of district and regional characteristics on the probability of a DMHIS's having a nonstandard verification method

Dependent variable	Existence of nonstandard verification methods
DMHIS belongs to a subdivided district	0.146 (0.084)*
Months the DMHIS has been operating	0.006 (0.004)
Annual premium, 2008 with zeros	-0.018 (0.013)
A flat rate in the DMHIS	0.139 (0.213)
Renewal fee for children, 2008	0.009 (0.027)
Understaffed and untrained staff	-0.108 (0.072)
Lack of education/ illiteracy/	-0.122 (0.074)
Preference for traditional medicine in the district	-0.002 (0.002)
Healthcare facilities accredited in 2008	0.066 (0.048)
Urban residence	-0.069 (0.040)*
Population in millions in each region	0.015 (0.118)
Poor regions: North, Upper East, and West	0.662 (0.176)***
Belongs to Greater Accra region	0.204 (0.244)
Constant	2,992
<i>N</i>	0.27
Adjusted R ²	

Sources: GDHS (2008); DMHIS 2008 Census.

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

Testing the Instruments' Exogeneity

In theory, government officials in the different DMHISs could have established more relaxed membership rules in districts with initial worse social indicators (such as higher poverty rates, malaria rates, or fertility rates or lower maternal education levels) or initial worse healthcare behaviors (such as lower child healthcare use rates or lower maternal healthcare quantity and quality). The exogeneity assumption is tested using 2003 GDHS data, which contain the best health indicators available in Ghana at the time the NHIS was created and before the district rules were actually established. First, for the instrument chosen, separate regressions are run on (1) the incidence of children under five years suffering from a fever (a proxy for malaria for children younger than five), (2) fertility rates in the district, (3) maternal education levels in the district, and (4) wealth levels. This study only controls for belonging to one of the three poorest regions in Ghana and to the Greater Accra region (the only time-invariant characteristics). The results are presented in Table 4.2. There was no impact of these indicators on the existence of nonstandard verification methods. These results help confirm that the instrument chosen is indeed exogenous.

Table 4.2 Impact of 2003 district-level indicators on 2008 membership rules**Panel A: Quantity and quality of maternal healthcare**

Dependent variable	Existence of nonstandard verification method
Number of prenatal visits	0.018 (0.028)
Told about pregnancy complications	-0.216 (0.175)
Urine sample taken during pregnancy	-0.060 (0.249)
Blood sample taken during pregnancy	0.110 (0.292)
Delivery at health facility	0.002 (0.163)
Had a checkup after delivery	0.021 (0.182)

Panel B: Curative and preventive child healthcare, health outcomes, education, and district wealth

Dependent variable	Existence of nonstandard verification method
Antimalarial medication taken for fever/cough	0.056 (0.172)
Seek medical treatment when child has fever/cough	-0.040 (0.144)
Incidence of children under 5 suffering from a fever	0.316 (0.295)
Fertility rates	-0.024 (0.047)
Maternal education level	0.042 (0.058)
Wealth levels	0.006 (0.008)

Sources: GDHS (2003); DMHS 2008 Census.

Notes: Every coefficient belongs to a separate regression performed on district-level variables. Every regression has two time-invariant controls: a dummy equal to one if the household belongs to one of the three poorest regions in Ghana and a dummy equal to one if it belongs to the Greater Accra region. Standard errors are in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%.

Second, separate regressions are run, using data at the district level, for the instrument chosen on each outcome examined in this paper. Again, the only controls are a dummy that is equal to one if the household belongs to one of the three poorest regions in Ghana and a dummy equal to one if it belongs to the Greater Accra region. None of the 2003 maternal health practices or curative health practices has statistically significant impacts on the membership rule. The results are shown in Table 4.2. Given these results, there is no concern that the estimates would be biased.

Placebo Test

To further confirm the validity of the instrument chosen, this study calculates the likelihood of women delivering at a health facility and getting postnatal checkups if they gave birth before creation of the district's DMHIS. If the district offices did not exist at the time of delivery, current insurance membership should not have affected the decision to seek this type of maternal care. The results of this placebo test can be found in Table 4.3. As expected, there are no statistically significant effects of insurance participation on these outcomes.

Table 4.3 IV estimation: Impact of being insured on postnatal outcomes (sample of women with no DMHIS in their districts at the time of birth)

	Delivery at a health facility	Had a checkup after delivery
Maternal healthcare	IV	IV
	(1)	(2)
Insurance	0.301	-0.305
Participation	(0.272)	(0.201)
Other controls	YES	YES
N	706	706
R ²	0.28	0.41

Sources: GDHS (2008); DMHIS2008 Census.

Notes: Sample of women who lived in districts that did not have a DMHIS at the time the women gave birth. All controls are included in the main estimation. Instrument: The existence of a nonstandard verification method in 2008. Robust standard errors are clustered by district level in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%.

Testing the Instruments' Strength

As part of this study, separate estimations were performed for the different sample sizes defined by the availability of the second-stage variable. If the instrument were weak, the standard IV point estimates would be unreliable, as would the ensuing hypothesis tests.¹⁵ The null hypothesis is that the instrument is weak. As Table 4.4 shows, for all estimations, the F-statistic (at a 5 percent significance level) of the set of instruments chosen ensured that the maximal bias of the IV estimator relative to OLS was no bigger than 10 percent for all outcomes. These results fit the definition of a nonweak instrument, according to Stock et al. (2002).

