Insuring Health or Insuring Wealth? An Experimental Evaluation of Health Insurance in Rural Cambodia

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We randomize the insurance premium for the SKY micro-health insurance program in rural Cambodia, allowing us to estimate the causal effects of health insurance on economic, health care utilization, and health outcomes. We find that SKY insurance has its greatest impact on economic outcomes. SKY also changed health-seeking behavior, increasing the use of covered public facilities and decreasing the use of uncovered unregulated care, but had no detectable impact on preventive care. As expected due to low statistical power, we did not find statistically significant impacts on health. Keywords: Insurance, Health, Impact, Randomized Trial, Cambodia

Serious injuries and illnesses typically both increase medical expenses and reduce a family's household income and home production (Wagstaff and Van Doorslaer (2003); Gertler, Levine and Moretti (2003); Gertler (2002)). "Each year, approximately 150 million people experience financial catastrophe [due to illness or injury], meaning they are obliged to spend on health care more than 40% of the income available to them after meeting their basic needs" (World Health Organization (2007)). Poor households often forego high-value care, yet still often pay substantial sums for care of low quality (Das,

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Hammer and Leonard (2008)). High health care expenditures mean a short-term health shock can lead to debt, asset sales, and removal of children from school – creating long-term increases in poverty (Van Damme et al. (2004); Annear (2006)).

Health insurance is designed to reduce economic difficulties following illness or injury. Health insurance may also improve health itself if it (a) pays for valuable care that people would have forgone or delayed, (b) increases preventative care, or (c) redirects care from low-quality (often informal) care to higher-quality insured care.

It is the poor who are most vulnerable to such economic setbacks and lack of high-quality care. Nevertheless, in developing countries few companies market health insurance to poor households (Sekhri and Savedoff (2005); Pauly et al. (2006)), for reasons ranging from poor families' inconsistent incomes, which may lead to missed premium payments, to the relatively high transaction costs of servicing an inexpensive insurance policy. The credit industry faced similar problems in developing countries, which led to the creation of micro-finance. Micro-health-insurance agencies have followed that lead, offering insurance to this previously unserved population.

The success of a micro-insurance program depends on its ability to improve economic and other outcomes while maintaining financial sustainability, or at least assuring donors that their money is being well spent However, because health insurance is a relatively new product in developing countries, little is known about how best to design an insurance program for the poor. In general, rigorous evidence on the impact of insurance is scarce, and there are even fewer studies on the effects of insurance in developing countries. One reason for the lack of evidence is that it is difficult to find a valid group to compare with the insured. We cannot simply compare the outcomes of insured and uninsured households because health insurance status is typically strongly correlated with other household characteristics. For example, rich and well educated households typically have both better health (Asfaw (2003)) and better health insurance coverage (Jutting (2004); Cameron and Trivedi (1991)), but that correlation does not mean insurance improves health. At the same time, those in poor health may be more likely to purchase health insurance when it is offered (Cutler and Reber (1998); Ellis (1989)), but that cor-

relation does not mean insurance worsens health.

To resolve this difficulty, we evaluate the health and economic effects of an NGO-run micro-health insurance program, Sokapheap Krousat Yeugn (SKY), on households in rural Cambodia using a randomized controlled trial. By randomizing the insurance premium, we induce variation in the likelihood of insurance take-up that allows us to estimate the causal effects of health insurance on three main categories of outcome: (1) economic outcomes, such as out-of-pocket medical spending and new debt to pay for health care; (2) health care utilization, such as timely utilization of curative care and substitution to public facilities from private health centers and traditional medicine; and (3) health outcomes, such as frequency of major health shocks and stunting and wasting.

We find that SKY has the greatest impacts on economic outcomes, as expected from an insurance program. For example, SKY decreased total health-care costs of major health shocks by over 40%, and households with SKY had over one-third less debt and over 75% less health-related debt. SKY also changed health-seeking behavior, increasing use of public facilities for serious health problems and decreasing the use of unregulated care. At the same time, SKY had no detectable impact on preventative care. We did not find statistically significant impacts on health, but the short time horizon of the study and the smaller sample size for these outcomes meant that, a priori, we did not expect to have sufficient statistical power to measure health impacts.

While the economic benefits are consistent with SKY's own expectations, the health care utilization and health outcomes are only partially so. We did not find that insurance made households less likely to forgo care or, when they do seek care, to do so more promptly.

I. Previous Research

The few studies using randomization or natural experiments to establish causality typically find that health insurance increases health care utilization; in some cases increased utilization also leads to detectable improvements in health.[1]

[1] This literature review draws on Polimeni (2006) and Levine, Gardner, and Polimeni (2009) .

The RAND Health Insurance Experiment (from 1974 to 1982) in the United States is the only large-scale randomized experiment examining the effects of health insurance on health and health care utilization to date. This experiment studied almost 4000 people in 2000 families. Some families were randomly assigned to a free care plan while others were assigned one of several plans that required varying copayments. The study found that those assigned to a cost-sharing plan sought less treatment than those with full coverage (e.g. Lohr et al. (1986); Manning (1987)). Those with cost-sharing primarily forwent preventive visits to doctors and "elective" care such as mental health treatment as opposed to emergency care (e.g., Keeler (1992)). For most health outcomes there were no benefits from having full coverage (e.g. Brook et al. (1983)). Health benefits were found, however, for individuals with poor vision and for persons with elevated blood pressure. Importantly, the improvement in high blood pressure led to a statistically significant 10% reduction in mortality risk, apparently due to increased detection and treatment of high blood pressure among low-income households with free care (e.g., Keeler (1992)).

Several other studies examine changes in insurance eligibility rules, using rigorous study designs such as comparing outcomes for individuals who are just eligible to those who just missed the eligibility cut-off. Across a variety of settings in the U.S. and Canada, expansions of health insurance coverage have consistently increased health care utilization (Fihn and Wicher (1988); Lurie et al. (1986); Lurie et al. (1984); Currie and Gruber (1996); Currie and Gruber (1996); Currie and Gruber (1997); Lichtenberg (2002); Card, Dobkin and Maestas (2007); Finkelstein (2005)). Some studies find important improvements in health (e.g., Hanratty (1996); Currie and Gruber (1997)), others find only modest or statistically insignificant improvements (e.g., Card, Dobkin and Maestas (2007)), and others evidence of no strong benefits (e.g., Finkelstein and McKnight (2008)).

Results are more mixed regarding the impact of health insurance on outcomes in poor nations. Most studies find a negative relationship between insurance coverage and out-of-pocket health expenditures (e.g., Jutting (2004), in Senegal; Jowett, Contoyannis and

Vinh (2003), in Vietnam; and Yip and Berman (2001), in Egypt). In contrast, Wagstaff, et al., (2009) find that, in China, out-of-pocket spending is the same or even higher for the insured than the uninsured. The authors posit that the institutional structure of health-care in China, which favors increased utilization and substitution toward more expensive services and treatments, explains this surprising finding. Fewer studies look at health outcomes, though Wagstaff and Pradhan (2005) find that a national voluntary health insurance program in Vietnam is correlated with increased health care utilization and increased height-for-age and weight-for-age measures for children and with an increased (that is, healthier) BMI for adults.

These studies in poor nations are useful, but are all subject to concerns that a very non-random group of people have health insurance. To our knowledge, no study of insurance in developing countries rigorously identifies the causal relationship between health insurance and health spending, health care utilization, or health outcomes.

If health insurance increases utilization of effective health care services, there is room for it to improve health in the poor area of Cambodia, where it is unfortunately common to forego care (World Bank (2006)). Research has shown that the impacts of health insurance or changes in the price of health care on health are largest among the lowest income populations, for example, in the RAND health insurance experiment in the US, noted above (Manning (1987)) and in the Indonesian Resource Mobilization Study (Dow et al. (1997)). Wagstaff and Pradhan (2005), however, find smaller effects of insurance for low-income households than for other households in Vietnam.

While many studies have focused on the effects of insurance on health and out of pocket health expenditures, health insurance can also influence longer-term economic outcomes. Health insurance may influence a family's long-term economic well-being by preventing families from selling productive assets or increasing child labor to cover medical expenses.

Any increases in health can also lead to increases in productivity and income. For example, Thomas, et al., (2004) show that improving health via iron supplements has a significant positive effect on productivity for adults in Indonesia. Dow, et al., (1997)

give evidence that, in Indonesia, higher prices for health care are associated with reduced labor force participation for women and lower wages for men.

The study of the impact of insurance on health utilization also fits into the emerging literature on demand for health and health care services. Insurance will only have an impact on utilization of health care services if demand for health is somewhat elastic. If households utilize health care even at high prices, then lowering the marginal price of insurance should not increase utilization of care. At the same time, because the SKY insurance program lowers the cost of public care as compared to other types of care, SKY may induce individuals to change health care provider (a stated goal of SKY).

Several recent studies and literature surveys have examined elasticity of demand for health care services. In a recent literature review, Dupas (2011) concludes that demand for coverage of acute illness is relatively inelastic (e.g., Cohen, Dupas and Schaner (2011), as referenced in Dupas (2011)). Access to credit has not been found to increase utilization of health services, possibly because households insure against health risks through social networks (Townsend (1994) and Robinson and Yeh (2011), as referenced in Dupas (2011)). Thus, we expect that SKY will not change the percentage who use health services following a major health shock, although it may cause those who do use health services after a major shock to make greater use of the public providers which it covers.

