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Going Beyond Adverse Selection: Take-up of a Health Insurance Program in Rural Cambodia

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Abstract

Standard insurance theory predicts that households that anticipate high insurance costs are those that are willing to purchase health insurance (adverse selection). However, there are also several other reasons why households may choose to purchase health insurance. Since insurance is a consumption-smoothing tool, risk-averse households may be more willing to purchase insurance. Households that can self-insure may be less likely to purchase insurance. Newer theories have hypothesized that budget constraints, present bias, or having little understanding of insurance may decrease the likelihood of buying insurance even for sick households. Age or gender bias may play into the decision, as may trust of Western medicine. These and other less-traditional type of selection factors may be particularly relevant in developing countries.

This paper presents evidence collected during the expansion of the SKY Health Microinsurance program in rural Cambodia. Health insurance is a newer product in developing countries, and this type of evidence has rarely been explored. A companion paper explores the extent of adverse selection into this program (Polimeni and Levine, 2011), while this paper studies other influences on take-up. Contrary to informational models, we find no evidence that risk-averse households are more likely to purchase SKY, and instead find evidence of the opposite. Budget constraints, quality of health facilities, and age and gender of ill household members are all found to influence the decision to purchase insurance.

Contents

Introduction

Voluntary health insurance has gained popularity recently as a potential health policy tool for poor nations. To understand both the effects of insurance and its financial viability, we must understand who purchases voluntary health insurance.

Standard economic theory predicts that households that anticipate high insurance costs are the ones that are willing to purchase health insurance (Rothschild and Stiglitz, 1976; Akerlof, 1970). Strong adverse selection may make it difficult for private voluntary insurance to survive. More optimistically, standard economic theory also predicts risk-averse households will also value insurance. If such households are also very cautious, insurance may flourish in the market and grow to cover a substantial share of the population. Several other factors may also lead a household to purchase insurance, such as the quality (real or perceived) of the health facilities connected with the health insurance, convenience of visiting a covered facility, and budget constraints. At the same time, if consumers do not understand or trust insurers, private voluntary insurance will not provide an effective safety net.

To understand more about the factors leading a household to purchase insurance, we study the characteristics of households that purchased or abstained from purchasing SKY health insurance in rural Cambodia. SKY partners with public health facilities to provide free care in exchange for a small (subsidized) monthly premium. We utilize data from two survey waves from over 5,000 households who attended a marketing meeting for SKY insurance. These surveys asked about health and health utilization behaviors, and also recorded risk measures, demographics, and various other characteristics of the households and household members.

The extent of adverse selection in this insurance market is explored in Polimeni and Levine (2011). This paper goes beyond adverse selection and examines other factors that may induce households to purchase or abstain from purchasing insurance. The richness of our data allows us to provide empirical evidence on a wide variety of measures of selection into a health insurance program. We also provide some of the first evidence on selection into a health insurance program in the context of a developing country, in which incentives to buy insurance may differ somewhat from a developed country.

Contrary to standard economic theory, we found no evidence that risk-averse households are more likely to purchase SKY, and instead found evidence of the opposite. Budget constraints, the low quality of health facilities, and the age and gender of ill household members were all found to influence the decision to purchase insurance.

1.The Setting

A description of the Cambodian setting and the SKY program can be found in Levine, Polimeni and Ramage (2011) and Polimeni and Levine (2011). Below we describe in more detail the choice of health care providers in Cambodia.

Cambodians rely on a mix of health care providers: public providers, private medical health care providers, private drug sellers (with and without pharmaceutical training), and traditional healers.[1] SKY partners only with public providers, because these are the only providers regulated by the government. Thus, a household's preference for and perceptions of providers may be an important determinant of take-up in this market.

Cambodia's public health system has three basic levels of health care facilities: provincial hospitals, operational district (OD) referral hospitals, and community health centers. The highest level of public care available within a province is at the provincial hospital in each province. Provinces are divided into several operational districts — a division specific to the health care system (that is, the ODs differ from the sub-provincial political administrative districts). Each OD has one (usually small) district-level referral hospital and an average of eleven health centers. In turn, each health center serves several villages and around 13,500 people on average. (Based on data from the Cambodian Government, 2004.)