¹⁵ 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 unitless 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.

Table 4.4 First-stage estimation: Impact of membership rules on the probability of being insured

Dependent variable	Probability of being insured					
	(Separate regressions for different sample sizes defined by the availability of the second-stage variable)					
	Number of prenatal visits	Pregnancy complications	Urine/blood sample	Health facility delivery	Postnatal checkup	Suffered a fever or a cough/malaria medicine/medical treatment
Existence of nonstandard verification methods	-0.163 (0.034)***	-0.164 (0.034)***	-0.163 (0.034)* **	-0.150 (0.034)** *	-0.150 (0.035)***	-0.145 (0.032)***
Other controls	YES	YES	YES	YES	YES	YES
N	1717	1751	1755	2111	2265	2755
Partial R ² of excluded instruments	0.015	0.015	0.015	0.013	0.013	0.012
F-test for weak identification	23.20	22.76	22.50	19.35	18.21	19.88

Sources: GDHS (2008); DMHS 2008 Census.

Notes: The estimations include the following controls: child's gender and age (except for maternal care second-stage variables), whether the child was a twin (except for curative care second-stage variables), mother's age and educational attainment, whether the mother is married, whether she is Christian or Moslem, the number of children born in the past five years, the number of living children older than five years, sex of the household head, the household's wealth level, the place of residence (urban versus rural), the population level in each region (in millions), a dummy if the household belongs to one of the three poorest regions in Ghana, a dummy for belonging to the Greater Accra region, the distance from the district to the nearest doctor and to the nearest government hospital (in kilometers), the number of facilities per 100,000 people in each region, the presence of deficient human resources in DMHS, the number of facilities accredited in 2007 and in 2008, the percentage of partners in the region who are self-employed in agriculture, the lack of healthcare facilities and of high-quality providers in the district; the existence of a poor road network in the district; the high prevalence of divorce or single parenthood in the district; and the low levels of education in the district, as well as the preference for traditional medicine or self-medication. First-stage estimations were combined when the coefficients were identical, as well as the *N*, partial R², and F-statistic. Robust standard errors are clustered by district level in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%.

Robustness to an Additional Instrument

This study also tests that the results obtained are robust to including an additional instrument that allows estimation of the Hansen J-statistic, a test of the exogeneity of the instruments. The joint null hypothesis of the Hansen's J-test is that the instruments are valid instruments—that is, they are uncorrelated with the error term—and the excluded instruments are correctly excluded from the estimated equation. The additional instrumental variable included was the existence of nonstandard verification methods in the DMHS in 2007 (which was much less prevalent, with an average of 10 percent in all DMHSs). The second instrument is not statistically significant, yet the overidentification test is easily accepted in all cases. These results are displayed in Table 4.5.

Table 4.5 IV estimation: Impact of being insured on healthcare practices, using the nonstandard verification rule of 2008 and 2007 as the instruments

Dependent variable	Impact of insurance participation	First-stage F-statistic	Hansen-J statistic P-value
Number of prenatal visits	-1.145 -1.618	11.53	0.119
Told about pregnancy complications	0.422 (0.216)*	11.59	0.731
Urine sample taken during pregnancy	0.489 (0.187)***	11.47	0.285
Blood sample taken during pregnancy	0.596 (0.211)***	11.47	0.527
Delivery at health facility	0.496 (0.212)**	10.07	0.192
Had a checkup after delivery	0.632 (0.258)**	9.24	0.963
Suffered a fever or cough	-0.033 -0.249	9.74	0.289
Antimalarial medication taken for fever/cough‡	0.218 (0.127)*	9.74	0.270
Seek medical treatment when child has fever/cough‡	0.274 (0.134)**	9.74	0.399

Sources: GDHS (2003, 2008); DMHIS 2008 Census.

Notes: The estimations include all previous controls used in the main estimations. ‡ Unconditional estimation. Instruments: existence of nonstandard verification methods in 2006 and 2008. Robust standard errors are clustered at the district level; * significant at 10%; ** significant at 5%; *** significant at 1%.

The statistical significance of most coefficients has stayed the same. The only two exceptions are the likelihood of a woman being told about pregnancy complications during prenatal visits and the probability that a child receives malaria medication, which slightly reduced the significance of those coefficients from 5 percent to 10 percent. All the coefficients that were previously not statistically significant are still not significant. The combination of the instruments used is weaker than the one used in the main estimations (the F-statistic of the instruments chosen ensured that the maximal bias of the IV estimator relative to OLS is no bigger than 20 percent in most of the estimations, in contrast to 10 percent in all the main estimations), which could potentially lead to biased estimates. Most coefficients for the statistically significant outcomes have changed—on average, by 6 percent. These results show that the main results can be replicated using this different estimation technique. Yet the results in the main estimation are preferred because the instrument used is much stronger and, hence, ensures a smaller bias.