While households do not change utilization of health care services for some illness, they are often unable to cover the costs associated with major health shocks (Gertler (2002) and Fafchamps and Lund (2003), as referenced in Dupas (2011)). Families without access to credit may decrease investments in productive assets and otherwise jeopardize their future (Rosenzweig and Wolpin (1993) and Robinson and Yeh (2011), as referenced in Dupas (2011)).

While demand for treatment of acute illness is inelastic, several studies find that demand for preventative services such as bednets, water treatment, and deworming products, is very price elastic (Kremer et al. (2011); Cohen and Dupas (2010); Kremer and Miguel (2007); Abdul Lateef Jameel Poverty Action Lab (2011)), with a small decrease

in cost producing a large increase in uptake. Thus, SKY, by decreasing the marginal price of preventative care, may increase this care, a secondary goal of the program.

II. The Setting

A. Health care in Cambodia

Cambodia is among the world's poorest and least healthy nations. It ranks 188 out of 229 nations in GDP per capita, has the 38th-highest infant mortality rate (of 224 countries with data), and the 46th-lowest life expectancy (Central Intelligence Agency (2010)).

Cambodians rely on a mix of healthcare providers: public providers, private medical providers, private drug sellers (with and without pharmaceutical training), and traditional healers.

Public facilities consist of local health centers for everyday illnesses, operational district referral hospitals for illnesses requiring more involved treatment, and provincial hospitals for care of more severe health shocks. Public facilities are subsidized by the Cambodian government or other organizations.

However, public facilities have low utilization. According to the 2005 Demographic and Health Survey (DHS), fewer than a quarter of those who sought treatment for illness or injury went to a public health facility. Private providers of varying capabilities are typically more popular than public ones, even when more expensive, because they often are more attentive to clients' needs, more available, visit patients in their homes, provide treatments patients prefer, and provide credit (Collins (2000); Annear (2006)). Real or perceived quality of public facilities may also be a factor in low utilization of public facilities: a survey of clinics involved in the current study shows that only 24% had all required drugs in stock, 87% did not have soap available for staff handwashing, 21% did not have running water, and 55% had floors in need of mopping (Levine et al. (2009)). At the same time, while households often utilize local private doctors and drug sellers for small health shocks, many visit public hospitals for surgery and other major health problems. The average rural household spends $9.60 per month on health care, of which

$2.48 is spent on public health center and hospital visits (DHS (2005)).

Major health shocks often contribute substantially to indebtedness and loss of land. For example, one study followed 72 households with a member who had suffered dengue fever following a 2004 outbreak in Cambodia. A year later, half the families still had outstanding health-related debt, with interest rates between 2.5% and 15% per month. Several of the 72 families had found it necessary to sell their land to pay their debt. (Van Damme et al. (2004)). Annear, et al., (2006) and Kenjiro (2005) found similarly high levels of indebtedness due to medical expenses.

B. SKY Health Insurance

Sokapheap Krousat Yeugn (SKY) micro-health insurance — the Khmer name means "Insurance for our Families" — was originally developed by Groupe de Recherche et d'Échanges Technologiques (GRET), a French NGO, as a response to high default rates among its micro-finance borrowers due to illness. Since 1998 GRET has been experimenting with micro-insurance schemes by examining responses to different premiums and benefits. Historically, take-up of insurance has ranged from 2% in regions where insurance has been only recently introduced to 12% in the longest-served regions.

While the SKY program targets the poor, it also is trying to avoid financial losses and become financially sustainable (without donor support) in the long term. Thus, the policy includes several terms that limit adverse selection. For example, SKY does not pay for the delivery of babies within the first few months of joining. Also, insurance is purchased at the household-level, eliminating the possibility that households would purchase insurance for only very ill or frail members. Finally, SKY insurance does not cover long-term care of chronic diseases. (Government programs pay for the very expensive drugs for HIV/AIDS and tuberculosis.)

At the time of the study SKY sold insurance at prices ranging from $0.50 per month for a single-person household to around $2.75 per month for a household with eight or more members. Households sign up for a six month cycle, paying for the first month's coverage plus two reserve months up front. While a household can stop insurance payments

at any time, failing to pay two consecutive months before the end of the six-month cycle results in the loss of one month of reserve. A household can join SKY at any time, but coverage will not begin until the start of the next calendar month. Households buying insurance for the first time are offered slightly lower premiums to encourage take-up. With their insurance, household members are entitled to free services and prescribed drugs at local public health centers and at public hospitals with a referral (SKY (2009)).

III. Theory and Measurement

A. Economic impacts

The economic benefits of insurance require both that the health insurer pay after a serious injury or illness, and that the family reduce expenditures on expensive private providers.

Health care expenditures arise precisely when the family has lost productivity and often income from one or more adult. For example, if a patient is hospitalized, other household members typically must provide meals and other care for the patient and may work less in order to have time to provide this care. The combination of low income and high expenditures can lead families to sell assets or take on debt. Market interest rates are high, so a loan often leads to asset sales at a later date.

We focus on serious health incidents, or "major health shocks", which we define as illnesses or injuries that lead to seven or more days of disability or to death. We hypothesize that when a major health shock occurs, insurance will lower the rate of selling assets and of taking on debt to pay for care.

We divide our economic impact measures into two categories: economic consequences of individual health incidents, and overall economic impacts to a household.

ECONOMIC IMPACTS FOLLOWING A HEALTH SHOCK. — We use several outcomes to measure the impact of health insurance following a major health shock. The goal of insurance is not focused on mean expenditures, but a substantial reduction in the rate of very high expenditures. Thus, we look at economic behavior following only a major health shock.

To test whether SKY reduces out-of-pocket costs, we examine total out-of-pocket costs for health care (including transportation costs) following a major shock. Because insurance is most important for larger shocks, we also estimate whether insurance decreases the occurrence of costs exceeding 250 USD following a single incident (the top 10th percentile), or of costs exceeding 100 or 350 USD for a household (the top 35th and 10th percentiles, respectively).

To reduce out-of-pocket expenses, SKY must reduce the amount of money spent at expensive private providers and must pay for care at a public facility following a health shock. To test for this, we look at the impact of SKY on large out-of-pocket costs paid for private care and examine how often SKY pays for care for insured households.

If SKY lowers out-of-pocket expenses, households may be less likely to pay for care using costly means of payment. To test this, we examine how often health care expenses following a major health shock are covered by borrowing money, selling an asset, or raising money through extra work. If SKY increases health care or prompt utilization of quality health care, an ill individual may recover more quickly and may have fewer lost days of productive activity. We calculate the impact of SKY on the total number of days of missed activity for ill individuals.

OVERALL ECONOMIC IMPACTS ON HOUSEHOLDS. — If insurance is effective, we expect insured families to be less likely to take on new loans due to health care costs and less likely to sell land and other assets. In addition to testing for this at the incident level, we also look at these measures at the household level: Of all households, were insured households less likely to take out a loan or sell an asset in the past year due to health (not necessarily related to a major incident)? To increase precision we also run this analysis on the subsample of households that had a death or long-term disability during the year.

If uninsured households sell productive assets or withdraw children from school to help pay for care, the result is that a short-term health shock can lower long term productivity and worsen long-term poverty (Van Damme et al. (2004); Annear (2006); Jacoby and Skoufias (1997); Smith (2005); Dupas (2011)). Conversely, if health insurance can

prevent large out-of-pocket expenditures, it may promote the accumulation of productive physical and human capital. We look at impact of SKY on productive assets and school enrollment, although this study was not designed to be large enough to measure such benefits unless they are very large.

B. Health-seeking Behavior

SKY health insurance lowers the cost of health care at public facilities. Thus, we expect that health insurance will increase health care utilization at public facilities, especially if households were seeking too little care prior to insurance purchase.

We expect that most effects of health insurance arise when someone has a serious illness or injury. At the same time, insured households may also increase preventative care. We measure both types of impacts, described below.

HEALTH-SEEKING BEHAVIOR FOLLOWING A MAJOR HEALTH SHOCK. — Insurance can increase health-seeking behavior by reducing the cost of care following a health shock. But if demand for health is relatively inelastic, as has been found in much of the recent health-demand literature, we may not see much increase in health care utilization, although insured households may shift from more costly private care towards SKY-covered care.

We also measure reduction in foregone health care and reduction in delayed care. One of SKY's principal goals is to reduce the share of families that forego necessary health care due to lack of funds. In our study, a sick household member is considered to have foregone care following an illness or injury if treatment was not sought, or was discontinued, due to cost. A concern in poor nations is that families delay treatment of illness due to costs. Thus, among serious incidents, we examine the effect of insurance on the number of days until first treatment.

More important for effective treatment is that households are seeking *qualified* health care in a timely manner. Thus, we also measure time until they were treated at a health

care provider other than a drug-seller.

As noted above, health care in rural Cambodia is dominated by poorly trained private doctors and drug sellers. SKY's theory of success posits insured families will make less use of such caregivers. We thus examine the proportion of serious or costly incidents that used a drug seller, traditional healer (*kru khmer*), or private provider.

Public health care providers are the only providers that are regulated by the Cambodian government. By partnering with only public facilities, SKY encourages utilization of these regulated facilities. To test this, we look at (a) the percentage of individuals visiting a public facility as a first treatment following a major health shock and (b) the percentage of individuals visiting a public facility at all following a major health shock.

