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ABSTRACT

Long-Run Consequences of Health Insurance Promotion: Evidence from a Field Experiment in Ghana*

We study the long-run impacts of health insurance promotion in Northern Ghana. We randomly provide three overlapping interventions to promote enrollment: subsidy, information campaign, and convenient sign-up option, with follow-up surveys seven months and three years after the initial intervention. Our interventions, especially the subsidy, promote enrollment and healthcare service utilization in the short and long runs. We also find short-run health status improvements, which disappear in the long run. We find suggestive evidence on decreased investment in disease prevention and selection that may help explain this pattern of health status changes.

JEL Classification: I1, O12

Keywords: health insurance, sustainability, moral hazard, selection, screening effect, randomized experiments

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1. Introduction

Many poor households in developing countries lack access to health insurance, and their poverty is exacerbated by health-related problems (Dercon, 2002). In the absence of insurance, households bear a high fraction of medical expenses in the form of out-of-pocket (OOP) payments, and face financial constraints as significant barriers to access to health care (Gertler and Gruber, 2002; Xu et al., 2003; Wagstaff, 2007).[1] Many developing countries have been increasingly instituting social health insurance schemes (SHIs) to help mitigate the effects of adverse health shocks, especially on the poor (WHO, 2005, 2010).[2] However, even though SHIs offer low sign-up costs and generous benefits to increase enrollment, take-up and retention rates remain very low in many countries (Fenny et al., 2016), especially among the poorest households (Acharya et al., 2013).[3]

There have been various efforts to promote health insurance enrollment and healthcare utilization, but many recent studies find such efforts have limited impact.[4] Even after successfully promoting health insurance enrollment in the short run, retention and sustainable increase in health service utilization and health statuses remain a challenge. The long-run effects of an intervention have important implications for policy. For example, an increased retention rate may yield economic and health benefits through engaging in health services on a regular and timely basis, which may improve the sustainability of the health insurance program. Nevertheless, this topic remains relatively understudied.

Subsidy is one of the few successful types of interventions to promote health insurance enrollment (i.e., Thornton et al., 2010). However, an important question emerges regarding the level of subsidy. A subsidy level may have a screening effect (selection), in which different levels of subsidy (price) may attract people with different characteristics, and this selection affects health

[1] The World Health Organization (WHO) (2015) finds that OOP payments as a proportion of private expenditure on health reach 77.6% in low-income countries.

[2] Recent examples of countries that have instituted SHIs include Ghana, Kenya, Nigeria, Tanzania, and Vietnam. Countries in the process of instituting SHIs include Cambodia, Laos, Malaysia, Zimbabwe, and South Africa. (Wagstaff, 2010).

[3] In a rural district of Northern Ghana, our study area, the annual fees and premiums of the SHI are about $5, and it covers almost 95% of disease conditions without deductibles or copayments. However, by the end of 2010, the total active membership reached only 34% of the total population (National Health Insurance Authority (NHIA), 2011).

[4] For example, Wagstaff et al. (2016) and Capuno et al. (2016) find subsidy and information do not successfully promote health insurance enrollment. Thornton et al. (2010) find subsidy increases short-term enrollment but does not increase health care service utilization.

care service utilization and health outcomes among the insured.[5] The screening effect by subsidy level has been studied for a few health products, such as malaria bed nets (Dupas and Cohen, 2010) and chlorine for water purification (Ashraf, Berry, and Shapiro, 2010) but has not been investigated in developing countries' health insurance setting.[6]

This study aims to fill this gap in the literature through a field experiment. Like Kremer and Miguel (2007) and Dupas (2014), we employ experimental variation in exposure to a health product and follow the behavioral response in the long run. We randomly provide three overlapping interventions in a rural district of Northern Ghana. The *Subsidy* intervention provides subsidy for the insurance premiums and fees for a one-year coverage. Subsidy levels are randomly selected from among one-third, two-thirds, and full subsidy. The *Campaign* intervention provides information on health insurance, including on registration, premiums, exemptions, and benefits through a community gathering at the village. The *Convenience* intervention provides an option for individuals to sign up in their community instead of traveling to the district capital. As a result, we have eight research groups with different combinations of treatments, including the control group. To measure the impact of these interventions, we conduct a baseline and two follow-up surveys seven months and three years after the initial intervention.

Through an experiment with short- and long-run follow-up surveys, we first study whether a subsidy for premiums and fees, an information campaign, and a convenient sign-up option promote health insurance enrollment in the short run. Second, we study whether a one-time intervention could have sustainable impacts on health insurance enrollment, health care service utilization, and health outcomes in the long run. Lastly, we study whether the level of subsidy affects health insurance enrollment, health care service utilization, and health status to shed light on the potential selection effect of level of subsidy in health insurance.

We find a significant increase in short-run insurance take-up. Those treated with at least one intervention are 28.8 percentage points (105%) more likely to enroll in health insurance in the short run. We also find a significant improvement in health care service utilization and health status

[5] In addition, as Dupas (2014) explains, the price level may affect the long-run adoption of health products through the "anchoring" mechanism, with which a previously encountered price may act as anchor and affect people's valuation of a product regardless of its intrinsic value.

[6] The burgeoning literature in developed countries, especially in the United States, has studied this topic extensively (see, for example, Einav, Finkelstein, and Levin, 2010 for a comprehensive overview).

in the short run. Among the three broad interventions, *Subsidy* is the most effective intervention in promoting enrollment and *Campaign* the least effective.

After three years from the initial intervention, we still observe increased long-run enrollment. Those treated are 18 percentage points (78%) more likely to enroll in health insurance, and those who enrolled in the short run (i.e., retention) are also more likely to enroll by 14.8 percentage points (37%). Insurance coverage has strong effects on health care service utilization in both the short and long runs. However, health improvements in the short run disappear in the long run. In addition, we find suggestive evidence of moral hazard that those covered by insurance are less likely to have bed nets for malaria prevention and to use safe water technologies in the long run. Lastly, we find some evidence of selection that sicker people are more likely to remain insured. Both the decreased investment in disease prevention and selection help explain the limited effect on health in the long run.

Specifying the amount of subsidy into three levels (i.e., one-third, two-thirds, and full subsidy) allows us to examine individuals' responses to price. First, we test whether the demand for health insurance in the short run depends on the amount of subsidy. We find that a one-third subsidy more than doubles short-run enrollment compared to a zero subsidy, a 38.4 percentage point increase. The marginal increases between a one-third and a two-thirds subsidy, and between a two-thirds and a full subsidy is smaller, with an 8.2 percentage point and a 5.3 percentage point increase, respectively. We then estimate how the short-run subsidy level affects long-run health insurance enrollment after the subsidy disappears. Even though long-run enrollment rates are mostly not statistically different by level of subsidy (14.6, 8.1, and 12.6 percentage points for the one-third, two-thirds, and full subsidy groups, respectively, compared to the control group), health care service utilization for those in the partial subsidy (positive price) group is higher compared to those in the full subsidy group, implying a significant screening effect by subsidy level.

Taken together, the empirical results suggest that even though short-term interventions successfully sustain health insurance enrollment in the long run, they do not successfully promote health statuses, especially among those with a full subsidy. Selection and behavioral responses to the interventions could be important to the long-run success of the health insurance.

Our study contributes to three strands of the literature. First, our study contributes to the broad empirical literature on the effects of health insurance coverage on health outcomes, which has so far produced mixed evidence. Thornton et al. (2010), Fink, Robyn, and Sauerborn (2013),

and King et al. (2009) do not find evidence that health insurance affects overall health care expenditure and health outcomes in Nicaragua, Burkina Faso, and Mexico, respectively.[7] However, Miller, Pinto, and Vera-Hernandez (2013) find that health insurance coverage improves health care service utilization and health outcomes in Colombia. In addition, Gruber, Hendren, and Townsend (2014) investigate Thailand's health care reform and find that increased access to healthcare among the poor could decrease infant mortality. In terms of OOP expenses, some studies observe no or negative (increasing) effects of insurance on such expenses (e.g., Thornton et al., 2010; Fink et al., 2013), while others find the opposite (e.g., Galárraga et al., 2010). Lastly, the existing literature on health insurance in developing countries mostly focus on short-run health effects.[8] To our knowledge, this study is the first to examine the effects of insurance coverage on both short- and long-run health outcomes in a low-income setting.

Second, our study contributes to the literature on the sustainability of health intervention programs. This study is, to our knowledge, among the first to document evidence on the long-run effects of interventions on insurance enrollment retention in a developing country. While the idea of promoting sustainability is attractive, in practice, sustainability is difficult to achieve. The challenges in promoting sustainable health insurance enrollment could be even more difficult because health care services in developing countries are generally of low quality and unreliable.[9] Some of the few studies on this topic include those by Kremer and Miguel (2007) and Dupas (2014). In contrast to Kremer and Miguel (2007), who find limited evidence that subsidy promotes long-run adoption of worm treatment, Dupas (2014) finds that a one-time subsidy may boost long-run adoption of malaria bed nets. It is important to note, however, that the long-run effect of a one-time health insurance intervention is quite different from those of the adoption of health products like worm treatment and malaria bed nets. Having health insurance does not necessarily mean improving health status. To be successful, health insurance enrollment should promote health care

[7] Further, Thornton et al. (2010) finds a substitution between use of health clinics covered by health insurance and those that are not covered, but overall utilization has not increased. King et al. (2009) find a decrease in catastrophic expenditure, but overall changes in health care service utilization are negligible.

[8] In the US setting, a RAND experiment reports insignificant effects of insurance coverage on average health outcomes but finds negative effects on health outcomes for the more vulnerable subgroups (Newhouse and the Insurance Experiment Group, 1993). Relatively recent studies find positive effects of exposure to public health insurance during childhood on various long-term health outcomes (Currie, Decker, and Lin, 2009; Wherry and Meyer, 2016; Boudreaux, Golberstein, and McAlpine, 2016).

[9] See, for example, Banerjee, Deaton, and Duflo, (2004), Goldstein, et al. (2013), and Das, et al.., (2016) for illustrations of low health care quality in developing countries. Alhassan et al. (2016) provides illustrations for Ghana.

service utilization and prevent moral hazard behaviors. In addition, learning the effects of other health products, such as deworming medicine, bed nets, and water disinfectants could be less setting-specific than in the case of health insurance, where quality of health care services could vary much across settings.

Third, our study complements a growing body of work explaining the role of pricing in take-up and use of health products and services in developing countries. We study whether the level of subsidy affects the characteristics of people who remain enrolled in health insurance in the long run. The effect of prices on utilization of health products and services has received considerable attention recently. While proponents of user fees argue that cost-sharing is necessary for the sustainability of the programs (World Bank, 1993; Easterly, 2006), there is a concern that even a small fee may prevent those most in need from purchasing the product. Recent studies aiming to test the existence of such screening effects of higher prices on health product utilization find mixed results. While Ashraf, Berry, and Shapiro (2010) find that high prices stimulate product use through a screening effect in chlorine for water sanitation, Cohen and Dupas (2010) find no effect of higher prices on the use of malaria bed nets.

The remainder of this paper is structured as follows. Section 2 outlines the research context, and Section 3 describes the experimental design and data. Section 4 presents the empirical strategy, and Section 5 presents the main results on the long-term effects of short-term promotion of health insurance enrollment. Section 6 presents the results on the impact of level of subsidy, and Section 7 concludes the paper.

2. Institutional Background

2.1. National Health Insurance Scheme (NHIS) in Ghana

The National Health Insurance Scheme (NHIS) in Ghana was established by the National Health Insurance Act (Act 560) in 2003. It aims to improve access to and the quality of basic health care services for all citizens, especially the poor and vulnerable (Ministry of Health, 2004). The law mandates that every citizen enroll in at least one scheme. However, in practice, there are no penalties for those who do not enroll. Most of the 170 administrative districts of Ghana operate their own District Mutual Health Insurance Scheme (DMHIS) (Gajate-Garrido and Owusua,

2013). [10] Each DMHIS accepts and processes applications, collects premiums (and fees), provides membership identification cards, and processes claims from accredited facilities for reimbursement.

Annual means-tested premiums, which are charged to informal sector workers, range from $5 to $ 32. However, owing to the lack of information on household incomes, rural districts tend to charge the lowest premiums, while urban districts charge higher premiums. Indigents, pregnant women, children under 18 years, and the elderly over 70 years are exempt from premiums but not registration fees.[11] All members, except for indigents and pregnant women, are required to pay registration fees when they first register and when they renew. Those who do not renew their membership by the due date pay penalties when they eventually renew their memberships.

The benefits package of the NHIS, which is the same across DMHISs, is very generous, albeit new members wait for three months before they can enjoy the insurance benefits. As described in Table A1, the package covers 1) full outpatient and inpatient (surgery and medical) treatments and services, 2) full payment for medications on the approved list, 3) payments for referrals on the approved list, and 4) all emergencies. The NHIA (2010) estimates that 95% of disease conditions that affect Ghanaians are covered by the scheme. Those who enrolled do not pay deductibles or copayments for health care service utilization by law; however, health care providers often charge unauthorized fees in what are inaccurately described as copayments, according to the USAID (2016).[12]

Despite the low premiums and generous benefits, enrollment in the NHIS remains low. By the end of 2010, the total active membership stood at 34% of the population of Ghana (NHIA, 2011). Enrollment is particularly low among the poorest. A 2008 nationwide survey found that only 29% of the individuals in the lowest wealth quintile were active members of the scheme

[10] There are three types of insurance schemes in Ghana: District Mutual Health Insurance Schemes (DMHIS), Private Mutual Health Insurance Schemes (PMHIS) and Private Commercial Insurance Schemes (PCHIS). The focus of this study is DMHIS, which explains 96 percent of insurance coverage (GSS, GHS and ICF, 2009). They are operated and subsidized by the government through the National Health Insurance Fund (NHIF). PMHIS are non-profit non-subsidized schemes run by NGOs, religious bodies and cooperative societies. PCHISs are for profit schemes that do not receive government subsidies.

[11] The law defines an indigent as "a person who has no visible or adequate means of income or who has nobody to support him or her and by the means test." Specifically, an indigent is a person who satisfies all of these criteria: i) unemployed and has no visible source of income, ii) does not have a fixed place of residence according to standards determined by the scheme, iii) does not live with a person who is employed and who has a fixed place of residence, and iv) does not have any identifiably consistent support from another person.

[12] http://www.africanstrategies4health.org/uploads/1/3/5/3/13538666/country_profile_-_ghana_-_us_letter.pdf

compared to 64% of households in the highest quintile (National Development Planning Commission, 2009).

In addition to the lack of affordability, negative perceptions toward the NHIS explain the low enrollment rate. For example, Alhassan et al. (2016) describe that those enrolled in the NHIS generally perceive they are not receiving good-quality health care, such as because of long waiting times and poor attitudes of health staff towards patients. Additionally, Fenny et al. (2016) observe that perceived quality of service and socio-cultural factors such as trust, bad attitude of health facility staff, and drug shortage contribute to low enrollment and retention rates in Ghana.

2.2. Setting

This study was conducted in Wa West, a poor and remote rural district in Northern Ghana (Figure A1). It covers an area of approximately 5,899 km^2 and had population of about 81,000 in 2010. Settlement patterns are highly dispersed, with a majority of residents living in hamlets of about 100-200 people. This high dispersion, coupled with the poor road network, makes traveling within the district difficult and expensive. The economy is largely agrarian, with over 90% of the population working as farmers. Estimates from the 2006 Ghana Living Standard Survey indicate that average per-capita income and health expenditure in a rural savannah locality like Wa West were about $252 and $26, respectively (Ghana Statistical Service, 2008).

In the study area, even though the Community-Based Health and Planning Services (CHPS) has increased accessibility to health care services,[13] there are only six public health centers and no tertiary health facility.[14] During the study period, the district had only 15 professional nurses and no medical doctor (Nang-Beifua, 2010). The district also has a high disease burden. The most common cause of outpatient visits in the region is malaria, which accounts for a third of outpatient visits. Other common causes of outpatient visits are acute respiratory-tract infections and skin diseases.