5. RESULTS AND DISCUSSION

Models for Maternal Healthcare Quantity and Quality

According to the first-stage regression parameters presented in Table 4.4, the instrument used in this study is relevant. The instrument is proven to be significant at a 1 percent level and displays a nonimmaterial effect on the probability of being covered by the NHIS. The existence of alternative verification methods in the district, which could make the enrollment process more cumbersome, decreases the probability of registration by about 16 percent. The first set of second-stage estimations is related to the quantity and quality of healthcare received by pregnant women. The results for both OLS and IV estimations of the impact of being insured on maternal care behaviors are found in Table 5.1. The odd columns show results without instrumenting for insurance participation. For all outcome variables, we instrument for insurance participation using the existence of nonstandard verification methods.

In Panel A of Table 5.1, the dependent variables are the number of prenatal visits sought during the last pregnancy, the probability of being told about pregnancy complications during prenatal visits, and the probability of having a urine sample taken during pregnancy. In Panel B, the dependent variables are the probability of having a blood sample taken during pregnancy, the probability of delivering at a health facility, and the likelihood of having a checkup after delivery.

For all OLS estimations, NHIS participation appears to have a positive and statistically significant effect on the likelihood of receiving higher-quantity and higher-quality maternal healthcare services. In all cases, the instrumental variable estimations similarly display positive coefficients, yet the magnitudes are much greater and some of the statistical significance is lost. According to the IV estimations, participating in the NHIS increases the likelihood of pregnant women being told about pregnancy complications during prenatal visits by 43.3 percentage points. It boosts the probability of having a urine sample and a blood sample taken by 51.8 percentage points and 61.6 percentage points respectively.

Finally, insurance participation increases the probability of delivering at a health facility by 52.9 percentage points and it raises the likelihood of having a checkup after delivery by 63.1 percentage points. However, the number of prenatal visits sought is not affected by insurance participation.

It is not immediately clear why participation in the NHIS should increase the incidence of delivering in a health facility, as even before the introduction of the NHIS, deliveries at health facilities were free. Yet, there is a huge difference in terms of insured mothers who deliver in a health facility (74 percent) and uninsured mothers who do so (45 percent). In contrast, there is no difference in terms of the insured mothers who seek prenatal care in a health facility (99 percent) versus uninsured mothers who do (98 percent). This means the health facilities are available to both; however, when delivering, being insured dramatically increases the odds of accessing a health facility. A possible hypothesis is that insurance participation increases the use of healthcare facilities for preventative and curative care, which, in turn, has a twofold effect. First, women's health knowledge and awareness of the benefits of institutional delivery increase during medical visits. Second, insurance participation increases familiarity with the institutional features of health facilities (such as location and sign-in procedures) that make women feel more comfortable in those facilities. This study tests whether being insured increases the probability of knowing that tuberculosis can be cured and that having too many children is dangerous for a woman (variables associated with health knowledge in the female questionnaire). The findings show that being insured increases the former by 51.3 percentage points and the latter by 50.5 percentage points (statistically significant at the 10 percent and 5 percent level, respectively).

Table 5.1 Estimation: Impact of being insured on quantity and unconditional quality of maternal healthcare practices

Panel A						
Maternal healthcare	Number of prenatal care visits		Told about pregnancy complications		Urine sample taken during pregnancy	
	OLS	IV	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)	(5)	(6)
Insurance	0.653	-0.817	0.054	0.433	0.055	0.518
Participation	(0.174)***	(1.685)	(0.025)**	(0.210)**	(0.015)***	(0.183)***
Other controls	YES	YES	YES	YES	YES	YES
<i>N</i>	1,717	1,717	1,751	1,751	1,755	1,755
<i>R</i> ²	0.19	0.15	0.07	-0.06	0.20	-0.14

Panel B						
Maternal healthcare	Blood sample taken during pregnancy		Delivery at a health facility		Had a checkup after delivery	
	OLS	IV	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)	(5)	(6)
Insurance	0.092	0.616	0.173	0.529	0.068	0.631
Participation	(0.018)***	(0.202)***	(0.023)***	(0.220)**	(0.018)***	(0.258)**
Other controls	YES	YES	YES	YES	YES	YES
<i>N</i>	1,755	1,755	2,111	2,111	2,265	2,265
Adjusted <i>R</i> ²	0.16	0.06	0.31	0.21	0.18	-0.07

Sources: GDHS (2008); DMHS 2008 Census.

Notes: Controls: if the child was a twin, mother's age and educational attainment, whether the mother is married, whether she is Christian or Moslem, the number of children born in the past five years, the number of living children older than five years, sex of the household head, the household's wealth level, the place of residence, the population level in each region (in millions), a dummy if the household belongs to one of the three poorest regions in Ghana, a dummy for belonging to the Greater Accra region, the distance from the district to the nearest doctor and to the nearest government hospital (in kilometers), the number of facilities per 100,000 people in each region, the presence of deficient human resources in DMHS, the number of facilities accredited in 2007 and in 2008, the percentage of partners in the region who are self-employed in agriculture, the lack of healthcare facilities and of high-quality providers in the district, the existence of a poor road network in the district, the high prevalence of divorce or single parenthood in the district, and the low levels of education in the district, as well as the preference for traditional medicine or self-medication. Instrument: the existence of a nonstandard verification method in 2008. Robust standard errors are clustered by district level in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%.