OTHER HEALTH-SEEKING BEHAVIOR. — We also analyze foregone care for households as a whole, whether or not any member had experienced a major health shock. To measure this, households are asked whether a member has ever foregone care due to lack of funds.

Insurance may increase care following a major health shock, but may also increase routine and preventative care. In general, having zero copay at public facilities may increase use of public health centers even in households without a major health shock. To test this, we examine use of a public provider in the three months prior to our household survey in households with or without a major health shock.

While immunizations and some other forms of preventive care in Cambodia are already free, many Cambodians have little exposure to the public health facilities that encourage and provide preventive care. Joining SKY – and thus using public facilities more – may increase preventive care. We test if SKY increases immunizations and modern contraception, and test whether SKY has any impact on birth-related outcomes such as ante- and postnatal care and location of birth.

C. Health Outcomes

Prompt and appropriate curative care, avoidance of harmful care from unqualified providers, and increased preventative care will over time improve health. Unfortunately,

it takes an extremely large multi-year study to detect such effects. Although this study was not designed to have much chance to measure such benefits, we measure how SKY insurance affects objective measures of health such as frequency of major health shocks and children's stunting and wasting.

IV. Data and Methodology

Those who choose to purchase insurance typically differ markedly from those who decline insurance. To understand the causal effects of insurance we implemented a randomized controlled trial that allows us to identify the impact of health insurance independently from all other factors that may affect a household's decision to take up insurance. No household was denied access to insurance. Rather, by subsidizing the premium of a randomly-selected group of households, we are able to estimate the effect of insurance on households without substantially altering the existing SKY program.

A. Randomization of Prices

Our randomized experiment was carried out as the SKY program expanded to 245 villages from November 2007 to December 2008. The expansion took place in Takeo, Kandal, and Kampot provinces, all rural areas of Cambodia.

When the SKY program first rolls out into a region, SKY holds a village meeting to describe the insurance product to prospective customers. The meetings are advertised ahead of time via loudspeaker announcements in each village.

To randomize price of insurance, we implemented a lottery whose winners received a deeply discounted price: 5 months of free insurance in the first 6-month cycle, with the option to renew for a second 6-month cycle with a coupon for 3 months free.

At the start of each meeting, an Evaluation Representative recorded the name of one representative of each household in attendance, and throughout the meeting, recorded the names of those arriving late.

SKY's Field Coordinator then described the product while the evaluation representative counted the number of households attending the meeting and determined the ap-

propriate number of high and low coupons to be distributed. The number of 5-month coupons to be raffled off was set equal to 20% of attendees for meetings of up to 60 households and equal to 12 for meetings of more than 60 households. The remaining households were entitled to a coupon for one month free in the first 6-month cycle. These high- and low-value coupons, printed on colored heavy-weight paper, were placed into an opaque bag.

At the end of the meeting, the field coordinator announced that there would be a lottery and explained the coupons, pointing out that a coupon could only be used by the family who had won it. The names from the attendance list were called off one by one, and one representative from each family came to the front of the room to draw a coupon from the bag. High and low coupons were different colors, so that meeting attendees could see which type of coupon was drawn, but care was taken to ensure that coupon type could not be seen while drawing and that high and low coupons could not be identified by touch. The outcome for each draw was recorded next to the person's name on the attendance sheet.

All households winning a high coupon were selected to be part of our survey sample. Research field staff also chose every fourth low-coupon household from the roster until they matched the number of high coupon winners.

Following the meeting, our staff and the village chief drew village maps with the location of the families chosen for our sample. SKY Insurance Agents then visited these households to offer them health insurance.

We encouraged members who received the steeply discounted offer to renew by offering additional discounts after the initial 12 months had passed.

B. Data

Our analyses use a longitudinal household survey and SKY data on membership. We chose our sample size to have 80% power to detect a feasible and economically important reduction in several important outcome measures. For example, we expected to have 80% power to detect a 2.6 percentage point reduction in the percentage of households

spending over $1.25 on health care in the previous four weeks (compared to the 10.1% mean in the 2005 DHS), or a 2.0 percentage point increase in the number of households using a public facility in the past four weeks (compared to the 5.1% utilizing public facilities in 2005 DHS data).

Although we collected data on prenatal care, birth outcomes, anthropometric measures for children, and frequency of major illness or death, the evaluation was not designed to have statistical power to detect impacts on these measures. For example, using our sample, we calculated that we could detect a 3.5 percentage point decrease in the percentage of households reporting any illness in the last 4 weeks (compared to the baseline mean of 20.2% in DHS 2005 data). Using our actual survey measure of percent of individuals with an illness lasting more than 7 days, we have 80% power to detect a 2.6 percentage point decrease compared to the control of 10.2% reporting such an illness. Even with increases in utilization of public facilities, which may provide better care than unregulated treatment, we did not expect to see this level of change in the percentage reporting ill. For prenatal care, birth outcomes, and anthropometric measures, we have data on only a small portion of our sample, so it becomes even harder to detect changes in outcomes.

HOUSEHOLD SURVEY. — Our main data source is a survey of over 5000 households. We use some data from the first-round baseline survey administered one to eight months after the village meetings, but we rely largely on the follow-up survey which took place a year later, that is, 13 to 20 months after the initial SKY marketing meetings.

The surveys cover demographics, wealth, objective health measures, health care utilization and spending, assets and asset sales, savings, debt, trust of health care institutions, and so forth. We ask households to describe health care utilization behavior following a major or costly health shock, which we define as a health incident causing a death, the inability to carry out usual household activities for seven or more days, or an incident causing an expense of over 100 USD. In most analyses we do not include behavior following a 100 USD health expense because households with SKY insurance would be less likely to fall into this category.

In each village we interviewed all households that were offered the steeply discounted price and an equal number of households that were offered the regular price. We selected the control households by choosing every fourth non-winner from the village meeting attendance list, as described above. In total, our randomized sample consists of 2617 households offered the deep discount and 2618 households offered the regular price, of which we interviewed 2561 and 2548 households, respectively, in the baseline survey, and 2502 and 2506 households, respectively, in the follow-up survey. Survey response rate and completion was almost identical between households that did and did not receive the deep discount. Figure 1 summarizes the timeline and sample size of the evaluation[2].

Because there was a delay between the first offer of insurance and the baseline survey, baseline survey results are not necessarily pre-insurance results. As a robustness check, we include "baseline" levels of some impact variables as controls. If insurance has already had an impact on households a few months after joining SKY, then the delay in the baseline will bias the estimated effects of insurance downwards.

SKY MEMBERSHIP. — For each household that becomes a SKY member, SKY records the date that coverage begins, and, if applicable, the date the household drops out.

C. Estimation

INTENTION TO TREAT. — The randomization of prices allows us to answer the question, "What is the effect of offering insurance at a deeply discounted price?" This result can be calculated by simply comparing average outcomes for households that received the large discount (including those that chose not to buy even at the discounted rate) to households that did not receive this large discount.

IMPACT ON THE INSURED (TREATMENT EFFECT ON THE TREATED). — We can also estimate the effect of SKY insurance on households that purchased insurance due to the discount (the effect of the treatment on the treated population).

[2]This figure includes only households randomized into the sample and not oversampled households that were interviewed for other parts of the study.

To estimate the effect of insurance on the insured, we cannot simply compare outcomes of the insured to the uninsured. If we estimate how SKY predicts each outcome Y for household i at time t with ordinary least squares:

$$Y_{it} = \beta \cdot SKY_{it} + \varepsilon_i \tag{1}$$

the estimated coefficient β_{OLS} can have very large bias because SKY membership is endogenous. For example, if people with health problems are more likely to purchase insurance, β_{OLS} could be strongly negative (indicating that SKY predicts poor health), even if SKY insurance actually improves health.

Thus, we instrument for SKY membership with the randomized treatment, with $T_i = 1$ for those offered the steeply discounted price. Due to dropout over time, SKY membership was higher a few months after a village meeting than several months later for those offered the higher price. We therefore included as an instrument the offered price interacted with the number of months since the village meeting ($Months_{it}$):

$$SKY_{it} = \gamma_1 \cdot T_i + \gamma_2 \cdot Months_{it} + \gamma_3 \cdot Months_{it} \cdot T_i + u_{it} \tag{2}$$

Our survey collects data on major health shocks using respondent recall over the 12 month period immediately prior to the survey date. Thus, for incident-level outcomes, that is to say, outcomes that are a direct result of an individual health incident in month t, t is defined as the month of the incident, $Months_{it}$ is defined as the number of months between the village meeting and time t, and the instrument $Months_{it} \cdot T_i$ is $Months_{it}$ multiplied by 1 if household i received a high coupon and 0 if the household received a low coupon. SKY status in month t, SKY_{it}, is defined as a three-month average membership rate centered in month t, to account for imperfect recall of the timing of health incidents. Thus, SKY_{it} can take on the values 0, $\frac{1}{3}$, $\frac{2}{3}$ or 1. For example, for a health incident occurring t months after the village meeting, SKY_{it} equals 1 if household i was

insured in months $t-1$, t, and $t+1$, but equals $\frac{1}{3}$ if the household was insured in only in month $t-1$.

Similarly, for birth outcomes, t is defined as the month of the birth and $Months_{it}$ is defined as the number of months between the village meeting and time t. SKY_{it} is again defined as a three-month average membership rate centered in month t.