Public facilities suffer from low utilization rates. According to 2005 DHS estimates, less than a quarter of the people who sought treatment for illness or injury went to a public health facility (Table 1). An even smaller percentage of second and third treatments were sought at public facilities.

Typical complaints about public facilities in Cambodia include having to engage in costly and time-consuming travel to reach facilities (rather than seeking treatment nearby or even receiving home care visits from private providers), personnel absences at public health facilities, long waiting times at facilities, frequent shortages of medicines, unpredictable costs, and poor health-worker attitudes toward patients (for example, scolding or belittling patients) (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, Gardner, Pictet, Polimeni and Ramage, 2009).

Private providers of varying capabilities are typically more popular than public ones even when they are more expensive because they are often more attentive to clients' needs, more available, willing to visit patients in their homes, and willing to provide more of the treatments patients prefer. They are also usually willing to extend credit of various types to clients (Collins, 2000; Annear, 2006). However, private facilities are not regulated and may provide inappropriate care such as improper drug prescriptions (Fort, Ravenholt and Stanley, 1998) and high rates of unnecessary (and sometimes unsafe) injections (Vong, Perz, Sok, Som, Goldstein, Hutin and Tulloch, 2005). In addition, local private providers are usually not

1 This description of Cambodian health care providers draws on Levine and Gardner (2008).

capable of treating more serious illnesses. For those, patients must seek care at public hospitals. Private hospitals are also available but are very costly, and are often used by only the wealthiest individuals.

Self-medication through purchase from local uncertified drug sellers is quite common. Pharmacists and other drug sellers are often situated near local public markets and are therefore more conveniently located than most public health centers. In addition, they are usually cheaper than a clinic and are willing to provide any medicine requested by customers. Thus, drug sellers of various types are usually the first (and often the only) place rural Cambodians seek treatment for their illnesses (DHS, 2005).

Though traditional healers and midwives also serve clients in both urban and rural areas, they are less common and are responsible for less than two percent of care sought (DHS, 2005).

2. Literature Review

We break down hypotheses into traditional measures and more modern extensions to these measures (Table 2). The dividing line is inherently arbitrary.

2.1. Traditional Insurance Theory

The standard economic theory of the demand for insurance predicts that insurance markets will suffer adverse selection, which occurs when less healthy people or people who are more risky with their health are more willing to purchase health insurance because they know that the amount they spend on health care will be more than the premium they will pay (Rothschild and Stiglitz, 1976; Akerlof, 1970). Living near a high-quality facility that is covered by insurance may also increase the likelihood that a household will find insurance valuable.

Traditional models also posit that the risk-averse will be more likely to buy insurance because they suffer greater loss of utility in the presence of health expenses. If risk aversion increases the probability of insurance purchase but decreases the amount of risk one takes with one's health, it may mitigate the impact of adverse selection (Chiappori, Jullien, Salanie and Salanie, 2006; Jullien, Salanie and Salanie, 2007).

Those who anticipate liquidity constraints if they face large health expenses will place higher value on insurance. Thus, the ability to self-insure can reduce the demand for insurance (Morduch, 1995; Townsend, 1994; Udry, 1994).

2.2. Recent Theory

Recent theoretical work has focused on how the problem of adverse selection may also be mitigated by factors such as wealth (which could both increase the probability of insurance purchase and improve health outcomes) (Case, Lubotsky and Paxson, 2002; Smith, 2005; Currie and Stabile, 2003) and optimism (where some people underestimate their accident probability and thus don't buy insurance but are also less willing to take precautions, leading to a higher probability of a health shock) (Koufopoulos, 2002).