The choice of quality of care in a developing-country setting could reflect differences in the type of health facility that the insured and uninsured are able to attend (for example, Community-based Health Planning and Service [CHPS] compounds, local health centers, clinics, regional hospitals, and teaching hospitals). Availability and quality of skilled personnel, supplies, and equipment differ by type of facility—for example, CHPS compounds do not have a doctor or medical assistant. Thus, a woman who chooses to use a CHPS compound for prenatal care but who does not have her blood sample taken may not necessarily be choosing lower-quality care; instead, it could simply be that the component was not available at the only facility within reasonable distance to her. This could be a possible limitation of the results presented. Yet, when the study tests whether being insured increases the probability of accessing prenatal care from a health facility in the different tiers of the hierarchical structure,¹⁶ it finds no statistically significant impact. Another caveat that should be made explicit is that some women currently insured might not have been so when pregnant. Yet, this, if anything, will tend to weaken the results found for prenatal care.

Models for Curative Child Healthcare Use

The second set of estimations looks into the use of curative child healthcare. We estimate the impact of being insured on the probability of suffering a fever or a cough in the past two weeks, as well as on such healthcare practices as giving the child antimalaria medication and seeking formal advice or treatment from a health facility or provider, which is unconditional on the child suffering a fever or cough. (Conditional results can be found in the technical appendix.) The results are found in Table 5.2, where odd columns show results without instrumenting for participation in the NHIS, whereas even columns provide second-stage estimates.

Table 5.2 Estimation: Impact of being insured on child healthcare outcomes and practices

Child healthcare outcomes/use	Suffered a fever or cough		Unconditional estimation			
			Antimalarial medication taken		Seek medical treatment	
	OLS	IV	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)	(5)	(6)
Insurance	-0.019	0.017	0.006	0.252	0.057	0.295
Participation	(0.022)	(0.251)	(0.012)	(0.127)**	(0.016)***	(0.132)**
Other controls	YES	YES	YES	YES	YES	YES
N	2,755	2,755	2,755	2,755	2,755	2,755
Adjusted R ²	0.01	0.01	0.02	-0.13	0.03	-0.07

Sources: GDHS (2008); DMHS 2008 Census.

Notes: The estimations include all previous controls, with the exception of whether the child was a twin. Additional controls: child's gender and age. Instrument: the existence of a nonstandard verification method in 2008. Robust standard errors clustered by district level in parentheses, * significant at 10%; ** significant at 5%; *** significant at 1%.

In simple OLS estimations, insurance participation has no statistically significant impact either on the probability of suffering a fever or a cough or on the unconditional probability of taking antimalaria medication. Yet, according to the OLS results, being insured has a positive and statistically significant impact on the unconditional likelihood of seeking formal medical treatment. Being insured raises the unconditional probability of seeking formal medical treatment for children by 5.7 percentage points.

¹⁶ Higher level: hospitals (private or public), polyclinics, clinics (private or public); middle level: health center; lower level: health posts, CHPS, mobile clinics (private or public), and maternity homes

The instrumental variable estimations show positive and statistically significant coefficients for all health behaviors but no impact on the probability of suffering a fever or cough. Being insured improves the unconditional probabilities of receiving malaria medication and of seeking formal medical treatment by 25.2 and 29.5 percentage points, respectively. These estimates point to the existence of a downward bias when endogeneity is not taken into account. The results are not surprising— according to the 2008 Citizens’ Assessment of the National Health Insurance Scheme (National Development Planning Commission 2009), the existence of an information asymmetry problem in developing countries such as Ghana implies a high likelihood that “high risk” groups could be selected into the scheme. This means there is underlying heterogeneity in returns to insurance participation. More important, the IV estimates calculate local average treatment effects (LATEs), in contrast to the OLS estimates, which provide average treatment effects (ATEs).

Local Average Treatment Effects

According to Angrist (2006), the IV estimates capture the causal impact of treatment on the treated, without being confounded by noncompliance or selection bias. 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 (compliers). The IV estimation measures the impact of being insured on the healthcare use rates of these “compliers.” ATE is a weighted average of the effect on both the always-takers and the compliers, whereas LATE only provides information about the compliers (Angrist 2006; Angrist and Pischke 2009). If the main reason these parents have low participation rates is because of higher-than-average costs of membership, rather than because of lower-than-average returns to participation, then the LATE will be above the average marginal return to insurance participation in the population as a whole.

Table 5.3 provides information to support this hypothesis and, hence, explain the large size of the coefficients found. We analyze compliers’ characteristics for two outcome variables—having a postnatal visit and giving a child antimalaria medication—because these have a particularly large IV coefficient in comparison to the OLS counterpart. Column (1) shows the mean for the population of the variable at the left. The ratios in column (2) give the relative likelihood that compliers have the variable indicated at the left.

Table 5.3 Complier characteristics ratios

Outcome variable	Variable (x_{1i})	$P[x_{1i} = 1]$ (1)	$P[x_{1i} = 1 C_{1i} > C_{0i}] / P[x_{1i} = 1]$ Nonstandard verification method (2)
Postnatal care	Child born out of wedlock living in female-headed household	0.12	1.41
	First-time mother	0.16	1.12
	Anemic child	0.43	1.19
	Poor road network	0.24	1.76
Antimalarial medication given	Child born out of wedlock living in female-headed household	0.10	1.30
	First-time mother	0.14	0.97
	Anemic child	0.46	1.12
	Poor road network	0.24	2.47

Sources: GDHS (2008); DMHIS Census (2008).