The Wa West DMIHS was introduced in January 2007. In 2011, it charged a uniform premium of $5.46 (GHC 8.20) for adults (18-69) and a processing fee of $2.60 (GHC 4) for first-time members and $0.60 (GHC 1) for renewals. Late renewals attracted a fee of $1.30 (GHC 2) in

[13] The CHPS is a community health facility that provides primary health care. It is located within rural communities with limited access to larger hospitals and is manned by nurses. Among the services it offers are treatment of common ailments (malaria and diarrheal diseases) and maternal and child care services.
[14] About 75% of the communities in the study sample are within 6 km (3.73 mi) of a health facility.

addition to full premiums for all years for which membership was not renewed.[15] The baseline enrollment rate in 2011 for the study sample is 21%.

3. Research Design

3.1. Interventions

To promote health insurance enrollment, we introduce three interventions: a subsidy for the insurance premiums and fees (*Subsidy*), an information campaign on the national health insurance (*Campaign*), and an option for individuals to sign up in their community instead of traveling to the district capital (*Convenience*), as shown in Figure 1. All interventions are randomized at the community level and effective only in the first year of the study.

The *Subsidy* intervention for insurance premiums and fees is provided to households in randomly selected communities. The level of subsidy is further randomized at the household level: one-third ($2.67), two-thirds ($5.40), or full ($8.13) subsidy. Subsidy is given in the form of vouchers, which are distributed between November 2011 and January 2012, with a two-month validity period and are redeemable at the Wa West DMHIS center. The voucher specifies the names, ages, and genders of all household members, expiration date, and place of redemption. Households that did not receive a full subsidy are informed about the extra amount needed to register all members.[16] Lastly, in all cases, children (aged 18 years and younger) and the elderly (aged 70 years and older) receive a full subsidy for registration fees, so the variation in subsidy level applies to adult household members only.

The *Campaign* intervention through a community gathering at the village assesses the impact of the lack of or incomplete information about the NHIS on enrollment. This intervention provides the following basic information on the NHIS: registration information, premiums, exemptions, benefits, and general education on the importance of being insured. For this intervention, trained fieldworkers visit randomly selected communities to provide information and

[15] The exchange rate at the time of the study was $1 = GHC 1.5.

[16] For one-third or two-thirds subsidy households, vouchers take one of two forms: specified and unspecified. If a household receives a specified subsidy voucher, its members are listed on the voucher, along with the specific amount of subsidy for each of them. Thus, reallocation of subsidy within a household is not possible. If a household receives an unspecified subsidy voucher, reallocation of subsidy is possible because the voucher only shows the total amount of subsidy for the whole household, not the specific amount for each member. Impacts on specified v.s. unspecified vouchers will be evaluated in another paper.

answer questions about the insurance scheme. Such communities are visited twice, with visits lasting from 9 AM to 5 PM, on different days of the week, each being seven days apart.

The *Convenience* intervention intends to reduce the cost of signing up for the NHIS stemming from long-distance travel. We allow residents of the randomly selected communities to sign up in their own community, instead of traveling to the DMHIS office in the district capital. For this intervention, an official from the Wa West DMHIS, accompanied by a fieldworker, visits randomly selected communities to register or renew memberships. They visit such communities twice, with each visit lasting from 9 AM to 5 PM, conducted on different days of the week, seven days apart. Each visit is pre-arranged with community leaders.

3.2. Data Collection

The study sample includes 4,625 individuals from 643 households in 60 communities. We restrict the sample to communities of 30-400 residents and that are at least 1 km from the nearest other community to minimize a potential spillover of the *Campaign* and *Convenience* interventions to neighboring communities.

We conduct a baseline survey in September 2011 and an intervention in October 2011. Two follow-up surveys were conducted after seven months and three years from the intervention. The baseline survey collects information on demographic characteristics, employment, health statuses, health care service utilization, enrollment in the NHIS, and health behaviors for all household members. To measure the respondents' familiarity with the NHIS, we collect information on the knowledge on the NHIS of the household head or an adult household member if the household head is absent.[17]

The first follow-up survey collects information on knowledge on the NHIS, health care service utilization, subjective and objective health statuses, and health behaviors. In the second follow-up survey, we collect similar sets of information as in the first follow-up survey but in greater detail to improve the quality of the data. For example, we ask for specific dates and the respondent's status for up to three episodes of several important illnesses, such as malaria, acute respiratory diseases, and skin diseases. As a result, there are some differences in the construction

[17] Questions on knowledge on the NHIS can be categorized into four main parts: questions on premiums (e.g., amount of premiums for children, adults, and seniors), benefits (e.g., whether one pays for consultations or X-rays), exemptions (e.g., whether children are exempt from paying premiums or fees), and others (e.g., frequency of membership renewals).

of short- and long-run utilization measures that prevent a direct comparison of health care service utilization of these survey periods.[18]

The main outcome variables of interest are health insurance enrollment, knowledge on the NHIS, health care service utilization, health behaviors, and health statuses.[19] Knowledge on the NHIS is the average of correct answers on 18 questions related to knowledge on premiums, benefits, exemptions, and other insurance-related topics. Third, health care service utilization is measured by health facility visits in the last four weeks and last six months, and health care facility visits for malaria. Subjective health status is measured by an indicator for whether the respondent reports being healthy or very healthy around the survey time. We also measure objective health status according to the following: i) the number of days an individual suffered an illness in the last four weeks, ii) an indicator for not being able to perform normal daily activities owing to such illness in the last four weeks, and iii) the number of days that an individual was unable to perform normal daily activities.[20] Health behaviors such as sleeping under bed nets and using safe water technologies are also measured.[21]

The attrition rate in the first follow-up survey is relatively low (4.6%) but increases in the second follow-up survey (22.4%), as shown in Table A2.[22] However, importantly, short- and long-run attrition rates are not systematically correlated with our interventions.

[18] The health facility visit variable in the first follow-up survey is constructed from the following question: "The last time (in the last four weeks/last six months) (NAME) was ill or injured, did he/she visit any health facility?" However, in the second follow-up survey, the same variable is constructed from questions about respondents' visits during illness episodes. For example, an individual is said to visit a health facility in the last six months if his/her illness episode occurred in the last six months and he/she sought treatment in the health facility. Thus, the magnitude of effects between short- and long-run are not directly comparable. Moreover, the last four weeks measure in the long run is taken from individuals' response in October 2014; because of the survey timing, there are many missing responses in November and December 2014. Similarly, our last six months measure in the second follow-up survey is based on the period from May 2014 to October 2014.

[19] Health insurance enrollment is measured at the individual level. Knowledge on the NHIS is measured for the household head. Subjective health status is restricted to those aged 18 years or older. Health behaviors are measured for those aged 12 years or older.

[20] This measure is similar to the Activities of Daily Living (ADLs) commonly used in the literature, although it is derived differently. In the literature, ADLs are usually constructed from asking respondents about their ability to perform basic daily activities such as self-feeding, ambulation, dressing, and undressing. The variables used here are derived from the following questions: "During the four weeks, did (NAME) have to stop his/her usual activities because of this (illness/injury)?" and "For how many days (in the last one month) was (NAME) unable to do his/her usual activities?" One advantage of this measure is that it is directly linked to illness/injury.

[21] We ask only about sleeping under a bed net in the baseline and short-run follow-up surveys but ask for more details on bed net and safe water technology use in the long-run survey.

[22] The main reasons for attrition in the first follow-up survey are deceased (17.78%), traveled (62.22%), relocated to other districts (14.07%), and others (5.93%).

3.3. Baseline Characteristics and Balance Test

Table 1 presents the summary statistics of baseline characteristics and balance test between the treatment and control groups. Columns 1, 3, and 5 report the total number of observations, and Columns 2, 4, and 6 reports the average characteristics for the entire sample, treatment, and control groups, respectively. The average respondent is about 23 years old, and 48% are male. Although 98% of the adult respondents had heard of the NHIS, on average, they only managed to answer 10 of 18 questions (59%) on their knowledge on the NHIS correctly. About 21% are enrolled in the NHIS at the baseline survey, and 38% have ever registered with the scheme. In terms of health characteristics, 12% report a sickness or injury in the last four weeks, about 8% visit a health facility in the last four weeks and 13% make a positive OOP health expenditure. The average household lives within 5.39 km of a health facility and 18.34 km from the district capital.

Our empirical approach requires a balance of baseline characteristics between the treatment and control groups that could affect outcome variables. To test this balance, Columns 7 to 13 compare each treatment group with the control group. Panels A, B, and C report the average values of the individual, household, and community characteristics. Overall, the treatment and control groups are reasonably balanced at the baseline. Only 2 (0.8%), 9 (3.7%), and 8 (3.4%) out of 238 t-tests for balance check are statistically significant at the 1, 5, and 10% levels, respectively, suggesting that our randomization is generally successful in creating balanced research groups. In addition, we find that health insurance enrollment and subsequent health outcomes differ by the level of initial subsidy. Table A3, which presents the results of the balance check by level of subsidy, confirms that the subsidy randomization went well.

4. Empirical Framework

To measure the effects of our intervention on various outcomes, we estimate two reduced-form equations. First, we estimate the effects of receiving any intervention as follows:

$$y_{ihc} = \beta_0 + \beta_1 Intervention_c + \theta X_{ihc} + \delta Z_{hc} + \omega V_c + \epsilon_{ihc} \quad (1)$$

where y_{ihc} denotes the outcomes for individual *i* of household *h* in community *c*. The outcomes of interest include NHIS enrollment, health care service utilization, health statuses, and health behaviors. $Intervention_c$ indicates an assignment to any intervention, namely *Subsidy*, *Campaign*, and *Convenience*. **X** denotes a vector of baseline individual covariates, such as indicator variables for the age dummies, gender, religion, ethnicity, and schooling. Household covariates **Z** includes household size and a wealth index indicator (poor third, middle third, and rich third).[23] Community covariates **V** includes distance to the nearest health facility and to the NHIS registration center. We also control for a baseline measure of the dependent variable to improve precision.[24] The results are robust when we exclude the baseline dependent variables (results not shown). Estimations employ a linear probability model, and the standard errors are clustered at the community level in all estimations. For each outcome, we present its short- and long-run estimations.

Next, we also estimate the effects of each original intervention, given by the reduced-form equation below:

$$y_{ihc} = \beta_0 + \beta_1 SUB_c + \beta_2 CAMP_c + \beta_3 CONV_c + \beta_4 CAMP \cdot CONV_c + \beta_5 SUB \cdot CONV_c + \beta_6 SUB \cdot CAMP_c + \beta_7 SUB \cdot CAMP \cdot CONV_c + \theta X_{ihc} + \delta Z_{hc} + \omega V_c + \epsilon_{ihc} \quad (2)$$

where SUB_c, $CAMP_c$, and $CONV_c$, refer to an indicator for being assigned to the *Subsidy*, *Campaign*, and *Convenience* interventions, respectively.

In addition, to obtain the effects of insurance coverage for compliers, we conduct a two-stage least squares (2SLS) regression, where the first-stage regression equation is Equation (2) with health insurance enrollment as the dependent variable. We estimate the following second-stage regression:

$$y_{ihc} = \alpha_0 + \alpha_1 Enrolled_{ihc} + \theta X_{ihc} + \delta Z_{hc} + \omega V_c + \epsilon_{ihc} \quad (3)$$

[23] The wealth index is obtained through a principal component analysis with dwelling characteristics (e.g., number of rooms and bedrooms in the house), enterprise (e.g., ownership of any private non-farm enterprise), livestock (e.g., number of chickens and pigs), and other assets (e.g., motorcycles and bicycles).

[24] One exception is knowledge on the NHIS. We do not include the baseline measure since the respondents of the baseline and follow-up surveys could differ. Again, knowledge on the NHIS is measured for the household head or an adult household member if the household head is absent.

where we instrument for the *Enrolled*. Then, we capture the local average treatment effect for those who enroll in the health insurance induced by our interventions.

5. Results: Promotion and Long-run Effects of Health Insurance

This section presents the empirical evidence on a variety of important responses to our interventions. We begin by demonstrating how much knowledge and take-up of NHIS enrollment changes over time. Next, we examine whether an increase in health insurance enrollment translated into health care service utilization, health statuses, and health behaviors.

5.1. Impacts on Insurance Take-up and Sustainability

Figure 2 illustrates the enrollment rates of the control and seven treatment groups at the baseline, short-run follow-up, and long-run follow-up surveys. In general, it shows that our interventions significantly promote enrollment in the short and long run even though the impacts attenuate over time. On average, the control group enrollment rates are about 20%, 27%, and 23% at the baseline, short-run follow-up, and long-run follow-up surveys, respectively. The corresponding numbers for the treated groups are 21%, 62%, and 43%, respectively.

The formal regression results are presented in Table 2. Columns 1 to 3 and Columns 4 to 7 present the short- and long-run impacts on enrollment, respectively. Columns 2 and 3 report the effects on enrollment among those who enrolled and did not enroll at the baseline survey, respectively. Columns 5 and 6 present the results on the sustainability of health insurance enrollment. The dependent variables for Columns 5, 6, and 7 are enrollment both in the short and long terms, enrollment at the second follow-up survey among those who are enrolled at the first follow-up survey, and enrollment at the second follow-up survey among those who are not enrolled at the first follow-up survey, respectively.

Our results show that the effects on enrollment attenuate but are sustained over time. As shown in Panel A, overall intervention increases insurance enrollment by 28.8 percentage points (105%) and the impacts are greater for those who are not enrolled at the baseline survey than those enrolled (Columns 2 and 3). Long-run enrollment also increases by 18 percentage points (78%), and the probability of enrollment both in the short and long runs increases by 15.6 percentage points (192 %) (Columns 4 and 5). The retention rate, that is, the long-run enrollment rate for those who are enrolled in the short run, is also high, as shown in Column 6. After three years, more than

50% of those are enrolled in the short run remain enrolled, and the share of those who remain enrolled is 14.8 percentage points higher in the treatment than the control group.[25]

Panel B shows the results from estimating Equation (2). We find that *Subsidy* is the most effective intervention in promoting short-run enrollment (Column 1). Moreover, those in the *Subsidy* treatment group are more likely to enroll both in the short and long runs (Columns 4 and 5, respectively). *Campaign* is also quite effective in promoting health insurance enrollment in the short run. Lastly, *Convenience* is not effective in promoting enrollment, at least in the short run (Column 1).[26] It is worthwhile to note that we are slightly under-powered in the regression analysis (the results of which are presented in Panel B) in the sense that the size of the standard errors is not small enough to capture the small effect (if any) of the intervention. For example, we are able to capture the causal impact of the *Convenience* intervention on short-run health insurance enrollment only if the change is greater than 13.1 percentage points (= 0.067 × 1.96). Similarly, we are not powered to test for potential complementarity effects in most specifications.

Columns 1 and 2 of Table A4 present the impacts on adult and children enrollment in the short run, respectively,[27] and similarly, Columns 7 and 8 show the long-run effects. The results confirm that the enrollment patterns between adults and children do not differ significantly: The impacts on enrollment among adult and children are similar in the short (29.7 and 27.9 percentage points, respectively) and long run (13.5 and 21.2 percentage points, respectively).

Lastly, we explore the heterogeneous responses to our interventions by baseline health statuses and health care service utilization to shed light on potential (adverse) selection, but we do not find significant differences, except for those with limited normal daily activities as shown in Table A5.

[25] This finding is in contrast to that of Thornton et al. (2010), who find no impact of subsidy on informal sector health insurance retention in Nicaragua.

[26] We find some evidence that the *Convenience* intervention increases enrollment in the long run (Column 4), but we do not have a clear explanation for this finding. This finding is possibly because those who are treated in the village may have created a personal relationship over time with the government field officers. This relationship may have increased the pressure against the treated to enroll in the long run but not in the short run.

[27] Children refer to household members younger than 18 years old. They are not necessarily children of the household head.