For all endogenous variables not related to a particular health incident or birth we define $Months_{it}$ as the number of months between the village meeting and the date the variable was measured (the date of the follow-up survey). For outcomes measured by behavior in the three months prior to the interview, such as having visited a public facility (for any reason, whether or not related to an illness), we define SKY_{it} as average membership in the four months prior to the survey (again, to account for imperfect recall). For outcomes that take time to accumulate such as health-related loans, SKY_{it} is defined as the share of the year prior to the interview that the household was a SKY member. The precise dating of membership never affected results.

Using our randomized price as an instrument estimates the effect of insurance on those households who purchase insurance due to the deeply discounted price. By defining SKY_{it} at the time of an incident (or the other definitions, above) and by including offer price interacted with months since the village meeting as an instrument, the "treatment on the treated" regression measures the impact of SKY on households that joined SKY and remained in SKY due to the large discount. For simplicity, we will often refer simply to the effect of SKY on the "insured" and contrast it with the control group (those without a high-value coupon), even though a small portion of the control group also purchased SKY.

The causal effect on this price-sensitive group – households that purchase insurance due to the deeply discounted price – is the local average treatment effect ("LATE"; Imbens and Angrist (1994)). In the discussion section we examine how our estimates may or may not generalize to other groups of rural Cambodians.

V. Results

A. Tests of Experimental Design

RANDOMIZATION. — Table 1 shows average characteristics of high and low coupon winners prior to the SKY meeting (for health shocks) or at the time of the first round survey. Of the thirty variables tested, only three show a statistically significant difference between high and low coupon at the 5% confidence level. 14% of low coupon households have wealth level subjectively graded by enumerators as "poor", while only 10% of high coupon households are rated as "poor". Similarly, low coupon households are slightly more likely to live in a house made of palm, another measure of lower wealth. Other wealth indicators did not show significant differences. Households offered a high coupon were also slightly less likely to be Khmer (as opposed to a minority ethnicity): 94.6% versus 95.3%, respectively.

We keep in mind these differences when interpreting results and, for some variables, we test whether holding first round survey values constant affects our results.

ANALYZING MAJOR HEALTH SHOCKS. — We analyze a number of outcomes that measure behaviors following a major health shock. If insurance affects the probability of a major health shock, then for these measures we are no longer identifying the effect of insurance solely using the randomized price. For example, suppose a member of a household with SKY insurance gets sick, seeks care, and therefore misses seven days of work. At the same time suppose that an uninsured person with the same illness doesn't seek care and continues working. By our measure, the insured household will be counted as having a "serious" illness while the uninsured household would not. Behavior by the insured individual will be included in our measure, while that for the uninsured individual will not, causing bias in our results.

One factor that helps to reduce this potential bias is that SKY does not greatly increase the incentive to spend a week at the hospital. Even with SKY insurance, hospital stays

require family members be present to handle some of the patient's care, including feeding. In addition, by the sixth day the marginal out-of-pocket cost of a hospital stay is zero even for the non-insured.

SKY members may also be less likely to have a death than non-SKY members because they may get better health care, but it is unlikely SKY would affect death rates by much over such a short time. We believe that neither of these factors will have a meaningful effect on the number of households from the insured and uninsured groups being classified by our measure as having a serious incident.

Consistent with our assumptions, the rates of major health shocks are almost identical in the high and low-coupon samples (Table 9). There are almost identical numbers of deaths for the treatment group (those offered the steeply discounted price) and the control group; both groups had average death rates of 0.007 and there was no statistically significant difference between them. The percentage of individuals who suffered health shocks requiring missed activity for seven or more days was 10.2% for both the treatment and control groups.

B. Summary statistics

Summary statistics for each outcome, subdivided into treatment and control means, are presented in each outcome table. Comparing outcomes for the treatment and control group provides the intention-to-treat estimates of the effects of distributing steep discounts.

C. First Stage

Our instrumental variables methodology requires that SKY membership be strongly correlated with our instrument (i.e., the steeply discounted price plus time since the village meeting). Figure 2 shows that this is in fact the case. For treatments, membership peaked at around 47% at month six , then steadily declined. For controls, membership did not change much over time, reaching only a slight peak of 3.3% at 20 months. Table 2 shows the first-stage regression for incident-level data.

Recall that, for the incident-level data, SKY_{it} averages membership in the month of, the month prior to, and the month following the incident month t, and that $Months_{it}$ is defined as the number of months between the village meeting and month t. First stages for the other specifications are in the Web Appendix. All are similar to Table 2 and show similarly large effects of the treatment on SKY membership and similarly strong statistical significance.

D. Economic Effects of Insurance

ECONOMIC EFFECTS FOLLOWING A MAJOR HEALTH SHOCK. — We analyze total out-of-pocket costs following a serious (seven or more days unable to work) or fatal incident (Table 3), and then examine how households paid for these expenses (Table 4).

To measure out-of-pocket costs, we top-coded each household's total health care expenditures for serious or fatal incidents at the 98th percentile (947 USD) to eliminate large outliers. We include both cost of treatment and cost of transport. The control mean cost for an incident is $103.81. The instrumental-variable estimate is that households that were induced by the large discount to purchase SKY and remained insured paid $45.79 less in care and transport for a serious or fatal incident ($P < .05$, Table 3). Summing over all incidents in the last twelve months, we estimate that households that purchased SKY due to the deep discount paid $57.80 less in care and transport for these major incidents compared to a control mean of $132.43, a decrease of 44% ($P < 0.01$). These results are driven by a decrease in treatment costs rather than transport costs (Polimeni and Levine (2011*c*)).

It is important that much of the savings in out-of-pocket costs is due to fewer households incurring very high medical expenses. Cumulating out-of-pocket costs for each serious incident[3], we found that 11% of incidents in control households had health care costs of over $250 and that insurance decreased this percentage by 8.6 percentage points ($P < 0.01$).[4] Moving to the household level (that is, cumulating across all incidents in the

[3] Results hold if we include households that did not have a death or missed 7 days, but spent over $100USD on care.

[4] We chose this cutoff to correspond to the top 10th percentile of spending. We tested different cutoffs under $250 and

past year for a given household), the probability of an insured household spending over $350 is 5.0 percentage points lower than that of a control household (11.5%, P = 0.19), while the probability of an insured household spending over $100 is 10.9 percentage points lower than that of a control household (38.2%, P < 0.10).

SKY decreases costs in part by lowering the percentage of households paying for expensive private visits, but this effect is modest. The probability of an insured household spending over $5 at a private provider following a major health shock is 12.3 percentage points lower than that of a control household (61.9%, P < 0.05), while the probability of an insured household spending $150 is 7.0 percentage points lower than that of a control household (9.7%, P < 0.05). For private expenses, varying the cut-off for amounts up to $1000 sometimes made the difference insignificant, but the insured had lower private expenses than the uninsured in all but one (statistically insignificant) case.

SKY also can reduce costs by paying for public care, but this will only be the case if SKY actually covers the care people need. Households induced to buy SKY with the large discount are 43.8 percentage points more likely than other households to have a treatment paid for by SKY following a serious or fatal health shock (P < 0.001, Table 4).

SKY households are also 9.2 percentage points less likely to sell assets after a major health shock than control households, for whom the mean is 22.4% (P < 0.05, Table 4); 13.6 percentage points less likely to take out a loan with interest than control households, for whom the mean is 19.6% (P < 0.01); and 6.4 percentage points less likely to take out a loan without interest than control households, for whom the mean is 12.8% (P < 0.10). SKY had no significant impact on the use of extra work to pay for health care expenses.

In results not shown, members of insured households who had major health shocks lose an average of 1.9 fewer days to illness than the control group average of 39.5 days, but the difference has very low statistical significance (P = 0.82).

in all cases the IV regression showed that the insured had significantly lower spending than the uninsured. Cutoffs above $500 did not produce statistically significant results.

OVERALL ECONOMIC IMPACTS ON HOUSEHOLDS. — Apart from analyzing the costs of each incident, we examined economic outcomes for households.

Consistent with insurance's expected effect of reducing out-of-pocket expenditures, we find that households with SKY also have less debt. On average, insured households have \$68 lower debt ($P < 0.05$), about one third of the mean for control households (Table 5). When we ask specifically about loans for health, we learn that insured families have \$22 less in such loans, a reduction of 77% compared to the control mean of \$29 ($P < 0.001$)[5].

Also as we expected, the lower debt for SKY members shows up only in households with a serious health incident or death: these households reduce debt by \$89 compared to the control mean of \$234.61 ($P < 0.05$, see Web Appendix). Households with no serious incidents have lower debt than households with a serious incident, with or without SKY, but among those with no serious incident, debt is not especially lower for insured households (results not shown).

Results were similar when we asked directly (in a different section of the survey) whether the household had more debt than the previous year due to health care costs or a birth. Households who bought insurance due to the high coupon were 7.7 percentage points less likely than control households (at 8.9%) to report an increase in debt due to health care costs or a birth (Table 5, $P < 0.01$).

Looking at the impact of SKY on productive assets, the insured are less likely to report a reduction in land from the previous year, though the estimate is not statistically significant (Table 5). When we focus on a reduction in farmland or village land because of health, we estimate that no SKY members sold land due to ill health; the IV point estimate shows that households that purchased SKY were 1.6 percentage points less likely to sell land for health reasons compared to the control mean of 1.1% ($P = .051$)[6].