Note: The estimations include all previous controls.

Compliers, which are affected by the existence of nonstandard verification methods, are much more likely to have children born out of wedlock who live in female-headed households. Parents of children born out of wedlock who live in female-headed households probably have a higher cost of becoming members of the NHIS, because they only have one income to cover the costs of raising a child and much higher time constraints. Hence, reductions to membership costs in terms of time use and ease of access would motivate these mothers, much more so than the average parent, to enroll in and take advantage of the system's health services.

In addition, compliers affected by the existence of nonstandard verification methods have a higher likelihood of being first-time mothers and of having children who are at least moderately anemic. These inexperienced mothers might not understand the importance of being enrolled in an insurance scheme but could be motivated to enroll when the paperwork becomes less cumbersome. Once enrolled, they probably would seek curative healthcare much more often than the average parent, because their inexperience might lead them to worry more than a more experienced parent would. Similarly, an anemic child would benefit much more from curative care if the child's parents had access to health insurance. Hence, mothers with anemic children who, due to easiness of enrollment, have more access to health insurance will use health services more frequently than the average parent.

Finally, compliers are more likely to live in districts with poor road networks.¹⁷ 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.

¹⁷ Nonstandard verification methods might imply that parents registering the children would have to make several trips to the DMHIS to achieve this, which would be particularly cumbersome and hence prove to be a much stronger deterrent to insurance enrollment when roads are in poor condition and trips to the DMHIS are much more time consuming.

6. CONCLUSION

The main objective of this research paper is to look at the impact of insurance enrollment in the NHIS on maternal and child curative healthcare use in Ghana. This is the first attempt to look into these particular outcomes using a geographically representative sample for Ghana. This study overcomes the difficulties in identifying the effect of joining a health insurance scheme on health behaviors by using an instrumental variable approach. The exogenous variation in the decision to join the NHIS comes from idiosyncratic variations in membership rules in the DMHIS. Specifically the instrument used in this study is the existence of nonstandard verification methods to allow enrollment of children. This study tests the exogeneity of the instrument by providing evidence to show (1) it was indeed an idiosyncratic variation; (2) government officials did not choose to establish less-stringent verification rules in districts that had worse initial social indicators; and (3) maternal health behaviors are not affected if insurance enrollment was not available at the time of delivery.

Using this identification strategy, this paper shows that being registered in the DMHIS increases the probability of seeking higher-quality maternal healthcare, as well as the likelihood of parents taking their children to health facilities more often for curative care. Yet being insured does not affect the number of prenatal care visits sought by expectant mothers. This result is not surprising because in Ghana—even before the creation of the NHIS—the average number of prenatal visits was quite high by developing-country standards. The World Health Organization’s recommendations in terms of frequency of prenatal care visits are four visits per pregnancy (Berg 1995), which is below the average number of prenatal visits in Ghana, even for uninsured women who seek prenatal care more than five times during their pregnancies. It appears that participating in the NHIS improves maternal care not through increases in quantity of care but in increases in quality of care. This finding is consistent with the findings in Powell-Jackson et al. (2014): free care promotes a switch from informal services to formal services, thus increasing the quality of providers used. The rest of the results are consistent with coefficients biased downward in the initial OLS estimations. If these biases were not accounted for, the impact of participating in a health insurance scheme would be greatly underestimated.

This paper calculates LATEs, in contrast to ATEs. Because “compliers” have larger unmet needs for health services and are more responsive to interventions, it is not surprising that the IV estimates are much larger than the average marginal returns to being insured and, in general, much larger than the average effects found in the literature. The results of this study are consistent with Asuming’s (2013) findings, which suggested that poorer households have larger unmet needs for health services and are more responsive to interventions. Similarly Powell-Jackson et al. (2014) found that the effect of free care on the use of primary care becomes larger as the sample is restricted to increasingly sicker (anemic) children.

Calculating effects for “compliers” is not a shortcoming of this paper; for policy evaluation purposes, it might be more relevant to calculate the average return to insurance participation for the group that will be most affected by changes in membership rules than to calculate the average marginal return for the whole population. Indeed, the impact of health financing reforms might be easier to identify on a subgroup of the population with the highest return to the reform. Future research should focus on analyzing other aspects of the quality of healthcare services used by members of the NHIS, especially for children. This would allow one to evaluate whether the creation of the NHIS has increased not only the quantity of care use but also the quality of the services provided for all beneficiaries.