5.2. Impacts on Knowledge on Insurance Scheme

Although 98% of household head respondents report that they have heard about the NHIS at the baseline survey, much of their knowledge of the NHIS are inaccurate, as shown in Table 1. Columns 8 and 9 in Table 2 show the short- and long-run impacts of our intervention on knowledge on the NHIS, respectively.[28] Panel A shows that our intervention significantly improves the respondents' knowledge by a 0.54 standard deviation in the short run (Column 8), but this effect completely disappears in the long run (Column 9). Panel B shows the impacts on each combination of interventions. We do not find statistically significant changes from a single intervention,[29] however, most combinations of interventions have significant and large impacts on knowledge on the NHIS in the short run.[30]

Several factors may explain the promotion of NHIS knowledge in the short run: informational component of each intervention, interaction with NHIS officials during the registration process, and experience of health service utilization.[31] To shed light on this mechanism, we look at the impacts on each domain of knowledge on the NHIS (Columns 3 to 6 and 9 to 12 of Table A4). Panel A shows that an increase in NHIS knowledge is driven mainly by knowledge on premiums and their exemptions rather than knowledge on benefits. The results suggest that the informational component of an intervention or interaction with NHIS officials rather than service utilization are the main sources of NHIS knowledge in the short run.

[28] The knowledge score is the standardized average of correct answers on questions pertaining to knowledge on premiums, benefits, exemptions, and others.

[29] Again, we are underpowered since we detect an effect only if the *Campaign* intervention increases knowledge by at least a 0.51 (= 0.26 × 1.96) standard deviation. If *Campaign* does not result in changes in knowledge, it could be because the *Campaign* intervention is implemented through a community gathering, which is different from an intensive information session for each individual. Similarly, we are not powered to test for potential complementarity effects.

[30] Even though we do not find significant effects in the *Campaign* only group (Column 8), the enrollment rate in the *Campaign* only group increases in the short run (Column 1). One possible explanation for this finding is that we are underpowered to detect small changes in knowledge. Another possible explanation is that the *Campaign* intervention does not effectively promote knowledge itself, but may directly affect the attitude towards health insurance in the community and individual enrollment decisions. It is worth emphasizing that we only provide information through a community gathering, not exclusively to each household. As a result, our visit is less intense than an individual information session and as expected, generates less effective results. This result differs from that of, for example, Capuno et al. (2015), who find a positive and significant effect of randomly distributing brochures and showing videos individually via home visits on insurance enrollment.

[31] Health care benefits in health insurance are experience goods, which are defined as goods whose quality and characteristics can only be verified upon consumption (Nelson, 1970).

5.3. Impacts on Health Care Services Utilization

Table 3 presents the effects on the utilization of health care services in the short run (Columns 1 to 5) and long run (Columns 6 to 10). Panels A and B present short- and long -run outcomes. Each panel consists of 2SLS (Panels A1 and B1) and intention-to-treat (ITT) results (Panels A2 and B2). The ITT results of estimating Equation (2) are shown in Table A6. As we explain, the outcome variables are health facility visits in the last four weeks and six months, number of visits in the last four weeks, health care facility visits for malaria, and OOP expenditure.

We find that insurance coverage leads to an increase in utilization of health care services in both the short and long runs, which corresponds to the fact that health insurance enrollment is sustained in the long-run. It is worthwhile to note that an increase in health care service utilization in the long run is at least as high as that in the short run even though enrollment rate decreased. [32] This finding suggests potential selection in enrollment in the long run: those who utilize health care service actively are more likely to remain enrolled.

We also study the impacts on OOP expenses (Column 5). We find limited evidence that health insurance prevents OOP expenses both in the short and long runs.[33] There are a few possible explanations for this finding. First, as we describe earlier, most services are free under the NHIS, but health care providers often charge unauthorized fees as copayment. Second, medicine is often in short supply at the public health centers, and those who receive a diagnosis may purchase medicine from a private pharmacy. Third, those without health insurance often use traditional or herbal medicine, which is inexpensive,[34] and therefore, substitution from traditional medicine to formal health care does not decrease OOP expenses.

[32] Note that due to different variable constructions, short- and long-run outcomes are not directly comparable.

[33] The size effect in the short- and long-run are not directly comparable because the short- and long-run OOP expenses are constructed differently. In the short run, respondents were asked about more general OOP expenses, unlike in the long run, where OOP expenses only recorded those related to the treatment of several important illnesses (e.g., malaria, skin diseases, and acute respiratory infection). Specifically, for the short-run OOP expense, we use the individual's response from the following question: "On (NAME's) most recent visit to a health facility, did he/she pay any money from his/her own pocket at a health facility in the last six months?" On the other hand, to construct the long-run OOP expense, we use information on whether individuals made positive OOP expenses in each illness episode (i.e., malaria, acute respiratory infection, and skin diseases) that occurred in the last six months. The OOP for the last six months is constructed from the individual's response between May 2014 to October 2014. Thus, the respondents are more likely to report OOP expenses in the short run than in the long run.

[34] Indeed, only 13% of individuals made positive out-of-pocket expenses at the baseline survey.

5.4. Impacts on Health Statuses and Behaviors

Table 4 presents the effects on health status. Panel A1 shows that insurance coverage improves subjective and objective health status in the short run (Columns 1 to 4), but these effects disappear in the long run (Panel B1).[35] Specifically, those insured are more likely to have a healthy subjective health status and fewer sick days in the short run. Also, the number of inactive days (Column 4) decreases mainly owing to malaria (Column 7).[36] However, these positive health effects seem to disappear in the long run even though health insurance enrollment and healthcare service utilization continue to increase, as shown in Tables 2 and 3. Moreover, we find similar results for both adults and children, as shown in Table A8.

Panels A2 and B2 of Table 4, which show the ITT results, confirm a similar pattern: the emergence of short-run positive health effects (although mostly not statistically significant) dissipate in the long run. We even find negative health effects on number of sick days and daily activities in the long run (Columns 2 to 4 in Panel B2). Again, inactivity and the number of inactive days (Columns 3 and 4) increased mainly owing to malaria (Columns 6 and 7).

To help shed light on the lack of long-run health outcomes, we conduct several further analyses. First, we investigate individuals' health behaviors.[37] Table 5 reports the short-run estimation results on sleeping under bed nets (Column 1) and long-run results on bed net ownership (Column 2), sleeping under bed nets (Column 3), and use of safe water technologies (Column 4).[38] We find some suggestive evidence of moral hazard that may explain the absence of health effects in the long run. Panel A indicates that individuals with insurance coverage are less likely to have mosquito nets (Column 2), sleep under mosquito nets (Column 3), and use safe water technologies (Column 4).[39] The effects are relatively large. For example, those covered by insurance are 51.6 percentage points less likely to own bed nets (Column 2), which accounts for a 178% likelihood reduction relative to the uninsured. In addition, we restrict the sample to adult members who are asked about their subjective and objective health statuses and their health behaviors (Table A8) to

[35] ITT results of estimating Equation (2) are shown in Table A7

[36] Subjective health status is measured only for those aged 18 years and above.

[37] Health behaviors are measured only for those aged 12 years and above.

[38] We ask questions about ownership of bed nets and water sanitation only at the baseline and second follow-up surveys.

[39] Specifically, we ask, "Does your household member do anything to your water to make it safe to drink?" and if the answer is yes, we ask the specific technology they use, such as boil, bleach/chlorine/alloy, strain through a cloth, use water filter, solar disinfection, let it stand and settle, and others.

verify whether our interpretation holds for such a restricted sample. In general, the signs of the coefficients in Table 5 are similar to those in Table A8.[40,41]

5.5. Selection to the Health Insurance

In addition to moral hazard, selection into the health insurance may explain the absence of long-run health effects. If sicker people are more likely to remain enrolled in the long run, the difference in health status between the treatment and control groups may diminish. To gain insight on selection into the health insurance, we compare the characteristics of compliers, always takers, and never takers. The impacts we estimate are driven by compliers who enroll in health insurance due to our intervention. Following Almond and Doyle (2011) and Kim and Lee (2017), we calculate the mean characteristics and test the differences among compliers, always takers, and never takers. The compliers characteristic can be calculated as follows:

$$\text{E(X|compliers)} = \frac{Pc+P}{Pc} \times [\text{E(X|H=1, T=1)} - \frac{Pa}{Pc+Pa} \times \text{E(X|H=1, T=0)}] \quad (4)$$

where X denotes individual characteristics; H indicates health insurance enrollment; T indicates assignment to an intervention group; *Pa* is the proportion of always takers; *Pn* is the proportion of never takers; and $Pc = 1 - Pa - Pn$, assuming that there are no defiers (monotonicity assumption).[42] The estimated share of compliers, always takers, and never takers are 31.4%, 27.2%, and 41.4% in the short run, and 19.8%, 23.0%, and 57.2%, respectively.

Table 6 presents the summary statistics of the entire sample, compliers, always takers (in the control group), and never takers (in the treatment group) for short-run selection (Columns 1 to 4) and long-run selection (Columns 8 to 11). Columns 5 to 7 report the t-statistics for the mean

[40] Identification card manipulation is another possible, albeit unlikely, explanation. Even though a photo is required for the NHIS identification card, identity manipulation cannot be completely ruled out. For example, the biometric identity card, which limits the possibility for identity manipulation, was issued to NHIS members in 2013 but was only expanded to the Upper West region after our evaluation is completed in 2014. If non-NHIS members who are sick receive health benefits from medical services by using their relatives' or friends' identification cards, the difference in health status between the insured and uninsured could become smaller. Therefore, it may explain the lack of difference in health status by enrollment status.

[41] One may be concerned that those who use medical services and receive a diagnosis could be more aware of the times or periods they were sick, and this tendency explains the lack of health effects. However, this tendency should apply both in the short- and long-run health outcomes, and thus, it cannot explain why we find positive health outcomes in the short run but not in the long run.

[42] See Almond and Doyle (2011) and Kim and Lee (2017) for more detailed explanation.

comparison between compliers and always takers, compliers and never takers, and always takers and never takers in the short run. Columns 12 to 14 report similar statistics in the long run. We find that our treatments attract sicker people both in the short and long runs. For example, compliers are more likely to be ill and have limited daily activities in the last four weeks compared to never takers, and the differences are more significant in illness due to malaria.[43]

6. Results: Role of Subsidy Level in Demand of and Selection into Health Insurance

6.1. Price Elasticity of Demand for Health Insurance

Figure 3 shows the enrollment rates at the baseline, short-run follow-up, and long-run follow-up surveys by level of subsidy. In general, the enrollment rate increases with subsidy level, but the increase is largest between the control group and the one-third subsidy group in the short run. In the long run, the intervention group is still more likely to enroll in health insurance, but the differences between the one-third, two-thirds, and full subsidy groups become insignificant.

For the formal regression, we estimate the following reduced-form effect of each level of subsidy after excluding those who are in the *Campaign* only, *Convenience* only, and *Campaign* and *Convenience* groups:

$$y_{ihc} = \gamma_0 + \gamma_1 1/3 Subsidy_{ihc} + \gamma_2 2/3 Subsidy_{ihc} + \gamma_3 FullSubsidy_{ihc} + \theta X_{ihc} + \delta Z_{hc} + \omega V_c + \epsilon_{ihc} \quad (5)$$

where y_{ihc} denotes the outcomes for individual i of household h in community c. The standard sets of covariates, **X**, **Z**, and **V**, as in Equations (1), (2), and (3), are included. **X** further includes the treatment status of the *Campaign* and *Convenience* intervention.

Panel A of Table 7 summarizes the effects of subsidy on short- and long-run enrollment and health care service utilization. In general, subsidy increases health insurance enrollment significantly. Column 1 shows that receiving one-third, two-thirds, and full subsidy is associated

[43] Table A9 shows the results of the investigation of the determinants of health insurance retention decisions. It shows that those who are more likely to visit a health care facility are more likely to retain their health insurance (both in Panels A and B), and those who are sicker are more likely to retain their health insurance (Panel B).

with a 38.4, 46.6, and 51.9 percentage point, respectively, higher likelihood of enrolling in insurance than the control group in the short run.[44]

The short-run arc elasticities are large. Overall, when price decreases from $8.13 to $0, demand for health insurance increases from 27.1% to 74.9% (arc elasticity is 0.47).[45] The estimated arc elasticity is close to the elasticity of preventive health products in developing countries, such as, -0.6 for chlorine, a disinfectant that prevents water-borne diseases in Zambia (Ashraf, Berry, and Shapiro, 2010) and -0.37 for insecticide-treated bed nets for malaria prevention in Kenya (Cohen and Dupas, 2010). The estimated arc elasticity is also similar to that of preventive health products in developed countries, such as 0.17 and 0.43 for preventive health care in the United States (Newhouse and the Insurance Experiment Group, 1993) and 0.47 for cancer screening in Korea (Kim and Lee 2017).

It is worthwhile to note that we find a very large increase in enrollment between zero and one-third subsidy (full and two-thirds price) but no significant difference between two-thirds and full subsidy (one-third and zero price).[46] This finding differs from those of Thornton (2008) and Dupas (2014), who find a bigger decrease between zero and small non-zero prices. A possible explanation for this finding is the framing of the price of health insurance. Unlike in the work of Thornton (2008) and Dupas (2014), our *Subsidy* intervention focuses on the level of subsidy instead of the level of price, and, therefore, the largest response to the treatment is found between zero and a small (one-third) subsidy.

Further, the enrollment impact of *Subsidy* diminishes over time in general but is still economically significant (Column 6 of Panel A). The initial differences in enrollment rates by level of subsidy disappear. Even though the enrollment rate of the one-third subsidy group is lower than that of the two-thirds and full subsidy groups in the short run, the enrollment rate of the one-third subsidy group is at least as big as those of the two-thirds and full subsidy groups in the long run (Column 6 of Panel A).

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[44] The F-test shows that the impact on enrollment by subsidy level does not statistically differ between one-third and two-thirds, and full subsidy levels.

[45] Arc elasticity estimates were obtained by the following formula: $[(Y_a - Y_b)/(Y_a + Y_b)]/[(P_a - P_b)/(P_a + P_b)]$. The short-run arc elasticity estimates when price increases from $0 to $2.67, $2.67 to $5.40, and $5.40 to $8.13 are 0.01, 0.29, and 1.93, respectively. Comparing the arc elasticity in a zero price setting to those in other settings could be problematic because the denominator, $(P_a - P_b)/(P_a + P_b)$, is always 1 if $P_b = 0$. Moreover, people tend to treat a zero price not only as a decrease in cost but also as an extra benefit (Shampanier, Mazar, and Ariely, 2007). This must be interpreted with this caveat.

[46] A formal F-test of equality of the effects of two-thirds subsidy and full subsidy yields p-value of 0.328.

6.2. Screening

Next, Table 7 presents the screening effects of subsidy level on health care service utilization (Panel A) and health statuses and behaviors (Panel B). For the sake of statistical power, we also present the results when the one-third and two-thirds subsidy groups are combined (Panels A2 and B2). We find no evidence of the screening effect that the health care service utilization depends upon the price paid for health insurance in the short run (Columns 2 to 4 of Panel A). However, in the long run, those in the partial subsidy (positive price) group are more likely to utilize health care services than those in the full subsidy group (Columns 7 to 9 of Panel A) even though the long-run health insurance enrollment rate does not differ across subsidy levels. Together, these results suggest selection in health insurance by health care service utilization in the long run, but not in the short run, which is confirmed by the results in Table A10. We find no evidence of health status improvement in the long run, especially in the two-thirds subsidy group (Columns 6 to 9 of Panel B1). The pattern that long-run increase in health care service utilization does not translate to health improvement corresponds to the results discussed in Sections 5.3 and 5.4.