Although this study was not designed to be large and long enough to be likely to mea-

[5] The large-valued coupon was worth around \$1.65 x 8 for 12 months, equal to a total of \$19.80 for high coupon households that joined for all 12 months. Insured households decreased health-related loans, compared to the control, by \$22.32 (this is total health care loans, not loans in the last 12 months). Even if we assume that the coupon is equivalent to a direct income transfer of \$19.80, this leaves insured households with \$2.52 less in health care debt.

[6] The effect size can be impossibly large in the linear probability model due to samping error among non-SKY households with high coupons. A similar issue arises for the impact of SKY on tetanus shots, presented below.

sure the long-term accumulation of productive physical and human capital, that is what SKY donors hope to promote through health insurance. We therefore took note of any such effects we could discern. Our IV results show that SKY members had substantially higher value of livestock ($96.9 higher, compared to the baseline mean of $540, P < .05, Table 5). There is no difference in other asset classes: cash, gold, or non-farm businesses (not shown), or between the treated and control groups as a whole[7]. A wealth-index composed of the averaged z-scores of the value of cash, gold, animal, durable assets, and non-farm business shows a positive impact of SKY on wealth, but the effect is not statistically significant (P = 0.13, Table 5)[8]. As expected, economic impacts are generally larger on households with major health incidents than on households overall (see Web Appendix).

Our instrumental variable estimate is that insured households have a 4.6 percentage point higher fraction of school-aged children enrolled in school versus the baseline mean of 83.1% (Table 5, P = 0.14). While provocative, the higher enrollment is not driven by households with major health incidents (see Web Appendix), and is therefore likely being driven by something other than SKY coverage. Future analyses will investigate this outcome in more detail.

E. Health Seeking Behavior

HEALTH SEEKING BEHAVIOR FOLLOWING A MAJOR HEALTH SHOCK. — For the impact of health insurance on forgone health care, our instrumental variables estimate is that households that purchased insurance due to the discount had a 3.2 percentage point reduction in discontinued treatment following a health shock compared to the control mean of 5.2%, but this difference is not statistically significant at conventional levels (Table 6, P = 0.19). We also examine the number of days until first treatment following a serious incident. Counter to expectations, insured individuals with a major health shock

[7] We test some outcomes holding baseline constant in the Web Appendix.

[8] To create this index, we created z-scores for each of the five wealth values (cash, gold, animals, assets, business). Each z-score is equal to the value of the variable for the houshold, minus the mean of that variable over all households, divided by the standard deviation of that variable over all households. For each household, the wealth index averages the z-score for each of the five variables. This is similar to a procedure used by Kling, Liebman and Katz (2005).

wait longer before their first treatment than uninsured individuals and are less likely to receive care within a day (Table 6). However, this may be because the uninsured are seeking a different kind of treatment. That is, a household with insurance may wait two days until they have time to go to the doctor, while an uninsured household may seek immediate care at a local drugseller. Thus, it appears that the uninsured are seeking care sooner, but it may be a different – and possibly lower quality – type of care (results below).

More important than delay until treatment is delay until *effective* treatment. Thus, we also examine days until insured visited a health care provider other than a drug-seller (the measure includes visits to traditional healers). We top-coded this measure at 30 days, and coded those with no visit to a health care provider other than a drug-seller as having a delay at the top-coded value of 30 days. We also measure the percent of individuals with a major health shock who receive care at a health care provider other than a drug-seller within a day of the incident. For both measures there was no significant difference between the baseline and those insured.

Insurance did have a significant effect on *where* a person received care during a serious health care incident (Table 7). Specifically, SKY insurance doubles the odds that a serious incident is first treated at a public health center. Among the control, almost half of serious incidents were first cared for at a private provider, 14% at a drug seller, 16% at a public hospital and 14% at a public health center. NGOs and *kru khmer* traditional healers make up the rest. SKY reduces the use of private providers and drug sellers as the first source of care by 11 percentage points ($P < 0.05$) and 8 percentage points ($P < 0.05$), respectively, and increased the use of public health centers as the first source of care by 18 percentage points ($P < 0.001$). The rates for public hospitals are not changed by economically or statistically significant amounts.

People with serious health incidents often receive care from multiple providers. Rates of using each type of provider at any point following a major health shock also shifted in favor of health centers: 18% among the ill in control households used a health center following a health shock, while the figure increased by 22 percentage points to 40%

among those who bought SKY insurance ($P < 0.001$, see Web Appendix). Nearly two-thirds of ill members in control households used a private provider following a major health shock; the 9 percentage point decline among those who bought SKY insurance is marginally statistically significant at the 7% level. There was a 9 percentage point decrease in the percent visiting a drug seller for care compared to 17.5% among the control group ($P < 0.05$).

OTHER HEALTH-SEEKING BEHAVIOR. — For health care in general (not necessarily following a major health shock), households that bought SKY insurance due to the large discount were 1 percentage point less likely to forgo care compared to the control mean of 0.9% (essentially indicating that the insured had no forgone care) but this impact was not statistically significant (see Web Appendix).

Respondents were also asked, "In the last three months, did you go to see a government doctor?" Contrary to SKY's theory of change, SKY membership does not increase the share of respondents who did so (see Web Appendix).

SKY also hoped to improve preventative care. Our results on preventative care have low statistical power because of the smaller sample size of children (for immunization measures) and women of reproductive age (for birth outcomes and contraception). With that caution in mind, there is no detectable effect on the proportion of children whose immunizations are up to date, or on the share of married women ages 16-45 using contraception or using modern contraception (see Web Appendix).

Table 8 presents SKY impacts on birth-related outcomes. On the one hand, the insured are no more likely to receive antenatal care in general, and there was no significant impact on the percent receiving post-natal check-ups. On the other hand, the insured are much more likely to report having received at least one tetanus shot during pregnancy ($P = 0.10$, compared to the control mean of around 92.6%).[9]

With or without insurance, 99% of births had a trained birth attendant, midwife, or

[9]The point estimate, taken literally, shows a 12 percentage point increase in reporting at least one tetanus shot, which would lead to over 100% of SKY members having a tetanus shot. This anomaly is due to estimating a linear probability model coupled with sampling error that meant an above-average number of high-coupon recent mothers who did not join SKY received a tetanus shot.

doctor present at the birth. Insured women were slightly more likely to give birth under the care of a trained birth attendant or doctor, and slightly less likely to give birth with a midwife, but these differences are not statistically significant at traditional levels.

We do find some difference in delivery location between insured and uninsured women. Women in insured households were 21 percentage points more likely to give birth in a public facility (the control mean is 59%), although the difference is not statistically significant given the small number of births in our sample. Pooling births at a any kind of formal facility, public or private, insured women were 31 percentage points more likely to give birth there (P = 0.06, control mean is 64%). Women not giving birth in public or private facilities gave birth either at home, the forest, or somewhere else.

F. Health Outcomes

As mentioned previously, the percentage of individuals in treatment versus control households who suffered death or a health shock lasting 7 or more days was no different than the percentage in the control group (Table 9).

We also found that SKY insurance had no detectable effect on objective measures of children's health (BMI, height-for-age, and weight-for-age) (Table 9), but we cannot make much of this finding because our study was not designed to have much chance to measure such benefits.

VI. Robustness Checks

For many of the outcomes above, we ran tests on several sub-groups, for example, only households with major health shocks or only those without. In some instances we included health incidents not only that resulted in a death or seven or more day illness, but also those incidents that did not meet those criteria but on which more than 100 USD was spent on care. We also varied the cutoff for some economic outcomes, testing the percentage of incidents or households with expenditures above $5, $50, $100, etc. In most cases these changes did not affect results; instances where they did are mentioned above. Changes in our definition of SKY_{it} in equation 2 also did not change general

results.

We also re-ran results using coupon status as an instrument for SKY purchase, rather than the interaction of coupon status and months since being offered SKY. These results were very similar to the main results, and are presented in the Web Appendix.

Our randomization tests showed that high coupon households were slightly richer at the start of our study, suggesting that pre-SKY differences may have influenced our results. We test this for a few variables by including the value of the variable at the time of the first round survey (see Web Appendix). While statistical significance decreased below the 5% level for some outcomes, the general results were the same. As noted above, because the first round baseline survey was administered several months after the start of insurance, these results may be somewhat biased downwards.

To further analyze the data, we subdivided the sample to test outcomes on various sub-populations. We examined effects of SKY by region, age, gender, wealth, and whether the ill household member has a long-term disability. We also examined whether proximity to a higher quality public facility influences the impact of SKY. We found that the impact of SKY on loans and health-related loans is largest for households starting off with the lowest value of assets and smallest for those with the highest value of assets at the baseline, and that SKY seems to have a bigger impact on females than males in decreasing the percent stopping care due to no money. However, in general we did not have enough statistical power to find statistical significance by sub-population and did not find any statistically significant differences by other sub-categories. Results of these extensions are presented in Polimeni and Levine (2011c).

VII. Conclusion

SKY has several goals. First, it is trying to shift rural Cambodians from unregulated private providers and drug sellers to the public system. It appears to be successful in this regard. SKY is also trying to reduce expensive private care and is having some success at that, though not as much as we had anticipated.

SKY aims to reduce delays prior to receiving qualified care. We do not find insured

households showing less delay in seeking first care than control households. However, this lack of effect may be because the uninsured are providing their own first care by buying medications from unqualified drug-sellers, which can be quicker and more convenient than seeking care from a qualified provider. As our measure of delay until treatment cannot distinguish between treatment at a qualified or unqualified provider, it is possible that SKY does reduce the delay in getting care from qualified providers, even though we are not picking up this effect.