APPENDIX: TECHNICAL INFORMATION

Previous Literature on the NHIS

The studies that have previously examined the impact of the NHIS are, in most cases, restricted in terms of the population analyzed and, with only one exception (Asuming 2013), have not dealt appropriately with the endogeneity of insurance choice. Mensah, Oppong, and Schmidt (2009) and Mensah et al. (2010) used propensity score matching (PSM) to find that pregnant women who participate in the scheme enjoy a 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. They looked at the impact of the scheme on only four districts in Ghana. Blanchet, Fisk, and Osei-Akoto (2012), who also employed PSM and used data restricted to the Accra metropolitan area, showed that insurance members have a higher probability of obtaining prescriptions, visiting clinics, and seeking formal healthcare when sick. Similarly, Sulzbach (2008) used PSM and data from two districts to analyze the impact of enrollment in the NHIS, finding that the insured are more likely to seek curative care. Chankova et al. (2009) used a repeated cross-sectional study of the same districts to look at the same outcomes as Sulzbach (2008), with similar results. Brugiavini and Pace (2010) was the only previous study that used data from the whole country. They found that participation in the NHIS increases the probability of attending prenatal care, of delivering at a formal health facility, and of being assisted by a professional during delivery. The authors mostly used simple Probit estimates; although they eventually introduced an IV estimation technique, the instrument chosen (a binary variable for the healthcare reform in 2005) is not shown to be either exogenous or strong. Finally, using a randomized controlled trial design, Asuming (2013) found that insurance coverage leads to increased use of healthcare services, a decrease of out-of-pocket spending, and fewer days of illness suffered. Although his estimates are causal, his analysis is confined to the Wa West district in northwestern Ghana, a particularly poor and remote rural district. Hence, the results are not nationally representative.

Ghana's National Health Insurance Scheme

From the colonial era through the 1970s, Ghana's governments tried various policies to render healthcare 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 in order to facilitate capitalization for the so-called cash-and-carry scheme for drug purchases and supply. This scheme, implemented in 1992, 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 to the hospital for emergencies had to pay at every point of service delivery. This policy 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, creating Ghana's National Health Insurance Scheme with the mission of "ensuring 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.¹⁸ The average premium paid by the informal sector (which constitutes the majority of the Ghanaian population) is around 10 Ghana cedis (GH¢), which is around 2.5 percent of the annual per capita income estimated from the last Ghana Living Standard Survey (GSS 2008). There is no limit on

¹⁸ Workers in the formal sector contribute 2.5 percent of their contribution to the SSNIT, with annual premiums ranging from 7.2 GH¢ (\$8) to 48 GH¢ (\$54) (Frempong et al. 2009).

what the NHIS pays in medical bills, as long as the care is within the provision of the benefit package. Finally, there are no copayments, coinsurance, or deductibles.

The government subsidizes pensioners under the Social Security and National Insurance Trust (SSNIT) scheme. In addition, under the NHIS, it subsidizes the old (70 years and older) core indigent populations, as well as the children and dependents younger than 18 of parents who participate in the system. These exempt groups are not required to pay premiums, but they must be registered to obtain coverage. In addition, starting in July 2008, pregnant women were exempted from paying premiums (Witter and Garshong 2009) but still needed to be enrolled to benefit.

Benefits of Health Insurance

Beneficiaries are given cards that can be used to seek treatment in any health facility 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 basic package consists of (1) coverage of all costs, including food, associated with outpatient 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 (Mensah, Oppong, and Schmidt 2009). Apart from the standard basic package, each DMHIS can choose to provide supplementary benefits.

The following minimum services are provided:

1. Outpatient services: general and specialist consultations and reviews; general and specialist diagnostic testing, including laboratory, X-rays, and ultrasound scanning; medicines on the NHIS medicine list; and surgical operations, such as hernia repair and physiotherapy
2. Inpatient services: general and specialist inpatient care, diagnostic tests, prescribed medication that is on the NHIS medicine list, blood and blood products, surgical operations, inpatient physiotherapy, accommodation in the general ward, and feeding
3. Oral health: pain relief (tooth extraction, temporary incision, and drainage) and dental restoration (simple amalgam, filling, and temporary dressing)
4. Maternal care: antenatal care, deliveries, caesarian section, and postnatal care
5. Emergencies: 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, and so on
2. Cosmetic surgeries and aesthetic treatment
3. Antiretroviral drugs for HIV
4. Assisted reproduction and gynecological hormone replacement therapy
5. Echocardiography, Photography and Angiography
6. Dialysis for chronic renal failure
7. Organ transplants
8. All drugs not listed on the NHIS medicine list
9. Heart and brain surgery, other than surgeries resulting from accidents
10. Cancer treatment, other than breast and cervical
11. Mortuary services

12. Diagnosis and treatment abroad
13. Medical examinations for purposes other than treatment in accredited health facilities (for example, visa applications, education, institutional, and driving license)
14. VIP ward (accommodation)

Distribution of District Mutual Health Insurance Schemes

The DMHISs are distributed across the different regions of Ghana and, by 2008, had accredited 1,672 health facilities across the country (see Table A.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, with an average of 48 percent of people in Ghana holding a valid insurance card (see Table A.2). According to the 2008 Citizens' Assessment of the National Health Insurance Scheme (National Development Planning Commission 2009), NHIS membership increased from 1,797,140 people in 2005 to 12,518,560 people in 2008.

Table A.1 District Mutual Health Insurance Schemes and facilities accredited by region, 2008

Region	Number of schemes	Number of facilities accredited	Number 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).

Table A.2 NHIS membership by region, 2008

Region	Percentage insured (with valid card)	Percentage registered (no valid card)	Percentage 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: National Development Planning Commission (2008).

Descriptive Statistics

Panel A of Table A.3 provides descriptive statistics on covariates for mothers (and their children) who are registered in the DMHIS in 2008 and mothers who are not. From this table, it is obvious that participants and nonparticipants in the insurance scheme are drastically different. Participant mothers have fewer children; are older, more educated, and wealthier; have a higher probability of being Christian and married; and have a higher probability of living in an urban area closer to health providers.