7. Conclusion

This study examines whether one-time short-run interventions could have sustainable impacts on health insurance enrollment, health care service utilization, and health outcomes in the long run. In addition, we study the role of pricing in health insurance by measuring important behavioral responses to different levels of subsidy (i.e., one-third, two-thirds, and full subsidy). In Northern Ghana, we implement three randomized overlapping interventions to promote health insurance enrollment: subsidy, information campaign, and convenient sign-up option. We then use the resulting variation in insurance coverage to estimate the effect of insurance coverage on utilization of health care services, OOP expenses, and health statuses and behaviors.

We highlight two main findings. First, our interventions significantly promote enrollment in the short run, and while the impacts attenuate, they remain three years after the initial intervention implementation. Insurance coverage leads to increased utilization of health care services in both the short and long runs. However, improved health status in the short run completely disappears in the long run. This finding can partly be explained by the moral hazard

behavior that those insured are less likely to invest in malaria and diarrhea prevention, as well as the selection effect that sicker people are more likely to remain insured. In sum, we find evidence of sustainability in health insurance enrollment but not in health status promotion. Critics of the Ghanaian NHIS have argued that the scheme is overly generous and financially unsustainable because of the huge percentage of NHIS members under premium exemption without co-payment (Alhassan et al, 2016). Moral hazard and selection may negatively affect the financial sustainability of the system.

Second, we find evidence that selection by level of subsidy may have important implications. Specifically, we find that the long-term effect of intervention of health insurance rates are similar across levels of subsidy, but the positive price group use health care services more than the full subsidy group, suggesting that the positive price for health insurance attracts people who are more likely to use health care services (selection effect). However, we do not observe positive health outcomes in the positive price group in the long run.

Would the results from a study of health insurance in Ghana apply to health insurance in other developing countries? As we mention earlier, the general impression of health care services under Ghana's NHIS is not positive, implying that the long-term take-up of health insurance and service utilization would be higher in a setting with better health care services. However, selection and behavioral responses are difficult to predict since high-quality health care services may have better educational components, but they may also increase moral hazard.

Taken together, these findings highlight that even though short-run interventions successfully increase health insurance enrollment, their long-run success in promoting health statuses could depend upon behavioral responses, such as selection and investment in health. Our findings suggest that as health insurance continues to be introduced in developing counties, careful enforcement of mandatory health insurance enrollment to prevent selection and policies to encourage desirable health behaviors need to be considered.

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Figures and Tables

Figure 1: Study Design

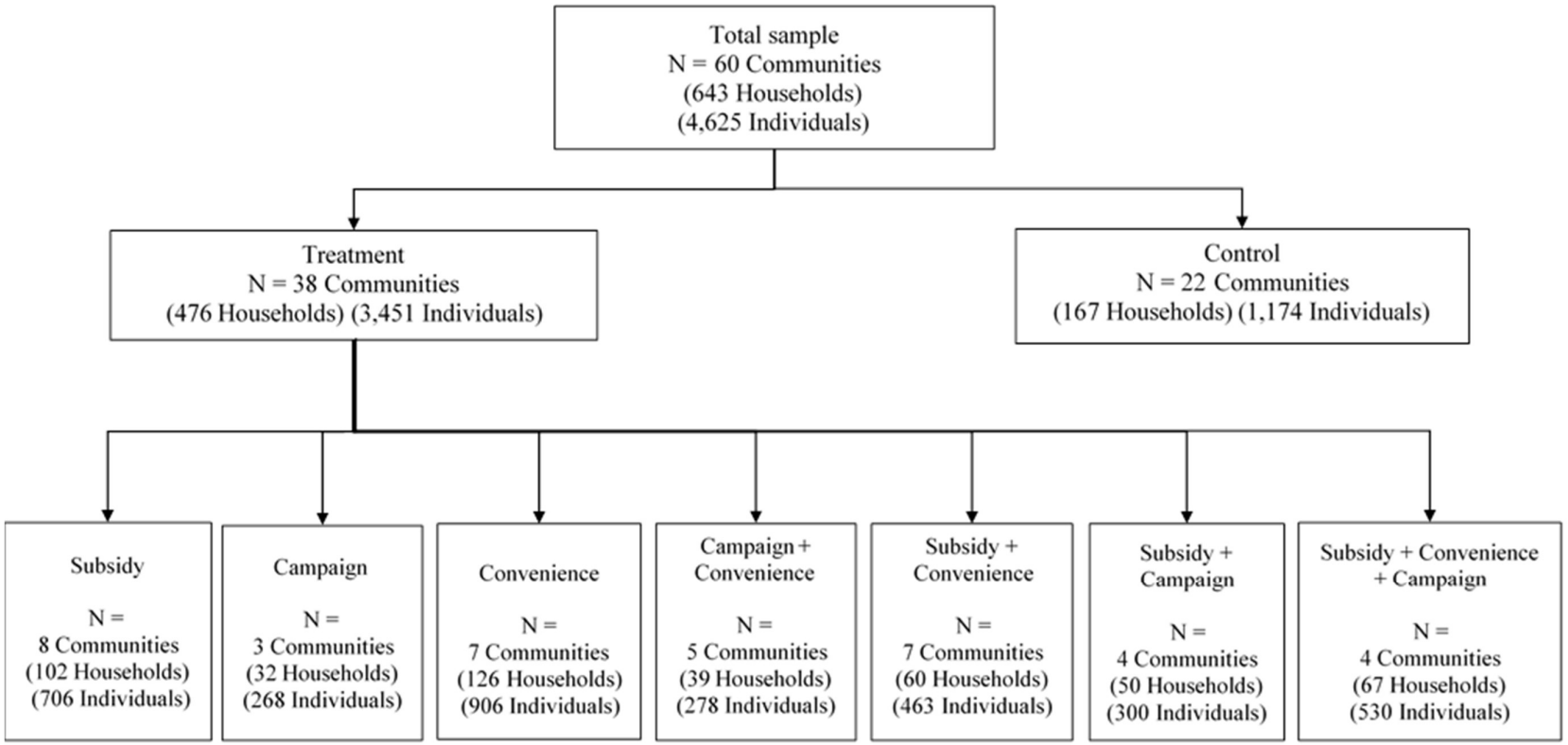
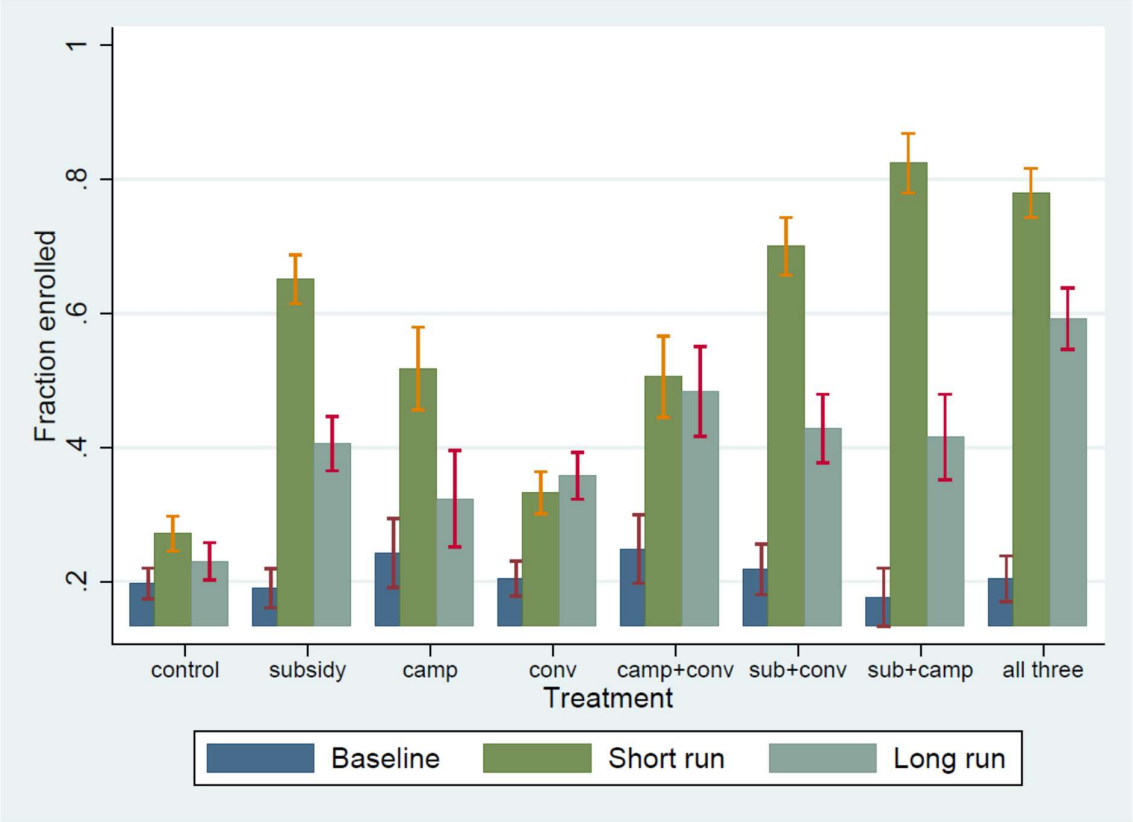
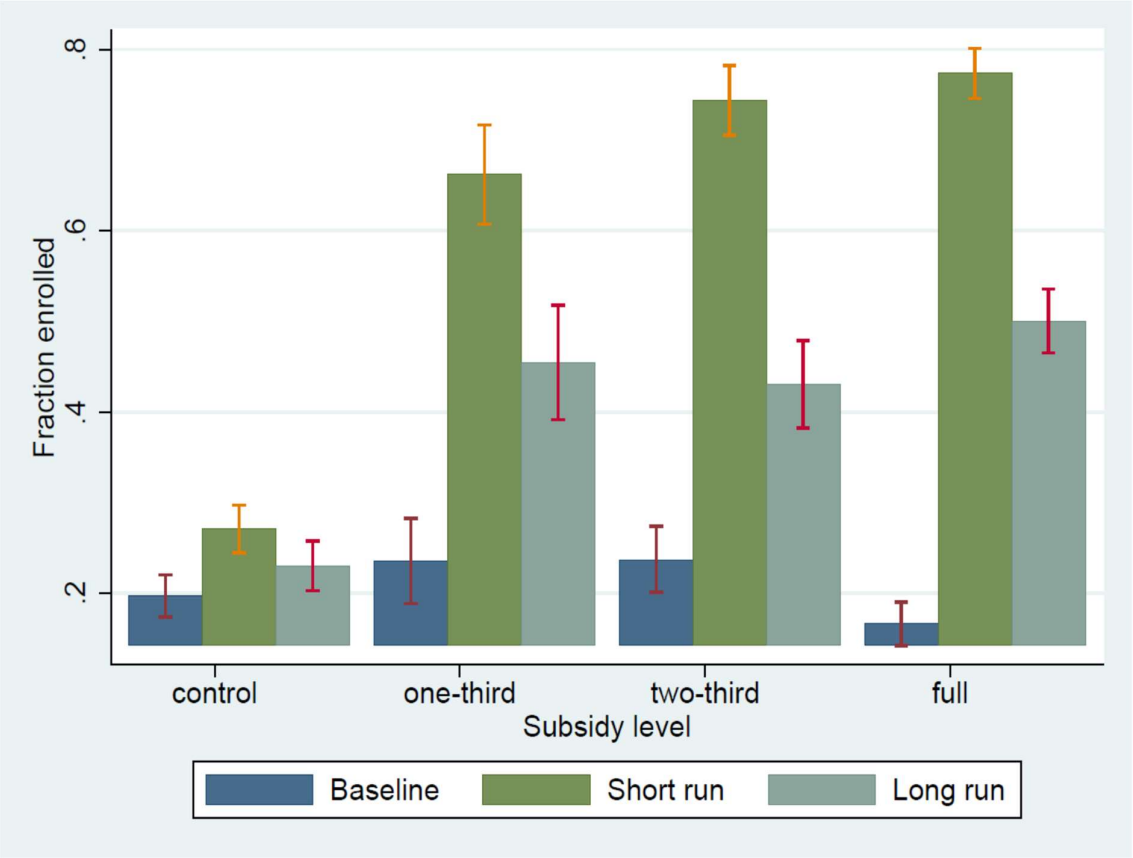


Figure 2: Enrollment Rate by Intervention Status at Baseline, Short Run, and Long Run



Notes: This figure shows means of enrollment rates by each study group at baseline, short run, and long run. The vertical lines indicate 95% confidence intervals.

Figure 3: Enrollment Rate by Subsidy Level at Baseline, Short Run, and Long Run



Notes: This figure shows means of enrollment rates of each subsidy-level group at baseline, short run, and long run. Sample includes those who received subsidy and the control group. The vertical lines indicate 95% confidence intervals.

Table 1: Baseline Characteristics by Study Group

Variable	N	All	N	Treatment	N	Control	Difference between treatment and control						
							Sub only	Camp only	Conv only	Camp + Conv	Sub + Conv	Sub + Camp	Sub + Camp + Conv
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Panel A: Individual Characteristics													
Age	4625	23.31	3451	22.96	1174	24.31	-0.839	-1.660	-2.160	-0.853	-1.929	1.080	-1.619
Male	4625	0.48	3451	0.48	1174	0.48	0.015	0.014	-0.014	0.025	-0.020	0.021	0.036
Christian	4625	0.43	3451	0.45	1174	0.37	0.073	-0.052	0.083	0.131	-0.025	0.29*	0.070
Dagaaba (ethnic group)	4625	0.53	3451	0.55	1174	0.46	0.028	0.471*	-0.010	0.160	0.041	0.348	0.053
Has some formal education	4625	0.33	3451	0.32	1174	0.34	-0.026	-0.072	0.017	-0.136*	-0.041	-0.074	0.099
Has a health condition (≥ 6 months)	4625	0.07	3451	0.07	1174	0.07	-0.007	-0.013	0.007	-0.015	0.012	-0.012	-0.010
Probably sick next year	4409	0.45	3269	0.45	1140	0.46	-0.007	-0.096	0.008	-0.041	0.031	-0.031	-0.065
Overall illness													
Ill in the last month	4624	0.12	3450	0.13	1174	0.10	0.035	0.048	-0.013	0.071	0.029	0.022	0.014
No. of days ill in the last month	4590	0.94	3428	0.97	1162	0.85	0.297	0.071	0.033	0.184	0.428	0.119	0.114
Could not do normal activities in the last month	4574	0.08	3411	0.08	1163	0.06	0.034	0.045	0.0001	0.032	0.045	0.018	0.018
No. of days could not perform normal activities in the last month	4412	0.50	3290	0.51	1122	0.48	0.141	0.0002	-0.136	0.191	0.093	0.123	-0.039
Malaria													
Ill in the last month	4573	0.05	3417	0.05	1156	0.04	0.026	0.034	-0.018	-0.007	0.053*	0.005	-0.005
No. of days ill in the last month	4547	0.25	3399	0.26	1148	0.22	0.139	0.047	-0.015	-0.061	0.290	0.019	-0.033
Could not do normal activities in the last month	4574	0.03	3411	0.028	1163	0.02	0.024	0.026	-0.005	0.001	0.033**	0.008	0.009
No. of days could not perform normal activities in the last month	4412	0.14	3290	0.15	1122	0.13	0.059	0.089	-0.056	-0.028	0.120	0.040	0.004
Visited health facility in the last month	3,904	0.04	3,020	0.04	884	0.04	0.005	0.032	-0.009	0.002	0.029	0.045	-0.0191
Visited health facility in the last six months	4,625	0.08	3,451	0.08	1,174	0.07	-0.002	0.012	-0.010	-0.007	0.052	0.032	-0.0194
Number of visits in the last month	3,933	0.07	3,043	0.07	890	0.06	-0.009	0.026	0.017	0.005	0.042	0.049	-0.020
Visited health facility in the last month for malaria treatment	3,904	0.01	3,020	0.01	884	0.01	0.003	0.027	-0.009	-0.007	0.017	-0.001	-0.011
Made out of pocket expense in the last six months	4625	0.13	3451	0.13	1174	0.13	0.007	-0.077	-0.010	0.054	0.005	0.007	-0.014
Ever enrolled in NHIS	4625	0.38	3451	0.41	1174	0.30	0.075	0.243**	0.033	0.231**	0.182*	0.055	0.091
Currently enrolled in NHIS	4625	0.21	3451	0.21	1174	0.20	-0.007	0.046	0.007	0.051	0.021	-0.020	0.007
Slept under mosquito nets (12 years old or older)	2667	0.53	1968	0.56	699	0.45	0.089	0.317**	0.009	0.305**	0.238*	0.259**	-0.097
Use safe drinking water technology (12 years old or older)	1,775	0.02	1,343	0.011	432	0.039	-0.029	-0.023	-0.039	-0.0004	-0.039	-0.025	-0.032
Panel B: Household Characteristics													
HH Size	643	7.06	478	7.10	165	6.93	-0.033	1.188	-0.162	-0.153	0.817	-0.933	1.052
Number of children under 18	643	4.01	478	4.09	165	3.75	0.059	1.430*	0.375	-0.117	0.715	-0.652	0.890
Male head HH	645	0.81	480	0.80	165	0.81	0.005	0.088	-0.146**	0.082	0.057	0.005	0.046
Owns farming land	592	0.49	442	0.50	150	0.49	0.161	0.013	-0.016	-0.066	0.061	-0.237*	0.029
Owns mosquito net	499	0.69	394	0.70	105	0.67	-0.010	0.185	-0.009	0.126	0.140	0.125	-0.135
Heard of NHIS	710	0.98	522	0.99	188	0.96	0.034	0.043	0.021	0.043	0.043	0.042	0.043
Knowledge about NHIS	643	0.59	475	0.60	168	0.58	0.010	0.025	0.002	0.088**	-0.0001	0.002	0.007
Household assets (principal component score)	643	0.01	478	0.04	165	-0.08	-0.060	0.726	-0.470	0.191	-0.185	1.047***	0.569
Panel C: Community Characteristics													
Distance to NHIS regist (km)	4625	18.34	3451	17.65	1174	20.37	2.712	0.604	-13.532***	12.445**	-0.956	7.261	-8.296
Distance to health fac (km)	4625	5.39	3451	5.46	1174	5.17	-0.429	-1.626	0.336	1.792	0.737	-0.230	1.309
Observations (N)	**4625**		**3451**		**1174**		**706**	**268**	**906**	**278**	**463**	**300**	**530**