SKY hoped that higher exposure to health messages at public health centers would increase the use of preventive measures such as immunizations and prenatal care. We do not find evidence of these effects, perhaps in part because some forms of preventative care, such as vaccines, are already free.

As in the general literature, it easier to detect changes in health care utilization than improvements in health. The sample size and timeframe of our study meant that we did not have statistical power to detect meaningful improvements in health. Thus, while we find no significant impacts of SKY on health, we cannot draw any conclusions from this result. One the one hand, it is possible that SKY indeed has no impact on health: Treatment at public facilities is often a replacement for other types of care (private or drug sellers). Treatment at public facilities may not actually improve health compared to treatment at other facilities, or if care is poor enough, may not improve health at all. On the other hand, even if public health centers are better than these other types of care and truly do improve health, they may not represent a big enough improvement in quality to cause a measurable difference over our short time horizon and using our survey sample.

But health insurance is primarily designed to protect against economic loss, not to improve health and health care. The effects of SKY were typically larger on economic outcomes than on utilization. SKY reduced total medical expenses following a major health shock, largely due to a lower percentage of households with large expenses. SKY households also accumulated less debt due to health problems and were less likely to sell productive assets to pay for a large shock. Insured households were less likely to sell

land to pay for a health issue, and had higher overall values of livestock than uninsured households.

Most families eventually have a serious health care shock. Our results suggest that many uninsured households will take on debt to pay for health care at some point in their lives. A substantial minority of those uninsured households will also sell productive assets such as land. SKY health insurance cuts the rates of these events by about a third.

Importantly, the overall savings to insured households compare favorably with the cost of insurance for these households. On average, households pay 1.65 USD per month (taking into account average household size of SKY buyers), or 19.80 USD for a year of membership. Our calculations show a decrease in expenditures of 57.80 USD over the last 12 months for insured households (Table 3), and even higher reductions using uncensored results. Thus, assuming the value of SKY to a consumer equals averted out-of-pocket costs (ignoring any social cost, and any added or subtracted value of using a public facility over an alternative form of care or no care), the value outweighs the cost of insurance for the insured. If private care or self treatment via drug sellers is actually harmful, then our estimates of value to SKY members is an underestimate, as we are not including any value of averting private care. In addition, this calculation of benefits does not include any averted interest payments due to decreased loans for health care. Conversely, if public care is harmful, our estimates of benefits are an overestimate.

Our study examines a group of households in rural Cambodia that are similar to the general population in age, education, and other demographic characteristics of households in rural areas of Cambodia. To that extent, results may generalize well to the rest of rural Cambodia. At the same time, SKY partners only with health facilities that are above average quality. The impact of a community-based health insurance scheme would most likely be worse in areas where health facilities are of lower quality.

Also, as noted above, using our randomized price as an instrument estimates the effect of insurance on the roughly one-third of households who purchase insurance due to the deeply discounted price. This price-sensitive group is relevant for business and public policy, as these customers are probably the most likely to purchase insurance if there

were a greater subsidy, successful new marketing techniques, and so forth. However, the effects of insurance on this group are probably not representative of the effects of insurance on the entire population. For example, a companion paper (Polimeni and Levine (2011*a*)) demonstrates substantially more self-selection among the 4% of the population who paid full price for SKY insurance than for the larger group who bought insurance only at a deeply discounted price. To the extent those who anticipate the greatest benefits of insurance buy insurance even at the full price, their benefits from insurance will be higher than our estimates.

Conversely, those who decline insurance even with the steep discount may correctly expect low benefits, perhaps because they are unlikely to need health care or because they live far from high-quality public facilities. In that case, the never-buying group would have fewer benefits from insurance than our estimates. At the same time, if the main barrier to uptake is low understanding of the benefits of western medicine or extreme poverty, those who decline insurance even with a steep discount would have as high or higher benefits as those who purchase with the discount. It is difficult to be sure how expansion to universal insurance would affect this part the population; as time goes on, understanding of insurance probably rises, which may affect take-up of insurance in the long run.

In companion papers (Polimeni and Levine (2011*a*) and Polimeni and Levine (2011*b*)) we find that those who purchase SKY and those who decline do not differ much on most observable factors, such as education or risk aversion. At the same time, SKY members tend to have had more health problems prior to purchasing SKY, particularly those who paid the full price. By measuring ex-post use of health care services, we provide evidence that SKY members paying the regular price have worse health than those purchasing at the discounted price, over and above what could be observed at the baseline. Specifically, holding constant measures of health observed at the baseline, SKY members who paid the full price tend to use SKY facilities substantially more than those who purchased SKY with a high coupon. This gap in health care usage is predicted by theories of adverse selection.

These results are relevant to our study, as it means that the health and the expected health care expenses of those who bought SKY with the high coupon (the group of SKY members we analyze) are much more similar to others in their communities than are those who paid full price for SKY.

In addition to limitations of our identification strategy, our measures all had limitations. For example, we did not measure the quality of private care. Thus, it is hard to tell if SKY increased effective care or simply replaced private with public care.

As noted, the study was too small to detect several longer-term outcomes, including changes in health. It bears repeating that "absence of evidence is not evidence of absence," so it is possible that health insurance does lead to long-term benefits for these outcomes.

This study examines one insurer operating in a few regions of a single nation. We need more studies that rigorously evaluate micro-insurance and other innovations in health care financing.

The low take-up of voluntary health insurance emphasizes the importance of other programs to increase access to health care for the rural poor (Bitran et al. (2011)). SKY itself is managing one of Cambodia's health equity funds, which provide free care for the rural poor. It is important to evaluate the impacts of health equity funds and other alternatives as a complement to this evaluation.

VIII. Tables and Figures

	Offered Full Price, Mean	Offered Deep Discount, Mean	Clustered ttest	
Observations	**2533**	**2536**		
Highest ranked wealth by enumerator	0.13	0.14	-0.98	
Lowest ranked wealth by enumerator	0.14	0.10	3.96	**
Answered all literacy/numeracy questions correctly	0.15	0.15	0.13	
Household Size	5.03	5.02	0.31	
Education of health decision-maker (years)	4.61	4.72	-1.13	
At least one household member with poor self-reported health	0.70	0.72	-1.15	
At least one member over 65	0.25	0.26	-1.11	
No child age 5 or under	0.55	0.57	-1.41	
Household has a stunted or wasted child under age 6	0.16	0.15	0.88	
All vaccines fulfilled for members under 6, 0 if no under 6, pre-mtg	0.27	0.25	0.96	
Miss 7 or more days of work or death due to illness, 2 to 4 months pre-Meeting	0.07	0.07	0.07	
Major health shock (*) and used health center for care (0 if no shock)	0.01	0.02	-0.97	
Major health shock (*) and used hospital for care (0 if no shock)	0.02	0.02	0.22	
Major health shock (*) and use private health care (0 if no shock)	0.05	0.05	-0.06	
Ln of max days ill for a major health shock (*), pre meeting (0 if no shock)	0.22	0.23	-0.44	
Major health shock (*) and spent 120,000 riel on care (USD30) (0 if no shock)	0.04	0.04	-0.34	
Khmer household	0.953	0.946	2.00	*
Ln of approximate value of animals, durables, and business (USD)	6.47	6.49	-0.64	†
Ln of approximate value of animals, durables, business, cash, and gold (USD)	6.68	6.74	-1.91	†
Area of farm land owned by household (hectares)	0.81	0.86	-1.05	†
Area of village land owned by household (hectares)	0.14	0.13	0.90	†
Household has at least one toilet	0.26	0.26	0.34	
House made of palm	0.04	0.03	2.23	*
Roof made of palm	0.05	0.04	1.40	
Roof made of tin	0.37	0.38	-0.53	
Roof made of tile	0.51	0.52	-0.66	
House made of brick	0.03	0.03	-0.41	

All variables are from the baseline survey.

Sample is all high coupon households and all low coupon households in the randomized sample.

Ttest clustered at village level. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

* Major shock includes all shocks causing 7 or more days of missed work or death.

Variables measured several months after baseline. Some, especially those marked with †, may be slightly changed since initial SKY take-up.