Panel B of Table A.3 shows the outcome variables for mothers (and their children) who were insured by the DMHIS in 2008 and mothers who were not. Insured women have more prenatal visits, though the average number of visits, even for noninsured mothers, is high for a developing country (more than five visits). Furthermore, insured women enjoy much higher quality of prenatal care. Their providers discuss pregnancy complications with them habitually, and the mothers have their urine and blood taken during pregnancy more often. Of noninsured mothers, 85 percent had either their urine or blood taken during pregnancy, in contrast to 92 and 95 percent, respectively, of insured mothers. Insured women have a much higher probability of delivering at a health facility. Only 54 percent of recent mothers who are not insured attend a postnatal checkup, whereas 70 percent of insured women do. Similarly, only 27 percent of noninsured women got malaria medicine for their sick children, compared with 37 percent of insured ones. Finally, 61 percent of insurance members seek formal medical treatment for their sick children, whereas only 33 percent of nonmembers do so. Yet the children of noninsured mothers do not seem to suffer from a fever or a cough at a different rate, which could be an indication of the absence of moral hazard, as also seen in Powell-Jackson et al. (2014).

Table A.3 Descriptive statistics by insurance participation

Panel A: Control variables for GDHS, 2008

	Not insured		Insured		T-statistic H ₀ :Diff between insured and not insured = 0	
	N	Mean	N	Mean	Diff	P-value
<i>Child and maternal characteristics</i>						
Gender (male)	1808	0.49	1178	0.53	−0.04	0.04**
Child's age (in years)	1808	1.96	1178	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***
Christian	1808	0.62	1178	0.72	−0.10	0.00***
Moslem	1808	0.20	1178	0.21	−0.01	0.48
Children born in the past 5 years	1808	1.67	1178	1.57	0.11	0.00***
Living children older than 5 years	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**
Married	1808	0.71	1178	0.78	−0.07	0.00***
<i>Household and community characteristics</i>						
Household head is male	1808	0.73	1178	0.75	−0.02	0.20
Wealth index (in 10,000)	1808	−45.87	1178	−1.96	−43.91	0.00***
Urban area	1808	0.28	1178	0.42	−0.14	0.00***
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**
Deficient human resources in DMHIS	1808	0.48	1178	0.49	−0.01	0.58
Number of facilities accredited in 2007	1808	23.33	1178	22.18	1.15	0.07*
Number of facilities accredited in 2008	1808	26.18	1178	25.14	1.04	0.12
% of partners in the region who are self-employed in agriculture	1808	0.51	1178	0.54	−0.03	0.00***
Population in millions (region)	1808	2.20	1178	2.10	0.10	0.00***
Number of facilities per 100,000 people (region)	1808	7.86	1178	7.92	−0.06	0.61
Dummy for poor regions	1808	0.33	1178	0.35	−0.02	0.26
Belongs to Greater Accra region	1808	0.11	1178	0.07	0.04	0.00***

Table A.3 Continued

Panel B: Community characteristics and outcome variables for GDHS, 2008

	Not insured		Insured		T-statistic H ₀ :Diff between insured and not insured = 0	
	N	Mean	N	Mean	Diff	P-value
Community characteristics						
Low-quality/quantity healthcare	1808	0.22	1178	0.17	0.06	0.00***
Poor road network	1808	0.24	1178	0.24	0.00	0.99
High rate of divorce /single parenthood	1808	0.02	1178	0.01	0.01	0.13
Lack of education/ preference for traditional medicine	1808	0.20	1178	0.16	0.04	0.00**
Quantity and quality of maternal healthcare						
Number of prenatal visits	992	5.21	707	6.49	-1.28	0.00***
Told about pregnancy complications	1014	0.62	718	0.73	-0.10	0.00***
Urine sample taken during pregnancy	965	0.85	706	0.92	-0.07	0.00***
Blood sample taken during pregnancy	965	0.85	706	0.95	-0.10	0.00***
Delivery at health facility	1357	0.45	909	0.74	-0.29	0.00***
Had a checkup after delivery	1357	0.54	909	0.70	-0.16	0.00***
Curative child healthcare						
Suffered a fever or a cough	1662	0.30	1092	0.30	0.00	0.88
Antimalarial medication taken for fever/cough	494	0.27	326	0.37	-0.10	0.00***
Seek formal medical treatment when child has fever/cough	494	0.33	326	0.61	-0.28	0.00***

Sources: GDHS (2003, 2008).

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

Fee Structure for the DMHIS

The fee structure for the DMHIS comprises (1) an annual premium or membership payments required to enroll for the first time, (2) a renewal fee to be paid for each additional year of enrollment, and (3) a small card-processing fee to be paid once during the initial enrollment. According to NHIA regulations, membership payments are supposed to be income related; however, this is only the case for the 3 percent of the population that are formal sector members (Gajate-Garrido and Owusua 2013). In practice, for informal members, there is a flat rate premium per person (this is the case in more than 84 percent of the DMHISs surveyed).¹⁹ According to the DMHIS census collected by this study, in 2008, the average annual premium nationwide for nonexempt adults was 10.6 GH¢, and the standard deviation in annual fees across districts was around 3.2 GH¢ (30 percent of the mean).