Notes: This table reports means for selected baseline variables. *Sub, Camp, and Conv* refers an indicator for being assigned to subsidy, campaign, and convenience interventions, respectively. Panel A, B, and C summarizes individual, household, and community level information, respectively. Columns 1 and 2, Columns 3 and 4, and Columns 5 and 6 show a summary for whole sample, treatment, and control groups, respectively. Columns 7 to 12 report mean differences between each treatment and the control group. All tests of differences adjust standard errors for intra-cluster (intra-village) correlation. *, **, and *** denote statistical significance at 10 %, 5 %, and 1 %. levels, respectively.

Table 2: Effects on Enrollment and Knowledge on NHIS

Dependent Variable	Enrollment							Knowledge	
	Short-run	Short-run	Short-run	Long-run	Both short and Long run[a]	Long-run	Long-run	Short-run	Long-run
Sample	Whole	Enrolled in baseline	Not enrolled in baseline	Whole	Whole	Enrolled in short run (at 1st follow-up)	Not enrolled in short run (at 1st follow-up)	Whole	Whole
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A									
Any Intervention	0.288***	0.132	0.329***	0.180***	0.156***	0.148*	0.107**	0.539***	-0.212
	(0.051)	(0.080)	(0.061)	(0.049)	(0.033)	(0.076)	(0.052)	(0.164)	(0.227)
R-squared	0.230	0.210	0.214	0.137	0.137	0.140	0.143	0.190	0.196
Panel B									
Subsidy only	0.398***	0.199**	0.444***	0.153**	0.168***	0.102	0.066	0.533*	-0.435*
	(0.044)	(0.085)	(0.049)	(0.072)	(0.061)	(0.100)	(0.054)	(0.288)	(0.250)
Campaign only	0.174**	0.065	0.199**	0.047	0.008	0.104	-0.031	0.010	0.534*
	(0.078)	(0.101)	(0.083)	(0.068)	(0.030)	(0.070)	(0.061)	(0.260)	(0.282)
Convenience only	0.010	0.162	-0.034	0.204***	0.123***	0.322***	0.092	0.426	-0.726**
	(0.067)	(0.110)	(0.068)	(0.073)	(0.046)	(0.105)	(0.072)	(0.269)	(0.325)
Campaign & Convenience	0.231	0.143	0.256	0.176	0.149	0.196*	0.131	0.904***	0.193
	(0.163)	(0.136)	(0.191)	(0.154)	(0.116)	(0.110)	(0.177)	(0.245)	(0.459)
Subsidy & Convenience	0.339***	0.065	0.418***	0.153**	0.127**	0.092	0.201	0.237	0.111
	(0.074)	(0.093)	(0.087)	(0.061)	(0.060)	(0.099)	(0.131)	(0.207)	(0.380)
Subsidy & Campaign	0.527***	0.142	0.608***	0.093	0.131*	-0.074	0.199*	0.829***	0.073
	(0.070)	(0.106)	(0.078)	(0.100)	(0.066)	(0.135)	(0.102)	(0.154)	(0.557)
Subsidy & Camp & Conven	0.466***	0.069	0.568***	0.403***	0.384***	0.369***	0.226***	0.871***	-0.110
	(0.063)	(0.109)	(0.064)	(0.084)	(0.074)	(0.110)	(0.067)	(0.234)	(0.367)
R-squared	0.303	0.219	0.331	0.160	0.173	0.180	0.155	0.226	0.264
Mean	0.505	0.753	0.443	0.379	0.214	0.511	0.241	-0.003	-0.004
Control group mean	0.272	0.651	0.179	0.230	0.081	0.393	0.171	-0.383	0.167
Number of observations	4,380	885	3,495	3,590	4,400	1,845	1,721	602	578
F-test (Prob > F)									
Sub = Camp	0.005	0.128	0.004	0.265	0.029	0.982	0.180	0.117	0.000
Sub = Conv	0.000	0.711	0.000	0.600	0.585	0.113	0.732	0.768	0.370
Sub = Sub + Camp	0.071	0.531	0.037	0.604	0.665	0.228	0.205	0.313	0.342
Sub = Sub + Conv	0.404	0.057	0.769	0.995	0.631	0.934	0.333	0.325	0.135
Sub = Sub + Camp + Conv	0.273	0.148	0.068	0.019	0.033	0.049	0.027	0.318	0.338
Sub+Camp = Sub&Camp	0.671	0.364	0.756	0.410	0.592	0.075	0.150	0.474	0.965
Sub+Conv = Sub&Conv	0.466	0.023	0.939	0.066	0.075	0.025	0.776	0.069	0.006

Notes: Knowledge on NHIS was measured only for household heads. Knowledge scores are standardized. All regressions include a standard set of covariates (individual, household, and community) and baseline measure of dependant variable. For knowledge on NHIS (Column 8 and 9), baseline measure of dependant variable were not included since respondants could be different between baseline and follow-up surveys. Robust standard errors clustered at community level are reported in parantheses. Results of F tests (p-values) for the equality of effect estimates for various pairs of treatment groups are also presented. *, **, and *** denote statistical significance at 10 %, 5 %, and 1 % levels, respectively.

Table 3: Effects on Utilization of Healthcare Services

Dependent Variable	Visited health facility in last four weeks	Visited health facility in last six months	# of visits in last four weeks	Visited Facility for malaria treatment in the last four weeks	Made an out-of-pocket for health service in the last six months
	(1)	(2)	(3)	(4)	(5)
Panel A: Short run outcomes					
Panel A1: 2SLS results					
Enrolled in NHIS	0.033	0.183***	0.069	0.040*	0.052*
	(0.033)	(0.054)	(0.049)	(0.024)	(0.027)
First-stage F-statistics	19.29	15.61	19.37	17.87	15.22
Panel A2: ITT results					
Any Intervention	0.006	0.032	0.012	0.006	-0.008
	(0.013)	(0.019)	(0.016)	(0.007)	(0.012)
R-squared	0.091	0.092	0.041	0.038	0.056
Control group mean	0.038	0.102	0.032	0.019	0.046
Number of observations	3,477	4,285	3,476	3,629	4,413
Panel B: Long run outcomes					
Panel B1: 2SLS results					
Enrolled in NHIS	0.083**	0.244***	0.080**	0.063*	0.021
	(0.041)	(0.074)	(0.040)	(0.035)	(0.029)
First-stage F-statistics	33.06	40.75	34.55	32.40	42.87
Panel B2: ITT results					
Any Intervention	0.030***	0.058***	0.026***	0.022***	0.007
	(0.008)	(0.016)	(0.007)	(0.007)	(0.006)
R-squared	0.058	0.064	0.042	0.042	0.060
Control group mean	0.017	0.050	0.036	0.010	0.013
Number of observations	3,616	4,256	3,640	3,616	4,256

Notes: Panels A and B report short-run and long-run estimation results, respectively. All regressions include a standard set of covariates (individual, household, and community) and baseline measure of dependant variable. Robust standard errors clustered at community level are reported in parantheses. *, **, and *** denote statistical significance at 10 %, 5 %, and 1 % levels, respectively.

Table 4: Effects on Health Status

	Overall Illness				Illness Due to Malaria		
	Healthy or very healthy	# Days ill last four weeks	Could not perform normal daily activities due to illness last four weeks	# days could not perform normal daily activities in the four weeks	# Days ill four weeks	Could not perform normal daily activities due to illness four weeks	# days could not perform normal daily activities in the four weeks
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: Short run outcomes							
Panel A1: 2SLS results							
Enrolled in NHIS	0.128**	-0.822***	0.034	-0.368	-0.100	0.012	-0.391*
	(0.058)	(0.235)	(0.040)	(0.550)	(0.079)	(0.019)	(0.237)
First-stage F-statistics	27.37	15.59	15.04	15.930	15.7764	15.59	16.38
Panel A2: ITT results							
Any Intervention	0.067*	-0.126	0.007	-0.020	-0.007	0.004	-0.097
	(0.037)	(0.111)	(0.016)	(0.277)	(0.039)	(0.007)	(0.115)
R-squared	0.132	0.051	0.090	0.142	0.047	0.035	0.038
Control group mean	0.817	0.617	0.081	1.379	0.123	0.022	0.343
Number of observations	1,326	4,354	4,354	4,201	4,304	4,330	4,173
Panel B: Long run outcomes							
Panel B1: 2SLS results							
Enrolled in NHIS	0.122	0.575	0.082**	0.581*	0.377	0.070*	0.545**
	(0.154)	(0.374)	(0.040)	(0.313)	(0.280)	(0.037)	(0.252)
First-stage F-statistics	36.21	42.12	42.44	42.07	41.07	42.51	42.52
Panel B2: ITT results							
Any Intervention	-0.080**	0.185**	0.027***	0.153**	0.120*	0.026***	0.142***
	(0.039)	(0.080)	(0.007)	(0.058)	(0.060)	(0.006)	(0.041)
R-squared	0.242	0.055	0.054	0.039	0.054	0.051	0.048
Control group mean	0.791	0.413	0.013	0.096	0.244	0.081	0.043
Number of observations	1,074	4,227	4,214	4,065	4,186	4,214	4,065

Note: Questions on self-reported health are restricted to household members aged 18 years old and over (Column 1). Panels A and B report short-run and long-run estimation results, respectively. Columns 1-4 report health outcomes caused by overall illness. Columns 5 – 7 report health outcomes casued by malaria. All regressions include a standard set of covariates (individual, household, and community) and baseline measure of dependant variable except for subjective health status. Robust standard errors clustered at community level are reported in parantheses. *, **, and *** denote statistical significance at 10 %, 5 %, and 1 % level respectively.

Table 5: Effects on Health Behavior

Dependent Variable	Short run	Long run		
	Sleep under mosquito nets	Have mosquito nets	Sleep under mosquito nets	Water safe to drink
	(1)	(2)	(3)	(4)
Panel A: 2SLS results				
Short-run enrollment in NHIS	0.175	-0.516***	-0.304	-0.181*
	(0.158)	(0.178)	(0.205)	(0.102)
First-stage F-statistics	18.60	36.26	39.92	29.01
Panel B: ITT results				
Any Intervention	0.069	-0.001	0.041	-0.067*
	(0.067)	(0.088)	(0.067)	(0.039)
R-squared	0.237	0.222	0.158	0.182
Control group mean	0.447	0.290	0.661	0.080
Number of observations	2,225	1,680	1,770	723

Note: Health behaviors were measured for those aged 12 years and above. Dependent variable in Column 4 is an indicator variable of whether a household member does anything to their water to make it safe to drink. All regressions include a standard set of covariates (individual, household, and community) and baseline measure of dependant variable. Robust standard errors clustered at community level are reported in parantheses. *, **, and *** denote statistical significance at 10 %, 5 %, and 1 % level respectively.

Table 6: Characteristics of Compliers, Always Takers, and Never Takers

	Short-run							Long-run						
	Mean				t-stat			Mean				t-stat		
	Total	Complier	Always	Never	C=A	C=N	A=N	Total	Complier	Always	Never	C=A	C=N	A=N
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Proportion	100	31.4	27.2	41.4				100	19.8	23.0	57.2			
Age	23.31	23.12	20.48	23.84	2.47	-1.25	-2.77	23.31	18.13	21.46	25.54	-2.34	-13.97	-2.68
Male	0.48	0.52	0.47	0.48	1.55	2.90	-0.16	0.48	0.51	0.44	0.50	1.91	0.40	-1.66
Christian	0.43	0.40	0.51	0.45	-3.73	-3.29	1.98	0.43	0.40	0.53	0.41	-3.78	-0.83	3.28
Dagaaba (ethnic group)	0.53	0.64	0.54	0.48	3.47	12.32	2.10	0.53	0.67	0.53	0.48	3.81	15.10	1.39
Has some formal education	0.33	0.37	0.35	0.28	0.70	7.61	2.44	0.33	0.39	0.35	0.30	1.03	7.65	1.52
Has a health condition (≥ 6 months)	0.07	0.08	0.05	0.07	1.90	1.11	-1.14	0.07	0.05	0.07	0.08	-1.09	-4.40	-0.56
Probably sick next year	0.45	0.38	0.54	0.44	-4.45	-9.42	2.73	0.45	0.42	0.46	0.44	-2.05	-2.94	0.95
Illness														
Ill in the last four weeks	0.12	0.15	0.11	0.11	2.28	5.20	0.13	0.12	0.13	0.17	0.10	-1.63	3.66	2.57
No. of days ill in the last four weeks	0.94	1.30	0.75	0.83	3.24	5.36	-0.42	0.94	1.06	1.05	0.93	0.06	1.40	0.42
Could not do normal activities in the last four weeks	0.08	0.13	0.04	0.07	7.65	7.66	-2.43	0.08	0.09	0.10	0.07	-0.37	2.08	0.98
No. of days could not perform normal activities in the last four weeks	0.50	0.80	0.33	0.37	3.82	10.39	-0.29	0.50	0.32	0.68	0.48	-1.65	-2.75	0.87
Illness due to Malaria														
Ill in the last four weeks	0.05	0.05	0.05	0.04	-0.11	2.60	1.07	0.05	0.06	0.08	0.03	-1.27	6.51	2.61
No. of days ill in the last four weeks	0.25	0.35	0.32	0.18	0.38	6.10	1.48	0.25	0.31	0.53	0.18	-1.23	3.63	1.89
Could not do normal activities in the last four weeks	0.03	0.04	0.02	0.03	3.84	4.48	-1.05	0.03	0.06	0.03	0.02	2.58	12.08	0.83
No. of days could not perform normal activities in the last four weeks	0.14	0.17	0.16	0.12	0.15	2.16	0.53	0.14	0.16	0.31	0.09	-0.91	3.84	1.30
Visited health facility in the last four weeks	0.04	0.05	0.05	0.03	0.41	4.71	1.13	0.04	0.03	0.06	0.03	-1.68	-0.32	1.54
Visited health facility in the last six months	0.08	0.10	0.09	0.05	0.60	7.78	2.11	0.08	0.07	0.13	0.06	-2.74	1.99	3.11
Number of visits in the last four weeks	0.07	0.07	0.08	0.06	-0.26	1.54	0.71	0.07	0.05	0.10	0.06	-1.28	-0.40	1.14
Visited health facility in the last four weeks for malaria treatment	0.01	0.02	0.01	0.00	1.66	7.43	0.62	0.01	0.01	0.03	0.01	-1.43	2.93	1.84
Made out of pocket expense in the last six months	0.13	0.13	0.12	0.13	0.54	0.40	-0.31	0.13	0.11	0.16	0.13	-1.96	-2.63	1.04
Ever enrolled in NHIS	0.38	0.42	0.65	0.25	-8.67	15.00	13.40	0.38	0.55	0.41	0.37	4.28	15.96	1.07
Currently enrolled in NHIS	0.20	0.11	0.47	0.11	-12.96	0.04	12.13	0.20	0.24	0.30	0.16	-2.06	8.54	4.29
Slept under mosquito nets (12 years old or older)	0.53	0.67	0.45	0.53	5.65	8.73	-1.70	0.53	0.70	0.53	0.53	3.57	11.47	0.04

Note: This table presents the mean characteristics of the entire sample, compliers and always takers, and never takers. The mean characteristics of compliers are estimated from Eq. (4). Columns 5-7 and 12-14 present the t-statistics from the two-sample t-test comparing compliers with always takers, compliers with never takers, and always takers with never takers, respectively.