Cutler and Zeckhauser (2004) describe several other cases in which insurance markets act differently from what standard theory would predict. For example, the authors give several examples of people over-insuring in a way that standard

theory would deem irrational, and cite theories of why this may occur. People may buy more insurance than standard theory would predict if the risk is particularly salient in their minds, as may be the case when people buy additional insurance immediately before an airplane trip (Tversky and Kahneman, 1974). Similarly, if a household knows someone who has been very ill or had high medical expenses in the past, they may increase their subjective probability of a costly shock. Present biased households or those with liquidity constraints may under-insure and also fail to invest in many other precautions. (This hypothesis is subtly different from the point that households that are not currently liquidity constrained will place a high value on insurance if they anticipate liquidity constraints in the case of a costly health shock.)

More broadly, it is likely that demand for insurance will be lower from households that do not trust Western medicine or do not understand how health insurance works.

If a household puts less weight on health care of certain household members, such as women, expected medical expenses will be lower for these household members, even when there is a high probability that they are ill. Thus, illness among such groups may have a weaker effect on insurance demand than illness among other household members.

2.3. Developing Country Context

Most theories have been formulated with developed countries in mind. On the one hand, potential customers in developing countries may be expected to behave similarly to those in more developed countries: those with higher expected health care expenses (or lower baseline health levels) are expected to purchase more insurance. On the other hand, there are several reasons to believe that clients in developing countries may behave differently than what has been found to be the case in developed countries. For example, because insurance is a relatively new and unknown product, only those who are willing to take a risk on a new product may be willing to try it. Similarly, households have often not been exposed to insurance, and thus may not understand the concept of paying ahead for an uncertain risk (Gine, Townsend and Vickery, 2007).

Credit constraints that bind households in developed countries may be an even more important factor in a context where many people often live on a dollar per day. Thus, wealthier households may be better able to afford insurance. At the same time, wealthier households may be better able to self-insure and thus may be less likely to buy insurance (Gine, Townsend and Vickery, 2007).

Developing countries also must contend with inconsistent quality at health facilities, and inability to travel due to poor quality roads or lack of transportation. Households may choose not to buy insurance if they perceive the quality of covered care as low, or if covered facilities are a long distance away (Fuller, 1974; Mwabu, Ainsworth and Nyamete, 1993; Banerjee, Deaton and Duflo, 2004).

Finally, bias towards the care of males, or towards the care of productive household members, may have more influence on insurance purchases in a developing country setting (Gupta, 1987; Pande, 2003; Sauerborn, Berman and Nougtara, 1996).

2.4. Empirical Literature

There is an extensive empirical literature on the extent of adverse selection in insurance markets in developed countries. This literature is discussed in Polimeni and Levine (2011).

While many studies find evidence of adverse selection Cutler and Zeckhauser (2000) give a good review of existing studies), others find a surprising lack of correlation between health utilization and purchase of health insurance (Finkelstein and McGarry, 2006; Cardon and Hendel, 2001). The lack of correlation may be explained by offsetting effects of "advantageous" or positive selection. Several studies find evidence of these non-traditional sources of selection into insurance. For example, Finkelstein and McGarry (2006) find that people with risk-avoiding behaviors are less likely to use a nursing home but more likely to buy long-term care insurance.

Fang *et al*. (2008) note that selection into insurance on any characteristic can be considered advantageous selection if that characteristic is both positively correlated with purchase and negatively correlated with health risk. They show that buyers of Medigap insurance in the United States tend to be healthier than non-buyers, and they show that the source of this advantageous selection includes income, education, longevity expectations, financial planning horizons, cognitive ability, and financial numeracy. They find that risk preferences are not in fact a major source of advantageous selection, as hypothesized in other papers. The authors hypothesize that the correlation of cognitive ability with insurance purchase coincides well with reports that seniors do not always understand Medigap rules. This finding is relevant to the current research, in which we hypothesize that many potential customers do not fully understand the concept of insurance. Note that Medigap is similar to SKY insurance in that within the six month open enrollment period, private insurers cannot discriminate based on previous health conditions, much like SKY does not.