Addressing Sample Selection

In addition to the endogeneity issue, there is also a concern about sample selection when looking at particular outcomes, such as prenatal care quality and curative child healthcare use. A woman has to seek prenatal care first before she chooses the quality of such care. Similarly, to be included in the sample that received curative care, the child has to report being recently sick with fever or cough. One might be concerned that these women and children could potentially be different from the population as a whole in terms of their NHIS status or other background variables, which could lead to an imprecise estimation of the scheme impact. Yet, in the case of prenatal care quality, this is a minor concern because almost all women in the sample (96.2 percent) had at least one prenatal visit. For the women who did not have prenatal visits, the missing values in the prenatal quality dummies are replaced by zeros in order to estimate the unconditional effect of participating in the NHIS. It is expected that women who self-select out of prenatal care (due to confidence selection or adverse selection) would also not be interested in higher levels of prenatal care quality.²⁰

For the sample of children who received curative care, it is even more important to address the selection problem, because only 20 percent of children in the sample experience a fever or cough. Moreover, the behaviors that correlate with not being sick could not translate into seeking less curative care. Hence, both the conditional and the unconditional effect of being enrolled in the NHIS are estimated by replacing the missing values (the cases where children did not experience a fever or cough) in the curative care dummies with zeros in one set of the estimations. The conditional estimates are presented in Table A.4. In simple OLS estimations, insurance participation appears to have no statistically significant impact on the conditional probability of taking antimalaria medication; yet it has a positive and statistically significant impact on the conditional likelihood of seeking formal medical treatment. The probability of seeking formal medical treatment conditional on the child's experiencing a fever or cough increases by 20.8 percentage points. The instrumental variable estimations show positive and statistically significant coefficients for all conditional health behaviors. The conditional probability of receiving malaria medication increases by 71.8 percentage points with insurance enrollment, whereas the conditional likelihood of seeking formal medical treatment when suffering a fever or cough increases by 65.5 percentage points. These results are consistent with the unconditional estimations found in the main text.

¹⁹ District scheme manager on exemption policy: "When you go to a community, you will realize that they are all farmers. You can't determine the income level at the end of the day, so how do you determine the poor, the poorer, and the poorest in that community? Why not ask everybody to pay the same premium? Yaa, so we have decided that they should all pay the same" (Sulzbach 2008).

²⁰ This study measures prenatal care quality using the following outcomes: the number of tetanus injections a woman had while pregnant, whether pregnant women were told about pregnancy complications during prenatal visits, whether these women were weighed while pregnant, whether their blood pressure was taken during their pregnancy, and whether they had urine and blood samples taken during pregnancy

Table A.4 OLS and IV estimation: Impact of being insured on child healthcare conditional outcomes and practices

Child healthcare utilization	Conditional estimation			
	Antimalarial medication taken		Seek medical treatment	
	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)
Insurance	0.035	0.718	0.208	0.655
Participation	(0.037)	(0.265)***	(0.037)***	(0.340)*
Other controls	YES	YES	YES	YES
N	820	820	820	820
R ²	0.04	−0.39	0.10	−0.06

Source: GDHS (2008); DMHIS 2008 Census.

Note: Controls: child's gender and age, mother's age and educational attainment, whether the mother is married, whether she is Christian or Moslem, the number of children born in the past five years, the number of living children older than five years, sex of the household head, the household's wealth level, the place of residence, the population level in each region (in millions), a dummy if the household belongs to one of the three poorest regions in Ghana, a dummy for belonging to the Greater Accra region, the distance from the district to the nearest doctor and to the nearest government hospital (in kilometers), the number of facilities per 100,000 people in each region, the presence of deficient human resources in DMHIS, the number of facilities accredited in 2007 and in 2008, the percentage of partners in the region who are self-employed in agriculture, the lack of healthcare facilities and of high-quality providers in the district; the existence of a poor road network in the district; the high prevalence of divorce or single parenthood in the district; and the low levels of education in the district, as well as the preference for traditional medicine or self-medication. Instrument: the existence of a nonstandard verification method in 2008. Robust standard errors are clustered by district level in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%.

Addressing Statistical Issues

When dealing with dichotomous variables in both the first and second stages of the IV estimation, the standard estimation techniques – two-stage least square (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 because linear and additive specifications are imposed on nonlinear 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 not much gain for the researcher. Following the maximum likelihood approach, the reduced-form equation in the first stage is estimated using a Probit model and the untransformed predicted z-value from this stage replaces the endogenous explanatory variable in the second stage (Timpone 2001). The second stage is also estimated using a Probit model, because the dependent variables are likewise dichotomous. Using this two-stage approach, consistent estimates will be obtained for the second stage; however, the parameters will require rescaling transformations for substantive interpretation. More important, the standard errors will be incorrect, and correcting them is exceedingly challenging (Timpone 2001).

Given these limitations, linear probability models have been the method endorsed and implemented in the literature (Timpone 2001). A relatively recent alternative is the use of bivariate Probit (BVP), which outperforms IV estimations in terms of the size of the average percentage absolute bias generated by the estimation, especially for large samples (Terza, Bradford, and Dismuke 2008). Yet, as those authors showed, for small samples, the bias differences between IV and BVP are trivial.

Given that the sample sizes used in this study are relatively small, we decided to use a linear probability model for both stages and to correct the estimates using weighted least squares in order to address the heteroscedasticity that is created.

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