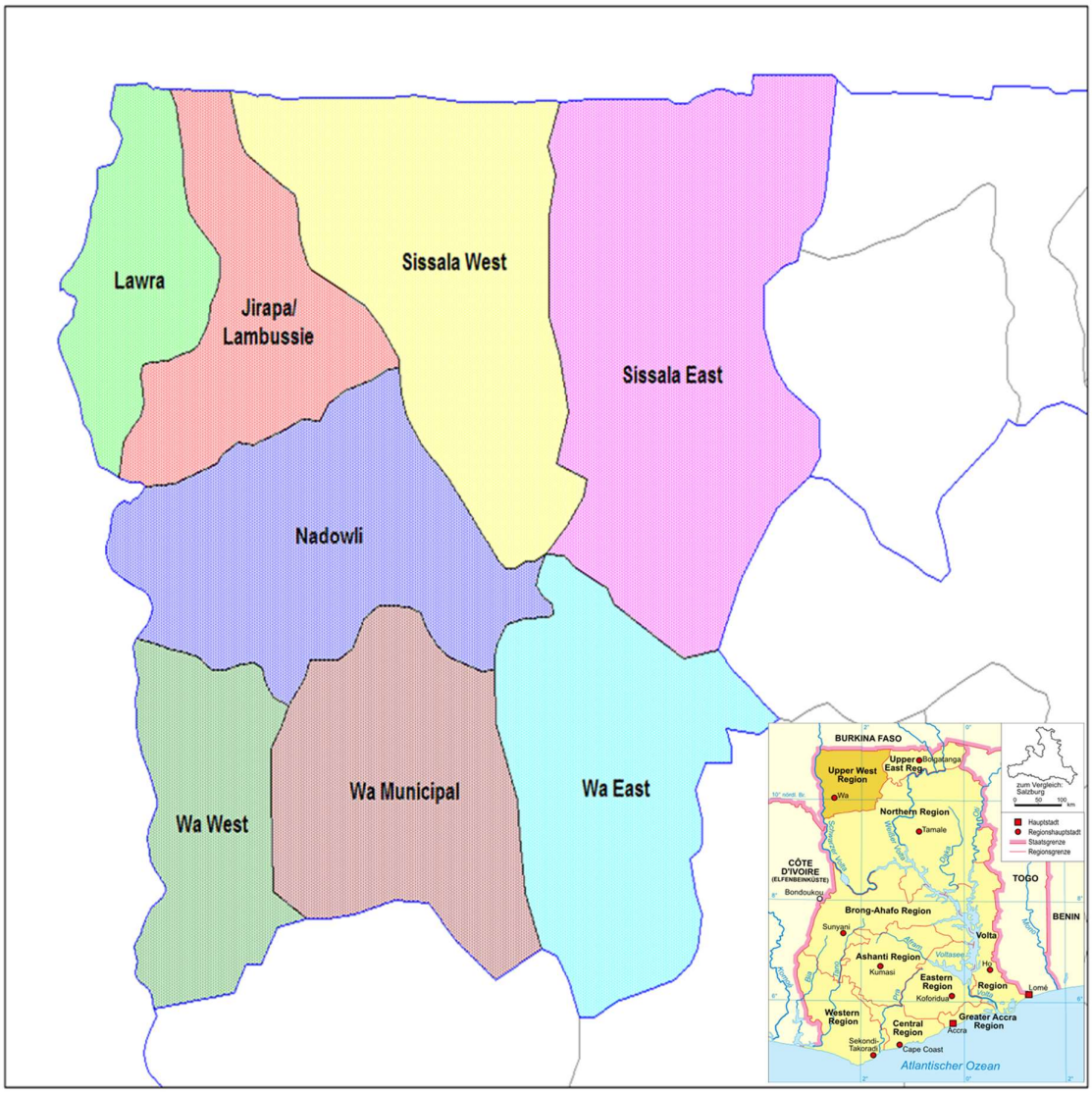
Table 7: Effects of Subsidy Level on Enrollment, Health Care Utilization, and Health Status

Panel A Enrollement and Health Care Utilization										
Dependent Variable	Short run					Long run				
	Enrollment	Visited health facility in last four weeks	Visited health facility in last six months	# of visits in last six months	Made an out-of-pocket for health service in the last six months	Enrollment	Visited health facility in the last four weeks	Visited health facility in the last six months	# of visits in last four weeks	Made an out-of-pocket for health service in the last six months
Sample										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Panel A1										
1/3 Subsidy (2/3 price)	0.384***	0.0004	0.010	-0.013	-0.014	0.146*	0.020	0.081**	0.018	0.025
	(0.071)	(0.016)	(0.023)	(0.022)	(0.013)	(0.082)	(0.014)	(0.034)	(0.015)	(0.026)
2/3 subsidy (1/3 price)	0.466***	-0.012	0.011	0.003	-0.002	0.081	0.071***	0.116***	0.059***	0.003
	(0.059)	(0.015)	(0.022)	(0.026)	(0.017)	(0.077)	(0.016)	(0.030)	(0.017)	(0.014)
Full subsidy (free)	0.519***	0.008	0.003	0.007	-0.009	0.126	-0.025	-0.020	-0.027	-0.040
	(0.057)	(0.021)	(0.028)	(0.035)	(0.022)	(0.099)	(0.019)	(0.048)	(0.022)	(0.028)
R-squared	0.352	0.106	0.129	0.065	0.095	0.173	0.099	0.102	0.081	0.105
Control group mean	0.271	0.038	0.102	0.032	0.046	0.230	0.017	0.050	0.050	0.013
Number of observations	2,785	2,130	2,710	2,124	2,805	2,304	2,228	2,688	2,231	2,688
F-test (Prob > F)										
1/3 subsidy = 2/3 subsidy	0.242	0.454	0.961	0.494	0.437	0.379	0.016	0.424	0.101	0.548
1/3 subsidy = Full subsidy	0.023	0.709	0.795	0.571	0.730	0.798	0.072	0.068	0.104	0.212
2/3 subsidy = Full subsidy	0.328	0.433	0.772	0.914	0.728	0.561	0.0001	0.004	0.003	0.021
Panel A2										
Partial subsidy (positive price)	0.433***	-0.007	0.010	-0.004	-0.007	0.107	0.049***	0.102***	0.041***	0.012
	(0.054)	(0.013)	(0.019)	(0.022)	(0.013)	(0.072)	(0.013)	(0.023)	(0.012)	(0.007)
Full subsidy (free)	0.514***	0.009	0.003	0.006	-0.009	0.130	-0.027	-0.022	-0.029	-0.039
	(0.058)	(0.022)	(0.029)	(0.036)	(0.022)	(0.098)	(0.019)	(0.047)	(0.022)	(0.027)
R-squared	0.351	0.106	0.129	0.065	0.094	0.172	0.094	0.101	0.078	0.103
Control group mean	0.271	0.038	0.102	0.032	0.046	0.230	0.017	0.050	0.050	0.013
Number of observations	2,785	2,130	2,710	2,124	2,805	2,304	2,228	2,688	2,231	2,688
F-test (Prob > F)										
Partial subsidy = Full subsidy	0.088	0.482	0.7572	0.788	0.870	0.735	0.0003	0.006	0.005	0.099
Panel B. Health Status and Behaviors										
	Short run					Long run				
	Healthy or very healthy	# Days ill last four weeks	Could not perform normal daily activities due to illness last four weeks	# days could not perform normal daily activities in the last four weeks	Sleep under mosquito nets	Healthy or very healthy	# Days ill last four weeks	Could not perform normal daily activities due to illness	# days could not perform normal daily activities in last four weeks	Sleep under mosquito nets
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Panel B1										
1/3 Subsidy (2/3 price)	0.116***	-0.390**	-0.010	-0.374	0.029	-0.078	0.205	0.030*	0.195	0.086
	(0.037)	(0.152)	(0.023)	(0.378)	(0.111)	(0.065)	(0.141)	(0.016)	(0.141)	(0.126)
2/3 subsidy (1/3 price)	0.129***	-0.222	-0.012	0.185	0.178	-0.218***	0.362***	0.048***	0.225*	0.040
	(0.040)	(0.155)	(0.018)	(0.375)	(0.129)	(0.077)	(0.110)	(0.017)	(0.127)	(0.122)
Full subsidy (free)	0.110**	-0.373**	-0.019	-0.431	0.259**	-0.135	-0.338*	-0.016	-0.281	-0.012
	(0.043)	(0.178)	(0.029)	(0.430)	(0.115)	(0.081)	(0.173)	(0.023)	(0.209)	(0.114)
R-squared	0.192	0.086	0.080	0.095	0.251	0.307	0.084	0.097	0.073	0.257
Control group mean	0.817	0.617	0.081	1.379	0.449	0.791	0.413	0.013	0.096	0.661
Number of observations	861	2,768	2,775	2,677	1,422	658	2,666	2,661	2,564	1,092
F-test (Prob > F)										
1/3 subsidy = 2/3 subsidy	0.759	0.379	0.943	0.208	0.241	0.145	0.359	0.453	0.880	0.487
1/3 subsidy = Full subsidy	0.889	0.924	0.728	0.871	0.086	0.397	0.009	0.074	0.016	0.220
2/3 subsidy = Full subsidy	0.633	0.338	0.770	0.096	0.526	0.456	0.000	0.015	0.041	0.425
Panel B2										
Partial subsidy (positive price)	0.123***	-0.290**	-0.011	-0.044	0.118	-0.154**	0.298***	0.040***	0.213**	0.059
	(0.033)	(0.119)	(0.016)	(0.316)	(0.108)	(0.058)	(0.093)	(0.012)	(0.091)	(0.118)
Full subsidy (free)	0.109**	-0.382**	-0.019	-0.464	0.254**	-0.126	-0.346*	-0.017	-0.283	-0.009
	(0.043)	(0.178)	(0.029)	(0.436)	(0.120)	(0.086)	(0.175)	(0.023)	(0.213)	(0.113)
R-squared	0.192	0.086	0.080	0.094	0.246	0.300	0.083	0.096	0.073	0.256
Control group mean	0.817	0.617	0.081	1.379	0.449	0.791	0.413	0.013	0.096	0.661
Number of observations	861	2,768	2,775	2,677	1,422	658	2,666	2,661	2,564	1,092
F-test (Prob > F)										
Partial subsidy = Full subsidy	0.676	0.504	0.724	0.175	0.256	0.743	0.0004	0.013	0.019	0.275

Notes: Panel A summarizes effects on enrollment and health care utilization. Panel B summarizes effects on health statuses and behaviors, respectively. Each panel reports effects of each subsidy level (Panels A1 and B1) and partial and full subsidy level (Panels A2 and B2). All regressions include a standard set of covariates (individual, household, and community), baseline measure of dependant variable, and other treatment status (any campaign and any convenience). Robust standard errors clustered at community level reported in parantheses. *, **, and *** denote statistical significance at 10 %, 5 %, and

Appendix A. Figure and Table

Figure A.1. Wa West District Map



Source: Wikipedia and www.wa-africa-living.com

Table A1: Included and Excluded Services: NHIS Minimum Coverage

Included Services	Exclusion List
1 Out-Patient Services i) General and specialized consultation and review ii) Requested investigation (including laboratory investigations, x-rays and ultrasound scanning) iii) Medication (prescription drugs on the NHIS Drug List) iv) HIV/AIDS symptomatic treatment for opportunistic infection v) Out-patient/Day Surgery Operations including hernia repairs, incision and drainage, hemorrhoidectomy vi) Out-patient physiotherapy 2 In-Patient Services i) General and specialist in-patient care ii) Requested investigations iii) Medication (prescription drugs on NHIS Drug List) iv) Cervical and Breast Cancer Treatment v) Surgical Operations vi) In-patient physiotherapy vii) Accommodation in general ward viii) Feeding (where available) 3 Oral Health Services i) Pain relief which includes incision and drainage, tooth extraction and temporary relief ii) Dental restoration which includes simple amalgam fillings and temporary dressing 4 Eye Care Services i) Refraction, visual fields and A-Scan ii) Keratometry iii) Cataract removal iv) Eye lid surgery 5 Maternity Care i) Antenatal care ii) Deliveries (normal and assisted) iii) Caesarian section iv) Postnatal care 6 Emergencies i) Medical emergencies ii) Surgical emergencies including brain surgery due to accidents iii) Pediatric emergencies iv) Obstetric and gynecological emergencies v) Road traffic accidents vi) Industrial and workplace accidents vii) Dialysis for acute renal failure	1 Rehabilitation other than physiotherapy 2 Appliances and protheses including optical aids, hearing aids, othopedic aids and dentures 3 Cosmetic surgeries and aesthetic treatment 4 HIV retroviral drugs 5 Assisted reproduction eg artificial insemination and gynecological hormone replacement therapy 6 Echocardiography 7 Photography 8 Angiography 9 Orthotics 10 Dialysis for chronic renal failure 11 Heart and brain surgery other than those resulting from accident 12 Cancer treatment other than cervical ad breast cancer 13 Organ transplating 14 All drugs that not listed on the NHIS Drug List 15 Diagnosis and treatment abroad 16 Medical examinations for purposes of visa applications, Campaign and institutional driving license 17 VIP ward accommodation 18 Mortuary Services

Source: NHIA (2011)

Table A2: Attrition

	Short run	Long run
	(1)	(2)
Panel A		
Any intervention	0.002	-0.038
	(0.020)	(0.033)
R-squared	0.111	0.073
Panel B		
Subsidy only	-0.001	-0.055
	(0.023)	(0.034)
Campaign only	-0.022	0.088
	(0.025)	(0.053)
Convenience only	0.038	-0.036
	(0.025)	(0.051)
Campaign & Convenience	-0.055	-0.049
	(0.036)	(0.060)
Subsidy & Convenience	-0.012	-0.021
	(0.025)	(0.038)
Subsidy & Campaign	-0.031	-0.050
	(0.029)	(0.040)
Subsidy & Camp & Conven	0.059	-0.092
	(0.036)	(0.067)
R-squared	0.123	0.079
Number of observations	4,624	4,624
Panel C		
1/3 Subsidy (2/3 price)	-0.008	-0.048
	(0.045)	(0.049)
2/3 subsidy (1/3 price)	0.002	-0.039
	(0.033)	(0.040)
Full subsidy (free)	0.011	-0.061
	(0.028)	(0.047)
R-squared	0.134	0.092
Mean	0.046	0.224
Control group mean	0.047	0.252
Number of observations	2,953	2,953

Notes: Dependent variable is a binary variable indicating whether an individual had been attrited in the short- and long-run follow-up surveys. All regressions include a standard set of covariates (individual, household, and community). Robust standard errors clustered at community level reported in parantheses. *, **, and *** denote statistical significance at 10 %, 5 %, and 1 % levels, respectively.