Despite the plethora of empirical work in developed nations, there have been far fewer studies of selection in developing countries, partly because there are far fewer insurance markets in developing countries. Non-experimental studies from developing countries have found enrollment to be more common in households with chronically sick members, which is evidence of adverse selection (Wagstaff, Lindelow, Jun, Ling and Juncheng, 2009, in China), but commonly find higher enrollment rates in wealthier households, potentially leading to positive selection if wealthier people also tend to be healthier (Wagstaff, Lindelow, Jun, Ling and Juncheng, 2009; Wagstaff and Pradhan, 2005, in Vietnam; Jutting, 2004, in Senegal; Lamiraud, Booysen and Scheil-Adlung, 2005, in South Africa). In contrast, Jalan and Ravallian (1999) found that wealthier households in rural China were better equipped to self-insure against income shocks. It is possible that households that are better able to self-insure are less likely to buy insurance.

Gine, Townsend and Vickery (2007) study the determinants of take-up of a rainfall insurance product in rural India. As predicted by traditional models of take-up behavior, those with fewer credit constraints, the wealthier, and those who plant more crops covered by the insurance were more likely to purchase insurance. Less in line with traditional models, farmers who were more risk-averse were less likely to purchase insurance and those more familiar with the insurer were more likely to buy insurance. We would expect these results to carry over to a health insurance product: a lack of knowledge regarding insurance, and an unwillingness to take a risk on a new product, may also be important determinants of take-up in the Cambodian health insurance context.

Recall that the SKY insurance program covers care only at public health centers and hospitals with which they partner. The convenience of these health facilities (e.g., time to travel to the facility and operating hours) and perceived quality (e.g., availability of necessary equipment and cleanliness of

the facility) may also influence purchase. In Chile, Fuller (1974) found that distance to a fertility clinic was the single most powerful indicator of utilization of contraception and Mwabu *et al*. (1993) found similar results in Kenya for use of health facilities. However, it has been more difficult to find impacts of quality on utilization of care. In the Kenya study, Mwabu *et al*. found no impact of drug availability on utilization (although results may have been biased downward by endogeneity issues). Similarly, Banerjee *et al*. (2004) also found that low quality of care (measured by training of medical staff, unscheduled closing of facilities, infrequent testing accompanied by high frequency administration of injections and drips) in rural Rajasthan, India, did not deter utilization of facilities, nor patients' perception of care. It is possible that these measures of quality are not correlated with perceived measures of quality by patients.

Several studies have shown gender discrimination among households, whereby male household members are favored in either nutrition or health care (in India, Gupta, 1987 and Pande, 2003). Other studies have shown no gender bias, but have shown that families spend more on health care for productive family members, and less on care of children or the elderly (Sauerborn, Berman and Nougtara, 1996). If families are less willing to pay for care of females, children, or the elderly, they may also be less willing to buy health insurance unless a male or productive household member is ill.

Finally, because we induce random variation in the price of SKY, we can say something about how demand varies with price (price elasticity). There is a newly emerging literature on demand for health and health care services. On the one hand, some studies have found that demand for coverage of acute illness (e.g., malaria) is relatively inelastic (Dupas, 2011), possibly because households insure against health risk through social networks (Townsend, 1994; Robinson and Yeh, 2011, as referenced in Dupas, 2011). On the other hand, demand for preventive services such as bednets, water treatment, and deworming products has been found to be very price elastic (Kremer *et al*., 2011; Cohen and Dupas, 2010; Kremer and Miguel, 2007; Abdul Lateef Jameel Poverty Action Lab, 2011). If we consider health insurance more akin to a "preventive" service, we may expect demand for insurance to be relatively elastic.

The research presented here adds to the literature in several ways. First, empirical studies have taken place for the most part in developed countries. As discussed, selection among the poor in developing countries may be very different than that described in the existing literature. Second, these empirical studies took place in more traditional competitive markets, whereas the SKY program in Cambodia is the only health insurance option in the rural markets targeted. Since there is no plan choice, adverse selection may show up differently in this market, as individuals must choose between SKY insurance or nothing at all.