TABLE 1—RANDOMIZATION TEST

	Avg SKY Membership Prior, Post, Following Incident
High Coupon	0.371***
	(13.45)
Months Since Mtg	0.00227
	-1.68
High Coupon Interaction With Months Since Mtg	-0.00847**
	(-3.03)
Constant	0.0442***
	-4.36
Observations	4009
Adjusted R^2	0.1502
F-Test	129.8

TABLE 2—FIRST STAGE REGRESSION FOR INCIDENT-LEVEL OUTCOMES, ROUND 1 AND 2 INCIDENTS USED

	Intention to Treat					Impact on the Insured		
	Mean							
	Treatment	Control	Difference	T-Statistic	N	IV Difference	IV T-Statistic	IV N
Following a Major Health Shock								
Amount spent on care								
Total USD spent on care for a given incident[1]	90.407	103.811	-13.404*	-2.326	4207	-45.789*	-2.384	3887
	(4.63)	(4.59)	(5.76)			(19.20)		
Total USD spent on care by a household on all major health incidents in the last 12 months[1]	113.94	132.43	-18.493*	-2.555	2128	-57.804**	-2.609	2128
	(5.33)	(5.73)	(7.24)			(22.15)		
Share of incidents with total cost greater than 250USD	0.084	0.11	-0.025**	-2.718	4207	-0.086**	-2.75	3887
	(0.01)	(0.01)	(0.01)			(0.03)		
Share of all households spending more than 100USD total on all major health incidents	0.347	0.382	-0.035	-1.747	2128	-0.109	-1.846	2128
	(0.02)	(0.02)	(0.02)			(0.06)		
Share of all households spending more than 350USD total on all major health incidents	0.101	0.115	-0.014	-1.081	2128	-0.05	-1.305	2128
	(0.01)	(0.01)	(0.01)			(0.04)		
Share of incidents with total cost greater than 5USD on a private provider	0.583	0.619	-0.036*	-2.328	4207	-0.123*	-2.232	3887
	(0.01)	(0.01)	(0.02)			(0.06)		
Share of incidents with total cost greater than 150USD on a private provider	0.076	0.097	-0.020*	-2.328	4207	-0.070*	-2.4	3887
	(0.01)	(0.01)	(0.01)			(0.03)		

All health incidents are for a death or 7 or more days disabled.
Endogenous variable: Varies by variable, see text.
Instrument : months between incident and meeting, coupon status, and interaction between the two.
1. Compressed to 98th percentile to remove outliers.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

TABLE 3—ECONOMIC IMPACTS FOLLOWING A MAJOR HEALTH INCIDENT

	Intention to Treat					Impact on the Insured		
	Mean							
	Treatment	Control	Difference	T-Statistic	N	IV Difference	IV T-Statistic	IV N
Is sky used to pay for any of the treatments?	0.167	0.034	0.133***	12.329	4207	0.438***	14.951	3887
	(0.01)	(0.01)	(0.01)			(0.03)		
Is cash used to pay for any of the treatments?	0.457	0.481	-0.03	-1.47	4207	-0.077	-1.346	3887
	(0.01)	(0.01)	(0.02)			(0.06)		
Are savings used to pay for any of the treatments?	0.066	0.067	-0.001	-0.087	4207	-0.011	-0.434	3887
	(0.01)	(0.01)	(0.01)			(0.03)		
Does family pay for any of the treatments?	0.213	0.229	-0.016	-1.098	4207	-0.044	-0.902	3887
	(0.01)	(0.01)	(0.01)			(0.05)		
Is work used to pay for any of the treatments?	0.09	0.101	-0.011	-1.117	4207	-0.037	-1.157	3887
	(0.01)	(0.01)	(0.01)			(0.03)		
Are assets used to pay for any of the treatments?	0.191	0.224	-0.032*	-2.472	4207	-0.092*	-1.977	3887
	(0.01)	(0.01)	(0.01)			(0.05)		
Are loans without interest used to pay for any of the treatments?	0.107	0.128	-0.021*	-2.028	4207	-0.064	-1.799	3887
	(0.01)	(0.01)	(0.01)			(0.04)		
Are loans with interest used to pay for any of the treatments?	0.16	0.196	-0.035*	-2.43	4207	-0.136**	-2.615	3887
	(0.01)	(0.01)	(0.02)			(0.05)		

All incidents for a death or 7 or more days disabled.
Endogenous Variable: Average SKY status for months prior to, during, and post the incident
Instrument : months between incident and meeting, coupon status, and interaction between the two
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

TABLE 4—METHOD OF PAYMENT FOLLOWING A MAJOR HEALTH INCIDENT

	Intention to Treat					Impact on the Insured		
	Mean							
	Treatment	Control	Difference	T-Statistic	N	IV Difference	IV T-Statistic	IV N
Overall Economic Impacts on Households								
Payment for care								
Amount borrowed in total	173.771	194.708	-20.937*	-2.458	4980	-68.469*	-2.413	4980
	(9.18)	(10.07)	(8.52)			(28.37)		
Total value of all loans related to health	22.066	28.943	-6.877***	-3.699	4980	-22.316***	-3.558	4980
	(1.49)	(1.81)	(1.86)			(6.27)		
More debt than last year due to health reasons or a birth	0.065	0.089	-0.024**	-2.932	4980	-0.077**	-2.836	4980
	(0.01)	(0.01)	(0.01)			(0.03)		
Productive Assets/Human Capital								
Less farm or village land than the previous year	0.081	0.093	-0.012	-1.485	4980	-0.035	-1.314	4980
	(0.01)	(0.01)	(0.01)			(0.03)		
Less farm or village land than the previous year due to health reasons	0.005	0.011	-0.006*	-2.29	4980	-0.016	-1.949	4980
	(0.00)	(0.00)	(0.00)			(0.01)		
Total value of farm animals, USD, compressed at 98th percentile	555.285	540.488	14.797	1.091	4980	96.945*	2.096	4980
	(17.67)	(18.03)	(13.56)			(46.25)		
Average z-score for cash, gold, animal, asset, and business value	0.039	0.023	0.016	0.917	4980	0.087	1.524	4980
	(0.02)	(0.02)	(0.02)			(0.06)		
Percent of children ages 6-17 enrolled in school	0.839	0.831	0.008	0.824	3528	0.046	1.462	3528
	(0.01)	(0.01)	(0.01)			(0.03)		

Instrument: months since meeting, coupon status, and interaction of the two.

* p < 0.05, ** p < 0.01, *** p < 0.001

TABLE 5—OVERALL ECONOMIC IMPACTS ON HOUSEHOLDS

	Intention to Treat					Impact on the Insured		
	Mean							
	Treatment	Control	Difference	T-Statistic	N	IV Difference	IV T-Statistic	IV N
Following a Major Health Shock								
Foregone care								
Stopped treatment because of no money	0.04	0.052	-0.013	-1.839	4207	-0.032	-1.305	3887
	(0.01)	(0.01)	(0.01)			(0.02)		
Delayed Care								
Days until first treatment. Top-coded at 30 days. Never treated is 30 days.	3.851	3.346	0.505*	2.181	4207	2.037*	2.451	3887
	(0.18)	(0.18)	(0.23)			(0.83)		
Percent receiving treatment on first day of illness	0.565	0.594	-0.029	-1.785	4207	-0.143*	-2.488	3887
	(0.02)	(0.01)	(0.02)			(0.06)		
Days until provider other than drug-seller. Top-coded at 30 days. Never went to non-drug-seller coded as 30 days.	5.491	5.001	0.49	1.413	2749	1.628	1.19	2429
	(0.29)	(0.23)	(0.35)			(1.37)		
Percent visiting non-drug-seller on first day of illness	0.511	0.519	-0.008	-0.418	2749	-0.007	-0.094	2429
	(0.02)	(0.01)	(0.02)			(0.07)		

All health incidents are for a death or 7 or more days disabled.
Endogenous Variable: Average SKY status for months prior to, during, and post the incident.
Instrument : months between incident and meeting, coupon status, and interaction between the two.
Days until hospital uses only incidents in Round 2 of data collection. All other outcomes use incidents in Round 1 and Round 2.
* p < 0.05, ** p < 0.01, *** p < 0.001

TABLE 6—HEALTH UTILIZATION FOLLOWING A MAJOR HEALTH SHOCK

	Intention to Treat					Impact on the Insured		
	Mean							
	Treatment	Control	Difference	T-Statistic	N	IV Difference	IV T-Statistic	IV N
Was the incident first treated at a public hospital?								3887
	0.16	0.157	0.003	0.23	4207	-0.002	-0.036	
	(0.01)	(0.01)	(0.01)			(0.04)		
Was the incident first treated at a health center?								3887
	0.188	0.141	0.047***	4.011	4207	0.176***	4.333	
	(0.01)	(0.01)	(0.01)			(0.04)		
Was the incident first treated at a public hospital or health center?								3887
	0.349	0.299	0.050***	3.527	4207	0.174***	3.532	
	(0.01)	(0.01)	(0.01)			(0.05)		
Was the incident first treated at a drug seller?	0.118	0.143	-0.024*	-2.308	4207	-0.082*	-2.339	3887
	(0.01)	(0.01)	(0.01)			(0.04)		
Was the incident first treated at a private doctor?								3887
	0.437	0.468	-0.031*	-2.025	4207	-0.113*	-2.14	
	(0.01)	(0.01)	(0.02)			(0.05)		
Was the incident first treated with Kru Khmer?								3887
	0.032	0.026	0.005	1.038	4207	0.014	0.88	
	(0.00)	(0.00)	(0.01)			(0.02)		
Was the incident first treated at an NGO?	0.008	0.008	-0.001	-0.313	4207	0	0.016	3887
	(0.00)	(0.00)	(0.00)			(0.01)		
Was the incident first treated at a non-public place?								3887
	0.595	0.646	-0.051***	-3.56	4207	-0.181***	-3.56	
	(0.01)	(0.01)	(0.01)			(0.05)		
Was the incident first treated at another place?	0.025	0.028	-0.002	-0.521	4207	-0.011	-0.724	3887
	(0.00)	(0.00)	(0.01)			(0.02)		

All incidents for a death or 7 or more days disabled.
Endogenous Variable: Average SKY status for months prior to, during, and post the incident
Instrument : months between incident and meeting, coupon status, and interaction between the two
$^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