Table A3: Baseline Characteristics by Subsidy Level

Variable	Difference between subsidy level and control		
	One-third	Two-thirds	Full
	(1)	(2)	(3)
Panel A: Individual Characteristics			
Age	1.180	-0.775	-1.620
Male	0.009	-0.010	0.022
Christian	0.073	0.102	0.058
Dagaaba (ethnic group)	0.153	0.208	0.017
Has some formal education	-0.022	-0.016	0.009
Has a health condition (≥ 6 months)	-0.002	-0.002	-0.004
Probably sick next year	0.002	-0.005	-0.033
Overall illness			
Ill in the last month	0.039	0.049	0.016
No. of days ill in the last month	0.505	0.208	-0.056
Could not do normal activities in the last month	0.011	0.039	0.023
No. of days could not perform normal activities in the last month	0.134	0.138	0.079
Malaria			
Ill in the last month	-0.006	0.028	0.004
No. of days ill in the last month	-0.049	0.182	-0.011
Could not do normal activities in the last month	-0.002	0.023	0.011
No. of days could not perform normal activities in the last month	-0.036	0.056	0.036
Visited health facility in the last month	0.033	0.023	-0.015
Visited health facility in the last six months	0.025	0.008	0.014
Number of visits in the last month	0.062	0.042	-0.036
Visited health facility in the last month for malaria treatment	-0.004	0.002	0.004
Made out of pocket expense in the last six months	-0.009	0.059	-0.021
Ever enrolled in NHIS	0.179**	0.084	0.071
Currently enrolled in NHIS	0.039	0.041	-0.030
Slept under mosquito nets (12 years old or older)	0.192*	0.140	0.025
Use safe drinking water technology (12 years old or older)	-0.039	-0.019	-0.019
Panel B: Household Characteristics			
HH Size	-0.289	0.114	0.615
Number of children under 18	-0.176	-0.072	0.472
Male head HH	-0.053	0.046	0.036
Owns farming land	0.088	-0.019	0.080
Owns mosquito net	0.026	0.058	-0.030
Heard of NHIS	0.049	0.049	0.049*
Knowledge about NHIS	0.028	0.003	-0.010
Household assets (principal component score)	0.561	0.318	0.576**
Panel C: Community Characteristics			
Distance to NHIS regist (km)	4.347	3.447	-4.466
Distance to health fac (km)	0.222	-0.687	1.017
Observations (N)	**314**	**522**	**944**

Notes: This table reports means for selected baseline variables. Columns 1 – 3 report mean differences between each subsidy level (i.e., 1/3, 2/3, and full) and the control group. All tests of differences adjust standard errors for intra-cluster (intra-village) correlation. *, **, and *** denote statistical significance at 10 %, 5 %, and 1 %. levels, respectively.

Table A4: Effect on Enrollment (Adults and Children) and Detailed Knowledge on NHIS

Dependent Variable	Short run						Long run					
	Enrollment (adult)	Enrollment (child)	Knowledge on Exemption	Knowledge on Premium	Knowledge on Benefits	Knowledge on Others	Enrollment (adult)	Enrollment (child)	Knowledge on Exemption	Knowledge on Premium	Knowledge on Benefits	Knowledge on Others
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Panel A												
Any Intervention	0.297***	0.279***	0.536***	0.300**	0.152	-0.080	0.135***	0.212***	-0.025	0.237**	0.045	-0.106
	(0.052)	(0.056)	(0.139)	(0.119)	(0.165)	(0.122)	(0.045)	(0.060)	(0.179)	(0.118)	(0.129)	(0.108)
R-squared	0.243	0.214	0.246	0.245	0.140	0.184	0.136	0.125	0.318	0.264	0.152	0.234
Panel B												
Subsidy only	0.403***	0.391***	0.528**	0.356*	0.004	0.034	0.147**	0.154*	0.148	0.528***	0.157	0.056
	(0.048)	(0.051)	(0.231)	(0.199)	(0.256)	(0.165)	(0.063)	(0.084)	(0.269)	(0.196)	(0.148)	(0.128)
Campaign only	0.258***	0.106	-0.013	-0.133	0.233	-0.079	0.040	0.047	1.124	0.323	0.370**	-0.190
	(0.094)	(0.091)	(0.309)	(0.122)	(0.301)	(0.204)	(0.054)	(0.104)	(0.810)	(0.226)	(0.173)	(0.332)
Convenience only	-0.025	0.030	0.434**	0.293	0.018	-0.274	0.152*	0.259***	-0.105	0.195	-0.072	-0.159
	(0.068)	(0.078)	(0.205)	(0.180)	(0.241)	(0.214)	(0.076)	(0.079)	(0.251)	(0.159)	(0.221)	(0.213)
Campaign & Convenience	0.229	0.236	1.001**	0.340	0.499**	-0.298	0.156	0.166	-0.125	0.225	-0.088	-0.020
	(0.177)	(0.159)	(0.404)	(0.315)	(0.226)	(0.199)	(0.134)	(0.173)	(0.300)	(0.246)	(0.110)	(0.204)
Subsidy & Convenience	0.345***	0.333***	-0.096	0.271	0.246	0.212*	0.108*	0.190***	-0.456	0.233	-0.043	-0.362*
	(0.077)	(0.080)	(0.177)	(0.214)	(0.199)	(0.116)	(0.058)	(0.069)	(0.438)	(0.249)	(0.212)	(0.193)
Subsidy & Campaign	0.609***	0.474***	0.922***	0.559***	0.105	-0.075	0.019	0.133	-0.076	0.039	0.061	-0.172
	(0.068)	(0.076)	(0.201)	(0.209)	(0.278)	(0.173)	(0.100)	(0.110)	(0.637)	(0.294)	(0.165)	(0.342)
Subsidy & Camp & Conven	0.453***	0.466***	0.957***	0.073	0.381*	-0.043	0.272***	0.506***	-0.034	-0.171	0.154	-0.004
	(0.068)	(0.071)	(0.288)	(0.127)	(0.225)	(0.185)	(0.072)	(0.102)	(0.325)	(0.146)	(0.162)	(0.180)
R-squared	0.330	0.283	0.311	0.260	0.155	0.199	0.149	0.161	0.348	0.290	0.162	0.243
Control group mean	0.240	0.305	-0.366	-0.234	-0.099	-0.011	0.206	0.258	-0.218	-0.191	-0.005	0.059
Number of observations	1,731	2,446	492	563	593	602	1,432	1,997	326	578	557	565

Notes: Columns 1 - 6 and 7 - 12 report short- and long run effects, respectively. Knowledge scores are standardized. Knowledge on exemption (Columns 3 and 9) is obtained from respondent's responses to question about exemptions from paying premium and fees. Knowledge on premium (Columns 4 and 10) is obtained from respondent's responses to question about the amount of premium for children (< 18 years old), adult (18 to 69 years old), and seniors (> 69 years old). Knowledge on benefits (Columns 5 and 11) is obtained from respondent's responses to question about benefits of enrolling in NHIS insurance program. Knowledge on others (Columns 6 and 12) is obtained from respondent's responses to question about NHIS insurance program-related questions other than exemption, premium, and benefits, such as frequency of membership renewal. All regressions include a standard set of covariates (individual, household, and community) and baseline measure of dependant variable, except for knowledge variables. Robust standard errors clustered at community level reported in parentheses. *, **, and *** denote statistical significance at 10 %, 5 %, and 1 % levels, respectively.

Table A5: Heterogeneity Effects on NHIS Enrollment by Ilness and Service Utilization

	X =				
	Got any illness in the last four weeks	Got Malaria in the last four weeks	Could not perform normal daily activities due to illness in the last four weeks	Visited health facility in last four weeks	Visited health facility in last six months
	(1)	(2)	(3)	(4)	(5)
Panel A: Dependent Variable: Enrolled in short run					
Any Intervention	0.286***	0.293***	0.278***	0.285***	0.284***
	(0.056)	(0.054)	(0.055)	(0.059)	(0.056)
X	0.037	0.125	-0.090*	0.075	0.104
	(0.063)	(0.114)	(0.050)	(0.091)	(0.085)
Any Intervention*X	-0.005	-0.123	0.116*	0.033	0.014
	(0.075)	(0.124)	(0.067)	(0.111)	(0.095)
R-squared	0.189	0.190	0.191	0.198	0.192
Control group mean	0.271	0.271	0.271	0.271	0.271
Number of observations	4,379	4,331	4,337	3,718	4,380
Panel B: Dependent Variable: Enrolled in long run					
Any Intervention	0.179***	0.179***	0.177***	0.141***	0.181***
	(0.051)	(0.051)	(0.051)	(0.052)	(0.049)
X	0.161**	0.218	0.106	0.184	0.189**
	(0.073)	(0.146)	(0.099)	(0.124)	(0.076)
Any Intervention*X	-0.052	-0.030	-0.033	-0.152	-0.073
	(0.078)	(0.156)	(0.104)	(0.138)	(0.087)
R-squared	0.134	0.134	0.130	0.114	0.133
Control group mean	0.230	0.230	0.230	0.230	0.230
Number of observations	3,589	3,547	3,558	3,044	3,590
Panel C: Dependent Variable: Enrolled in both short and long run					
Any Intervention	0.148***	0.153***	0.146***	0.136***	0.151***
	(0.036)	(0.035)	(0.036)	(0.038)	(0.036)
X	0.036	0.099	-0.052	0.042	0.079
	(0.043)	(0.089)	(0.033)	(0.081)	(0.063)
Any Intervention*X	0.045	0.039	0.127**	0.041	0.046
	(0.053)	(0.106)	(0.051)	(0.103)	(0.079)
R-squared	0.124	0.125	0.125	0.120	0.125
Control group mean	0.081	0.081	0.081	0.081	0.081
Number of observations	4,399	4,351	4,357	3,733	4,400
Panel D: Dependent Variable: Enrolled in long run among short run enrollees					
Any Intervention	0.121	0.127	0.117	0.076	0.133
	(0.085)	(0.084)	(0.082)	(0.085)	(0.083)
X	0.044	0.063	-0.227	0.007	0.109
	(0.158)	(0.260)	(0.171)	(0.186)	(0.133)
Any Intervention*X	0.073	0.141	0.323*	0.063	-0.001
	(0.162)	(0.265)	(0.173)	(0.191)	(0.140)
R-squared	0.141	0.143	0.143	0.138	0.140
Control group mean	0.060	0.249	0.012	0.014	0.044
Number of observations	1,845	1,825	1,831	1,571	1,845

Notes: X denotes baseline characteristics presented at the top of each column. All regressions include a standard set of covariates (individual, household, and community). Robust standard errors clustered at community level reported in parentheses. *, **, and *** denote statistical significance at 10 %, 5 %, and 1 % levels, respectively.

Table A6: Effects on Utilization of Healthcare Services

	Visited health facility in last four weeks	Visited health facility in last six months	# of visits in last four weekss	Visited Facility for malaria treatment in the last four weeks	Made an out-of-pocket for health service in the last six months
	(1)	(2)	(3)	(4)	(5)
Panel A. Short-run outcomes					
Subsidy only	-0.008	0.016	-0.005	-0.000	-0.009
	(0.012)	(0.020)	(0.019)	(0.008)	(0.012)
Campaign only	0.022	0.024	0.053**	0.007	-0.017
	(0.028)	(0.026)	(0.022)	(0.012)	(0.017)
Convenience only	-0.012	-0.013	-0.020	0.003	-0.033*
	(0.013)	(0.028)	(0.020)	(0.012)	(0.018)
Campaign & Convenience	0.012	0.030	0.016	-0.004	-0.030**
	(0.021)	(0.050)	(0.023)	(0.015)	(0.012)
Subsidy & Convenience	0.048**	0.014	0.056**	0.002	0.021
	(0.021)	(0.024)	(0.024)	(0.008)	(0.016)
Subsidy & Campaign	-0.014	0.101***	-0.010	0.001	0.001
	(0.013)	(0.026)	(0.016)	(0.009)	(0.015)
Subsidy & Camp & Conven	0.034	0.130***	0.066**	0.048***	0.027
	(0.021)	(0.028)	(0.031)	(0.012)	(0.017)
R-squared	0.100	0.106	0.048	0.044	0.064
Control group mean	0.038	0.102	0.032	0.019	0.046
Number of observations	3,477	4,285	3,476	3,629	4,413
F-test (Prob > F)					
Sub+Camp = Sub&Camp	0.357	0.111	0.060	0.712	0.257
Sub+Conv = Sub&Conv	0.003	0.786	0.020	0.912	0.014
Camp+Conv = Camp&Conv	0.938	0.750	0.662	0.508	0.457
Sub+Camp + Conv = Sub&Camp&Conv	0.320	0.019	0.306	0.071	0.002
Panel B. Long-run outcomes					
Subsidy only	0.024**	0.066**	0.020*	0.018	-0.001
	(0.011)	(0.027)	(0.010)	(0.012)	(0.008)
Campaign only	-0.010	0.009	-0.010	-0.012	0.014
	(0.010)	(0.020)	(0.008)	(0.009)	(0.012)
Convenience only	0.042***	0.077***	0.041***	0.036***	0.016
	(0.013)	(0.027)	(0.012)	(0.011)	(0.011)
Campaign & Convenience	0.024	0.002	0.003	-0.002	-0.009
	(0.027)	(0.032)	(0.013)	(0.015)	(0.015)
Subsidy & Convenience	0.039***	0.041	0.045**	0.032*	0.002
	(0.015)	(0.037)	(0.017)	(0.016)	(0.006)
Subsidy & Campaign	0.018	0.053	0.012	0.014	0.004
	(0.020)	(0.057)	(0.018)	(0.019)	(0.012)
Subsidy & Camp & Conven	0.047**	0.112***	0.039*	0.036	0.025
	(0.022)	(0.036)	(0.023)	(0.022)	(0.030)
R-squared	0.062	0.070	0.046	0.046	0.063
Control group mean	0.017	0.050	0.036	0.010	0.013
Number of observations	3,616	4,256	3,640	3,616	4,256
F-test (Prob > F)					
Sub+Camp = Sub&Camp	0.872	0.727	0.931	0.690	0.579
Sub+Conv = Sub&Conv	0.137	0.044	0.424	0.309	0.306
Camp+Conv = Camp&Conv	0.777	0.075	0.186	0.233	0.084
Sub+Camp + Conv = Sub&Camp&Conv	0.678	0.397	0.635	0.815	0.924

Notes: Panels A and B report short-run and long-run estimation results, respectively. All regressions include a standard set of covariates (individual, household, and community) and baseline measure of dependant variable. Robust standard errors clustered at community level are reported in parantheses. *, **, and *** denote statistical significance at 10 %, 5 %, and 1 % levels, respectively.