Finally, because this study examines a population previously unexposed to insurance, differences in the characteristics of households that buy or decline insurance at the baseline have not been influenced by prior insurance contracts. These influences on take-up are an important aspect of both effective targeting and financial viability of the insurance program. For the insurance program to have the greatest impact, it must be taken up by as many households as possible. Likewise, to maintain financially stability, marketing must target households in the most efficient way possible.

3. Specification

To investigate self-selection in take-up, we perform a probit estimation of the following equation, where i is a household-level observation and v is a village-level observation.

$$SKY_i = F\left(\begin{array}{c}\pi_i, H_i, M_i, M_i \cdot Publ_i, M_i \cdot Priv_i, Z_i, D_i, \\ fac_v, qual_v, finrisk_i, hlthrisk_i, selfins_i, \\ W_i, disc_i, u_i, sal_i, trust_i, pref_i, \varepsilon_i\end{array}\right) \quad (1)$$

Here, the independent variable SKY_i = 1 if the household accepts insurance. π_i is an indicator variable equal to 1 if a household received a large discount for SKY. H_i is subjective health, equal to 1 if at least one household member is in poor self-reported health. M_i is a measure of past health care shocks (presence of a health shock in the months prior to the SKY village meeting). Publi and Privi indicate a visit to a public facility or private facility, respectively, following a health shock. Z_i is a measure of objective health characteristics of children under age five (an indicator variable equal to 1 if the household has a stunted or wasted child aged 5 or under). D_i is a set of demographic characteristics of the house hold (number of household members, indicator variables for old or young members, education of the health care decision maker). fac_v are measures of distance and cost to travel from village v to public facilities covered by SKY. qualv is a measure of the quality of public facilities. $finrisk_i$ is a measure of financial risk aversion. $hlthrisk_i$ is a measure of risks households take with their health. $selfins_i$ is a measure of the ability to self-insure for health shocks. W_i is a measure of a household's wealth, as observed by the enumerator. $disc_i$ is a measure of a household's discount rate. u_i is a measure of a household's understanding of insurance. sal_i is a measure of salience of health shocks. $trust_i$ are measures of trust of Western medicine, including a variable equal to 1 if all children under 6 have received all recommended vaccinations and a variable equal to 1 for always covering water jugs. $pref_i$ are variables representing preference for care of male or working-aged ill household members. ε_i is an error term. Finally, F(•) is the probit function.

Table 2 summarizes the hypothesized sign on each of the variables we analyze. Appendix B describes a theoretical model of take-up behavior that informs our hypotheses.

Supply and demand dictates that households facing the higher coupon and lower price will be more likely to buy SKY. Based on theory, we expect households that have a member in self-reported poor health will be more likely to purchase SKY insurance, as will households that have at least one member who had a large health shock, measured as a health event that resulted in missing 7 or more days of normal household activities, resulted in an expense of over US$100, or resulted in a death. Of households that reported a shock, we expect that households that used a public facility for care (health center or public hospital) will be more likely to purchase SKY, because SKY covers only public facilities. Similarly, we expect that households that used private facilities for care prior to the SKY village meeting will be less likely to purchase SKY. Households with stunted or wasted children should be more likely to buy SKY if stunting and wasting is an accurate proxy for poor health. Results of these adverse selection measures are presented in Polimeni and Levine (2011).

We use household size as a control variable, but as SKY's premium is based on the number of household members, and becomes slightly cheaper per person as household size increases, household size may be positively correlated with take-up. We predict that households with elderly or young members will be more likely to buy insurance if these groups have higher rates of illness, but will be less likely to take up if illnesses by these members are not frequently treated outside of the home. Similarly, if Cambodian households favor health care for males or working-aged individuals, households with ill members with these characteristics will be more likely to buy health insurance.

We predict that households that live far from a public facility or near a public facility that is of poor quality will be less likely to buy SKY, which only partners with public facilities.

Households willing to take a financial risk may be less likely to buy SKY because they care less about fluctuations in income. However, because SKY is a new product, some households with low risk aversion for financial loss may be more likely to purchase SKY because they are less concerned that they will lose their money if SKY turns out to be a bad product.