TABLE 7—PROVIDER TYPE, FIRST TREATMENT AFTER MAJOR HEALTH INCIDENT

	Intention to Treat					Impact on the Insured		
	Mean							
	Treatment	Control	Difference	T-Statistic	N	IV Difference	IV T-Statistic	IV N
Antenatal Care[1]								
Received at least one antenatal check-up	0.919	0.92	-0.001	-0.041	337	0.03	0.34	337
	(0.02)	(0.02)	(0.03)			(0.09)		
Received at least one tetanus injection during pregnancy	0.963	0.926	0.037	1.509	337	0.124	1.631	337
	(0.02)	(0.02)	(0.02)			(0.08)		
Birth								
Gave birth in a public facility[1]	0.63	0.59	0.05	0.87	337	0.21	1.20	337
	(0.04)	(0.04)	(0.06)			(0.17)		
Gave birth in a public or private health facility[1]	0.72	0.64	0.08	1.48	337	0.31	1.88	337
	(0.04)	(0.04)	(0.05)			(0.17)		
Assisted at birth by a trained birth attendant[2]	0.204	0.178	0.026	0.638	436	0.091	0.693	436
	(0.03)	(0.03)	(0.04)			(0.13)		
Assisted at birth by a midwife[2]	0.763	0.796	-0.033	(0.76)	436	(0.11)	-0.789	436
	(0.03)	(0.03)	(0.04)			(0.14)		
Assisted at birth by a doctor[2]	0.03	0.02	0.01	0.41	436	0.02	0.51	436
	(0.01)	(0.01)	(0.02)			(0.05)		
Post-Natal Care[2]								
Received at least one postnatal check-up	0.639	0.69	-0.052	-0.972	310	-0.193	-1.009	310
	(0.04)	(0.04)	(0.05)			(0.19)		

Sample includes post-SKY births in Round 1 and Round 2, except post-natal care which uses only births listed in Round 2 survey.
Endogenous variable: Average SKY status for months prior to, during, and after the birth
Instrument: months since meeting, coupon status, and interaction of the two.
1: Includes most recent birth 3 or more months after the first possible SKY start date.
2: Using most recent birth after the first possible start date of SKY.

TABLE 8—BIRTH-RELATED UTILIZATION

	Intention to Treat					Impact on the Insured		
	Mean							
	Treatment	Control	Difference	T-Statistic	N	IV Difference	IV T-Statistic	IV N
Major Health Shocks								
Percent of individuals who died in the last year	0.007	0.007	0.00	0.321	24865	0.001	0.253	24741
	(0.00)	(0.00)	(0.00)			(0.00)		
Percent of individuals sick for 7 or more days in the last year	0.102	0.102	0.00	-0.079	24684	-0.007	-0.641	24560
	(0.00)	(0.00)	(0.00)		`	(0.01)		
Anthropometrics								
Length/height-for-age z-score	-1.386	-1.385	-0.001	-0.01	2222	0.071	0.442	2207
	(0.05)	(0.04)	(0.05)			(0.16)		
BMI-for-age z-score	-0.698	-0.69	-0.008	-0.149	2221	-0.057	-0.34	2206
	(0.04)	(0.03)	(0.05)			(0.17)		
Weight-for-age z-score	-1.369	-1.364	-0.005	-0.114	2232	-0.001	-0.012	2217
	(0.03)	(0.03)	(0.04)			(0.13)		

Endogenous variable: varies by variable, see text.
Instrument: months since meeting, coupon status, and interaction of the two.
* p < 0.05, ** p < 0.01, *** p < 0.001

TABLE 9—HEALTH IMPACTS

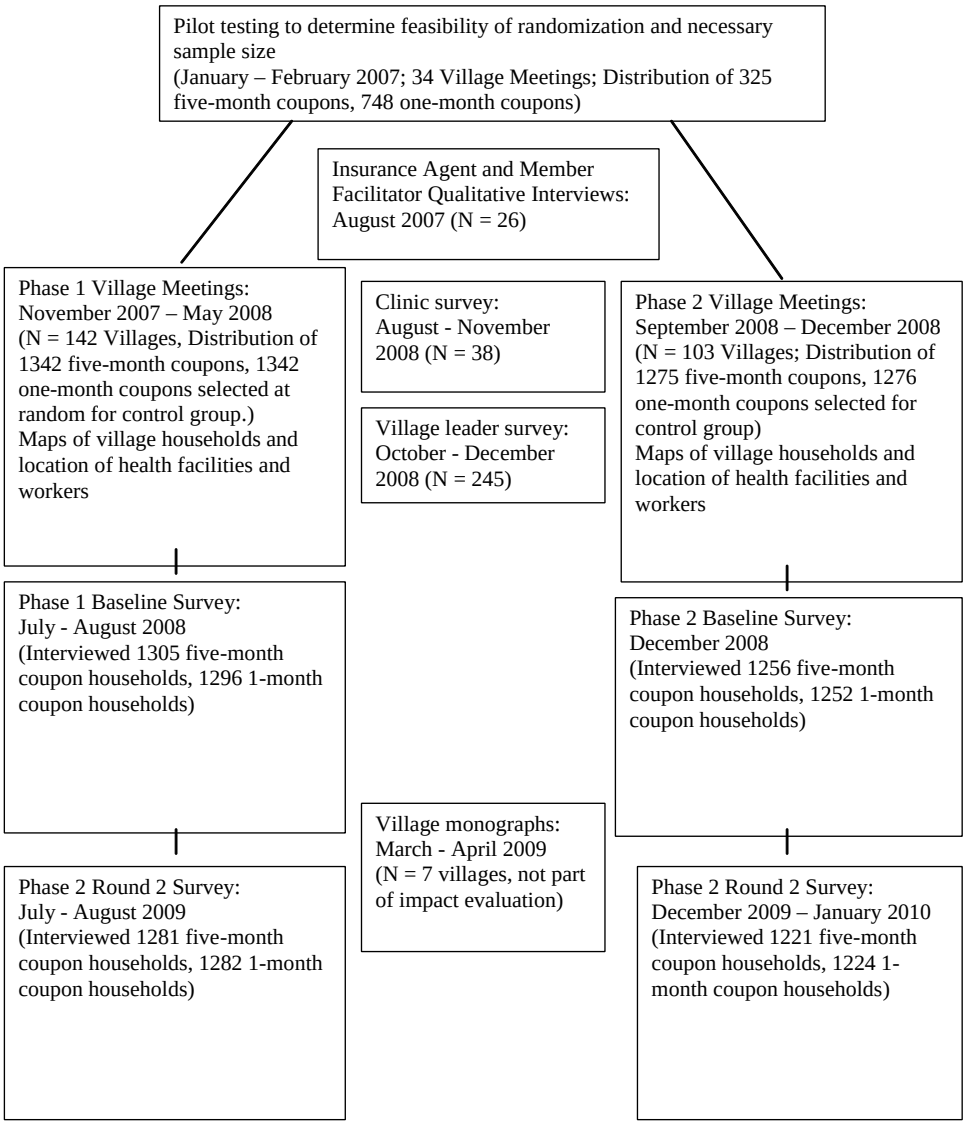

FIGURE 1. TIMELINE OF EVALUATION

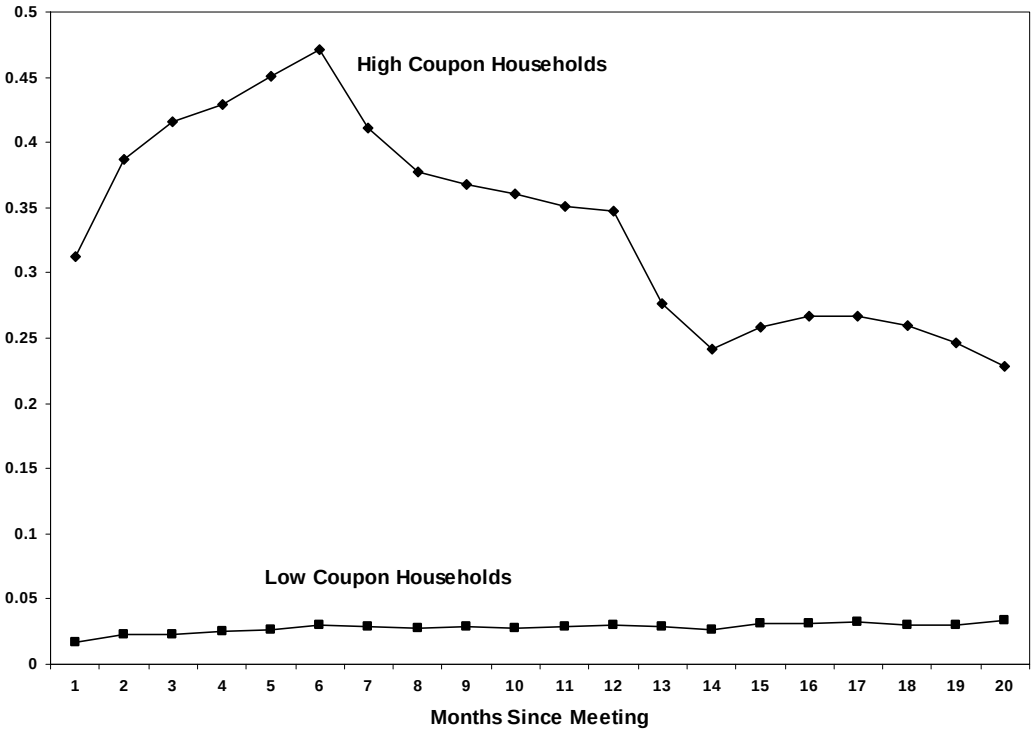

FIGURE 2. PROPORTION IN SKY, BY MONTHS SINCE VILLAGE MEETING AND COUPON TYPE

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