Table A7: Effects on Health Status

	Overall Illness				Illness Due to Malaria		
	Healthy or very healthy	# Days ill last four weeks	Could not perform normal daily activities due to illness last four weeks	# days could not perform normal daily activities in the four weeks	# Days ill four weeks	Could not perform normal daily activities due to illness four weeks	# days could not perform normal daily activities in the four weeks
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: Short-run outcomes							
Subsidy only	0.134***	-0.210	-0.000	0.392	-0.069	-0.006	-0.231
	(0.033)	(0.144)	(0.016)	(0.372)	(0.045)	(0.008)	(0.141)
Campaign only	0.116***	-0.095	-0.033	-0.042	0.004	0.002	0.159
	(0.042)	(0.138)	(0.024)	(0.477)	(0.086)	(0.018)	(0.340)
Convenience only	0.034	0.191	-0.008	0.106	0.017	0.004	0.076
	(0.059)	(0.161)	(0.028)	(0.568)	(0.069)	(0.010)	(0.216)
Campaign & Convenience	0.009	-0.020	0.058***	-0.131	0.109	0.017	-0.232
	(0.085)	(0.199)	(0.022)	(0.305)	(0.065)	(0.014)	(0.144)
Subsidy & Convenience	0.009	-0.245	0.021	-0.230	0.012	0.009	-0.095
	(0.061)	(0.153)	(0.028)	(0.373)	(0.053)	(0.010)	(0.127)
Subsidy & Campaign	0.109**	-0.391***	-0.019	-0.640**	-0.071**	-0.008	-0.316**
	(0.046)	(0.133)	(0.021)	(0.257)	(0.030)	(0.006)	(0.119)
Subsidy & Camp & Conven	0.006	-0.315*	0.037	-0.249	0.003	0.025**	0.011
	(0.056)	(0.175)	(0.024)	(0.434)	(0.054)	(0.011)	(0.173)
R-squared	0.147	0.054	0.095	0.144	0.049	0.038	0.040
Control group mean	0.817	0.617	0.081	1.379	0.123	0.022	0.343
Number of observations	1,326	4,354	4,354	4,201	4,304	4,330	4,173
F-test (Prob > F)							
Sub+Camp = Sub&Camp	0.008	0.670	0.680	0.108	0.954	0.870	0.542
Sub+Conv = Sub&Conv	0.029	0.370	0.439	0.303	0.479	0.430	0.827
Camp+Conv = Camp&Conv	0.176	0.677	0.011	0.789	0.526	0.659	0.283
Sub+Camp + Conv = Sub&Camp&Conv	0.0004	0.414	0.031	0.316	0.658	0.260	0.987
Panel B: Long-run outcomes							
Subsidy only	-0.108*	0.106	0.027**	0.129	0.113	0.029**	0.163**
	(0.058)	(0.102)	(0.011)	(0.081)	(0.070)	(0.011)	(0.065)
Campaign only	0.058	0.118	0.017*	0.125	-0.019	0.010	0.018
	(0.058)	(0.113)	(0.009)	(0.102)	(0.130)	(0.010)	(0.067)
Convenience only	-0.155**	0.270*	0.045***	0.298***	0.229**	0.049***	0.298***
	(0.062)	(0.142)	(0.011)	(0.079)	(0.105)	(0.011)	(0.063)
Campaign & Convenience	-0.030	0.114	-0.002	-0.008	-0.091	-0.010	-0.073
	(0.057)	(0.130)	(0.014)	(0.122)	(0.088)	(0.014)	(0.095)
Subsidy & Convenience	-0.045	0.190	0.025**	0.077	0.133	0.025**	0.096*
	(0.084)	(0.119)	(0.010)	(0.077)	(0.091)	(0.011)	(0.057)
Subsidy & Campaign	-0.125	0.109	-0.010	-0.114	0.041	-0.012	-0.100*
	(0.092)	(0.210)	(0.011)	(0.085)	(0.196)	(0.009)	(0.059)
Subsidy & Camp & Conven	0.029	0.369	0.057	0.420	0.261	0.055	0.337
	(0.098)	(0.271)	(0.037)	(0.283)	(0.206)	(0.033)	(0.207)
R-squared	0.256	0.057	0.059	0.045	0.056	0.060	0.056
Control group mean	0.791	0.413	0.013	0.096	0.244	0.081	0.043
Number of observations	1,074	4,227	4,214	4,065	4,186	4,214	4,065
F-test (Prob > F)							
Sub+Camp = Sub&Camp	0.474	0.622	0.0009	0.005	0.815	0.002	0.003
Sub+Conv = Sub&Conv	0.033	0.224	0.003	0.001	0.086	0.002	0.000
Camp+Conv = Camp&Conv	0.571	0.256	0.010	0.032	0.158	0.006	0.012
Sub+Camp + Conv = Sub&Camp&Conv	0.058	0.702	0.375	0.645	0.793	0.319	0.478

Notes: Panels A and B report short-run and long-run estimation results, respectively. All regressions include a standard set of covariates (individual, household, and community) and baseline measure of dependant variable. Robust standard errors clustered at community level are reported in parantheses. *, **, and *** denote statistical significance at 10 %, 5 %, and 1 % levels, respectively.

Table A8: Effects on Health Care Utilization and Health Status and Behaviors by Age Groups

	Short run					Long run				
Dependent Variable	Visited health facility in last month	Visited health facility in last six months	# of visits in last month	Visited Facility for malaria treatment in the last month	Made an out-of-pocket for health service in the last six months	Visited health facility in the last four weeks	Visited health facility in the last six months	# of visits in last six months	Visited Facility for malaria treatment in the last four weeks	Made an out-of-pocket for health service in the last six months
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Panel A: Adults (Aged 18-69)										
Panel A1: 2SLS results										
Enrolled in NHIS	-0.002	0.213***	0.023	0.025	0.026	0.162**	0.335***	0.182**	0.119**	0.051
	(0.038)	(0.056)	(0.050)	(0.040)	(0.029)	(0.074)	(0.091)	(0.076)	(0.057)	(0.048)
First-stage F-statistics	22.26	16.60	20.96	18.45	16.58	24.84	32.33	25.16	24.34	34.16
Panel A2: ITT results										
Any Intervention	-0.014	0.045*	-0.019	0.001	-0.017	0.036***	0.039**	0.035***	0.030***	0.004
	(0.021)	(0.026)	(0.027)	(0.014)	(0.015)	(0.009)	(0.019)	(0.010)	(0.009)	(0.008)
R-squared	0.067	0.086	0.055	0.058	0.078	0.069	0.062	0.060	0.060	0.048
Control group mean	0.052	0.103	0.202	0.018	0.056	0.019	0.063	0.063	0.010	0.019
Number of observations	1,332	1,690	1,332	1,397	1,740	1,400	1,684	1,411	1,400	1,684
Panel B: Children (Aged under 18)										
Panel B1: 2SLS results										
Enrolled in NHIS	0.066*	0.163***	0.118**	0.055***	0.079***	0.047	0.175**	0.029	0.029	0.004
	(0.038)	(0.059)	(0.056)	(0.019)	(0.029)	(0.041)	(0.078)	(0.039)	(0.037)	(0.024)
First-stage F-statistics	13.78	11.26	13.91	13.45	10.34	24.96	32.89	25.98	24.41	34.18
Panel B2: ITT										
Any Intervention	0.023	0.024	0.040**	0.009	-0.001	0.023**	0.067***	0.018**	0.013	0.008
	(0.015)	(0.020)	(0.017)	(0.007)	(0.011)	(0.011)	(0.020)	(0.009)	(0.009)	(0.006)
R-squared	0.129	0.101	0.041	0.036	0.052	0.054	0.074	0.034	0.037	0.066
Control group mean	0.027	0.101	0.200	0.019	0.037	0.015	0.040	0.040	0.010	0.008
Number of observations	1,990	2,397	1,989	2,062	2,465	2,050	2,374	2,062	2,050	2,374

	Short run					Long run				
	Overall Illness					Overall Illness				
Dependent Variable	Healthy or very healthy	# Days ill last month	Could not perform normal daily activities due to illness last month	# days could not perform normal daily activities in the last month	Sleep under mosquito nets	Healthy or very healthy	# Days ill last month	Could not perform normal daily activities due to illness	# days could not perform normal daily activities in last month	Sleep under mosquito nets
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Panel C: Adults (Aged 18-69)										
Panel C1: 2SLS results										
Enrolled in NHIS	0.135**	-1.002***	-0.005	-0.043	0.191	0.202	1.477***	0.122**	0.699*	-0.289
	(0.065)	(0.331)	(0.054)	(0.773)	(0.162)	(0.138)	(0.559)	(0.061)	(0.391)	(0.187)
First-stage F-statistics	20.79	17.34	16.25	16.24	20.79	30.16	34.6123	32.8504	28.6699	38.67
Panel C2: ITT results										
Any Intervention	0.069*	-0.166	-0.008	0.326	0.060	-0.060	0.218*	0.030***	0.187***	0.046
	(0.040)	(0.152)	(0.024)	(0.363)	(0.064)	(0.040)	(0.119)	(0.010)	(0.069)	(0.064)
R-squared	0.115	0.066	0.101	0.148	0.247	0.210	0.050	0.064	0.050	0.163
Control group mean	0.817	0.888	0.108	1.667	0.455	0.762	0.422	0.017	0.089	0.679
Number of observations	1,040	1,717	1,728	1,678	1,516	822	1,677	1,677	1,626	1,204
Panel D: Children (Aged under 18)										
Panel D1: 2SLS results										
Enrolled in NHIS	0.051	-0.446*	0.058	-0.654	0.078	-0.165	0.023	0.057	0.436	-0.364
	(0.084)	(0.254)	(0.036)	(0.583)	(0.170)	(0.273)	(0.426)	(0.035)	(0.350)	(0.295)
First-stage F-statistics	7.03	10.44	10.54	11.36	7.03	10.21	32.35	34.22	36.81	17.26
Panel D2: ITT results										
Any Intervention	0.218**	0.028	0.017	-0.158	0.086	-0.221**	0.140	0.020***	0.098	0.025
	(0.090)	(0.128)	(0.015)	(0.314)	(0.086)	(0.090)	(0.091)	(0.007)	(0.070)	(0.082)
R-squared	0.390	0.028	0.085	0.149	0.226	0.300	0.061	0.031	0.037	0.177
Control group mean	0.828	0.380	0.059	1.126	0.433	0.969	0.406	0.010	0.103	0.634
Number of observations	156	2,436	2,422	2,331	534	154	2,353	2,340	2,253	429

Notes: Samples are restricted to adults (aged 18 to 69 years old) for Panels A and C, and to children (aged under 18 years old) for Panels B and D. The first part (Panels A and B) report effects on health care utilization. The second part (Panels C and D) report effects on health status and behavior. Estimates on short-run outcomes are reported in Columns 1 to 5 and long-run outcomes are reported in Columns 6 to 10. All regressions include a full set of covariates (individual, household, and community) and baseline measure of dependant variable. Knowledge scores are standardized. Robust standard errors clustered at community level reported in parantheses. *, **, and *** denote statistical significance at 10 %, 5 %, and 1 % level respectively.

Table A9: Determinants of Health Insurance Enrollment Retention

Sample	Among those enrolled in the baseline			
Dependant variable: Enrolled at the first follow-up	Coefficient	Standard error	N	R-squared
	(1)	(2)	(3)	(4)
Healthy or very healthy	0.056	(0.101)	262	0.001
# Days ill last month	0.002	(0.005)	879	0.0001
Could not perform normal daily activities due to illness last month	0.056	(0.049)	881	0.002
# days could not perform normal daily activities in the last month	0.001	(0.003)	881	0.0001
# Days ill last month (Malaria)	-0.004	(0.019)	880	0.0001
Could not perform normal daily activities due to illness last month (Malaria)	0.125	(0.089)	880	0.002
# days could not perform normal daily activities in the last month (Malaria)	0.004	(0.006)	880	0.001
Visited health facility in last four weeks	0.132**	(0.063)	818	0.005
Visited health facility in last six months	0.121***	(0.037)	857	0.012
# of visits in last six months	0.115**	(0.055)	813	0.005
Visited Facility for malaria treatment in the last four weeks	0.178**	(0.074)	841	0.007
Made an out-of-pocket for health service in the last six months	-0.131	(0.089)	885	0.002
Sample	Among those enrolled in the short run			
Dependant variable: Enrolled at the second follow-up	Coefficient	Standard error	N	R-squared
	(1)	(2)	(3)	(4)
Healthy or very healthy	0.021	(0.050)	515	0.0003
# Days ill last month	0.017***	(0.006)	1,845	0.005
Could not perform normal daily activities due to illness last month	0.100*	(0.057)	1,845	0.002
# days could not perform normal daily activities in the last month	0.011	(0.008)	1,845	0.001
# Days ill last month (Malaria)	0.011	(0.007)	1,845	0.001
Could not perform normal daily activities due to illness last month (Malaria)	0.101	(0.064)	1,845	0.001
# days could not perform normal daily activities in the last month (Malaria)	0.011	(0.009)	1,845	0.001
Visited health facility in last four weeks	0.289***	(0.054)	1,845	0.015
Visited health facility in last six months	0.310***	(0.033)	1,845	0.044
# of visits in last six months	0.235***	(0.057)	1,845	0.009
Visited Facility for malaria treatment in the last four weeks	0.251***	(0.065)	1,845	0.008
Made an out-of-pocket for health service in the last six months	-0.245***	(0.076)	1,845	0.006

Notes: Panel A summarizes determinants of short-run enrollment among those enrolled in the baseline (i.e., short-run retention). Panel B summarizes determinants of long-run enrollment among those enrolled in the short run (i.e., long-run retention). Each row shows univariate regression result where dependant variable is enrollment in the short run (Panel A) and in the long run (Panel B). Robust standard errors clustered at community level reported in parantheses. *, **, and *** denote statistical significance at 10 %, 5 %, and 1 % level respectively.

Table A10: Determinants of Health Insurance Enrollment Retention (Subsidy and Control Groups)

Sample	Among those enrolled in the baseline			
Dependant variable: Enrolled at the first follow-up	Coefficient	Standard error	N	R-squared
	(1)	(2)	(3)	(4)
Healthy or very healthy	0.044	(0.118)	161	0.001
# Days ill last month	-0.011	(0.008)	531	0.004
Could not perform normal daily activities due to illness last month	0.059	(0.062)	535	0.002
# days could not perform normal daily activities in the last month	-0.0003	(0.004)	535	0.000
# Days ill last month (Malaria)	-0.016	(0.022)	531	0.001
Could not perform normal daily activities due to illness last month (Malaria)	0.100	(0.106)	532	0.002
# days could not perform normal daily activities in the last month (Malaria)	-0.0001	(0.008)	532	0.000
Visited health facility in last four weeks	0.110	(0.080)	497	0.004
Visited health facility in last six months	0.148***	(0.050)	513	0.017
# of visits in last six months	0.119	(0.081)	494	0.004
Visited Facility for malaria treatment in the last four weeks	0.148	(0.092)	511	0.005
Made an out-of-pocket for health service in the last six months	-0.054	(0.103)	535	0.001
Sample	Among those enrolled in the short run			
Dependant variable: Enrolled at the second follow-up	Coefficient	Standard error	N	R-squared
	(1)	(2)	(3)	(4)
Healthy or very healthy	-0.010	(0.060)	360	0.0001
# Days ill last month	0.013*	(0.007)	1,305	0.003
Could not perform normal daily activities due to illness last month	0.129*	(0.069)	1,305	0.003
# days could not perform normal daily activities in the last month	0.013	(0.009)	1,305	0.002
# Days ill last month (Malaria)	0.006	(0.010)	1,305	0.0003
Could not perform normal daily activities due to illness last month (Malaria)	0.124	(0.077)	1,305	0.002
# days could not perform normal daily activities in the last month (Malaria)	0.011	(0.011)	1,305	0.001
Visited health facility in last four weeks	0.260***	(0.065)	1,305	0.012
Visited health facility in last six months	0.300***	(0.040)	1,305	0.042
# of visits in last six months	0.214***	(0.066)	1,305	0.008
Visited Facility for malaria treatment in the last four weeks	0.216***	(0.074)	1,305	0.006
Made an out-of-pocket for health service in the last six months	-0.258***	(0.088)	1,305	0.007

Notes: Sample is restricted to those in *Subsidy* and control groups. Those in *Campaign* only, *Convenience* only, and *Campaign* and *Convenience* are excluded. Panel A summarizes determinants of short-run enrollment among those enrolled in the baseline (i.e., short-run retention). Panel B summarizes determinants of long-run enrollment among those enrolled in the short run (i.e., long-run retention). Each row shows univariate regression result where dependant variable is enrollment in the short run (Panel A) and in the long run (Panel B).