Households that take health risks may either be more or less likely to purchase SKY. On the one hand, these households may have higher expected health care costs, which would make them more likely to purchase SKY. On the other hand, these households may give their health needs less weight than other households, and may be less likely to seek preventive care, etc. If that is the case, these households may foresee lower health expenses than other households and thus be less likely to buy SKY.

Some families may be able to pay for health care expenses without much sacrifice, even without SKY. Households that can, for example, borrow from family or use savings may feel less need for outside insurance, and thus we predict they will be less likely to purchase SKY.

We expect that the coefficients on wealth variables will be positive, because these households will be better able to afford insurance. At the same time, if these households have a preference for private care, or are better able to self-insure in the absence of SKY insurance, they will be less likely to buy SKY.

Insurance is the trade-off of a small payment today to avoid a possible future loss. Households with a high discount rate may not be willing to sacrifice consumption today for the possibility of increased consumption at a later date. Thus, we predict that households with a high discount rate will be less willing to buy SKY.

Households that are better able to understand SKY will be more likely to buy, so we expect households that are better educated, literate and able to understand the survey question on risk aversion will be more likely to buy SKY.

Whether or not their own future health care needs are actually high, a household may estimate higher expected medical costs and be more likely to purchase insurance if they know someone who has recently had a serious illness or injury with high costs.

Households that trust Western medicine should be more likely to buy SKY, as SKY covers facilities that offer Western but not traditional medicine. One measure of trust we use is having all vaccines up to date for children under age 6. On the one hand, households with all vaccines fulfilled can be considered to trust Western medicine, and may prioritize health, and thus may be more likely to buy SKY. On the other hand, households with up-to-date vaccines may feel that they are less prone to a health shock, and may therefore be less likely to buy SKY. Households that use covers for their water jugs are also considered to trust Western medicine (and its emphasis on preventing the spread of germs), and thus may be more likely to use Western medicine and buy SKY.

4. Data

Our analyses use several sources of data: a household survey, SKY administrative data, a village chief interview, a health center survey, and a village meeting interview. In this section we describe these data sources. The sample is all households for which we have baseline data. Appendix C gives descriptions of all variables used in our analyses.

4.1. Household Survey

The principal component of data collection is a large-scale survey of over 5,000 households. Most of the data for the selection study come from the baseline survey, but we also use some data from the second round of the household survey which was administered one year after the baseline.

For the baseline survey, we intended to visit households shortly after the village meeting, within two to seven weeks. However, logistical concerns meant that we could only interview households in two phases over the 13 months of meetings. The first phase of the baseline survey took place in July and August 2008, and the second phase took place in December 2008. Thus, households were interviewed anywhere from two to nine months after the SKY meeting in their village. The second-round survey was administered in two phases in July and August 2009, and December 2009 to January 2010.

The baseline survey collected data on household demographics, wealth indicators, self-perceived and objective health, health care utilization and spending, assets and asset sales, savings, debt, health risk behaviors, willingness to take financial risks, trust of institutions, means of paying for large health expenses, and willingness to trade current for future income. For most questions, the baseline survey interviewed a primary respondent, and requested that this respondent answer questions for other members of the family.

4.2. SKY Administrative Data

For each household that joins SKY, SKY records registration date, date the household starts coverage, and date the household drops out of SKY. We use this SKY administrative data to determine if and when each household from the village meeting purchased SKY insurance. To match our baseline data to the SKY database, for each village, we matched the names of household members in our survey to the names listed in the SKY database.

4.3. Village Leader Survey

In each village, we interviewed the village chief or another village leader in order to collect general village-level information, including the distance to local public health centers.

4.4. Health Center Survey

Households may be more likely to purchase SKY if the quality of the local public health clinic with which SKY partners is of good quality. To measure this, we administered a simple survey of health clinics in areas covered by our study. The survey consists of checklists of operating hours, drug supply, cleanliness, and equipment supply.

To minimize data collection costs, the health center survey focuses on observations by SKY member facilitators. SKY hires member facilitators to be present at health facilities to facilitate treatment for SKY members and manage client complaints and questions as needed. Member facilitators typically work mornings at one particular health center.

4.5. Village Meeting Survey

At the end of each village meeting, our field team spoke to a village leader to collect village-level data relevant to our study. Data from this source include, for example, distance to the nearest public referral hospital.

5. Background Results

5.1. Summary Statistics

Table 3 and Table 4 present summary statistics for each variable used in the analysis of take-up. Means are presented for all households, and separately for buyers and decliners. From the summary statistics, we can see that households that buy SKY are different than those that decline SKY on a number of characteristics.

Purchasers of SKY insurance are less likely to report an ability to mortgage land to pay for a large health expense (0.4% vs. 0.8%, $p < 0.05$) and are less likely to borrow without interest to pay for such an expense (16.7% vs. 21.1%, $p < 0.001$).

Buyers live near health centers that were open for more hours during the week of the clinic survey (97.3 vs. 94.3 hours, $p < 0.10$), and received slightly higher scores on the facility quality index (79.5% vs. 78.2%, $p < 0.01$).

Buyers are also more likely to have a family member with a costly health shock in the past year (Table 4), but this includes household members, so it is essentially a measure of health status and thus adverse selection into insurance. In our multivariate analysis, we control for in-household health shocks so that this variable can be argued to represent only out-of-household health shocks, and can thus be counted as a salience measure.

Buyers are somewhat richer, and this difference is statistically significant for enumerator-ranked subjective wealth (16.1% vs. 12.8% are in the wealthiest group, $p < 0.01$; and 11.2% vs. 13.0% are in the lowest-ranked wealth group, $p < 0.05$).

SKY buyers are significantly more likely to have members in poor health for almost all ages and genders. However, SKY households are no more or less likely to have an ill female over the age of 64.

Buyer/decliner differences for other variables are not statistically significant.

5.2. Characteristics of Ill Members

In our analyses of take-up of insurance, we include characteristics of household members and also of ill members to gauge whether there is any discrimination by gender or age in insurance purchases. If households purchase less insurance for older household members, but older household members are more likely to have a health shock and pay for care, then households may not be acting rationally in the neoclassical sense. Similarly, if households are more likely to purchase health insurance for a working-aged female than a working-aged male, then these households are acting rationally only if ill working-aged females are more likely to receive insurance-covered care.

To ease interpretation of subsequent results, in this section we examine the likelihood that an individual of a given age and gender will be ill and seek care, and the likelihood that each of these individuals will seek care following a health shock. We look at only households that did not receive a large discount on insurance; most of these households did not purchase SKY and thus insurance is less likely to have influenced health-seeking outcomes.

Table 5 regresses poor health and health utilization on the characteristics of individuals. Columns 1 through 6 present utilization results for all individuals; columns 7 through 10 present these results for only individuals with major health shocks. In short, results show that the elderly are the most likely to be ill, but the least likely to receive care following an illness compared to other age groups. Females of working age are more likely to be ill, and about as likely to receive care for an illness than their male counterparts.

Columns 1 and 2 use indicator variables for poor health and a recent health shock as dependent variables, respectively. The oldest household members are most likely to be in poor health, followed by working-aged household members and those under the age of 6 (differences between the working-aged and those under 6 and between the working-aged and those over 64 are significant at $p < 0.001$). Those aged 6 to 15 (the excluded category) are least likely to be ill.

Females are more likely than males to be in poor health if they are of working age (col. 1, $p < 0.001$), and are more likely to have a health shock (col. 2, $p < 0.001$).[2] For those 65 or older, females are more likely than males to be ill (col. 1, $p < 0.01$) but are not more likely to report a major health shock. Males under 6 are more likely than females under 6 to be ill or report a health shock (col. 1, $p < 0.01$, col. 2, $p = 0.054$).

Looking at all individuals, whether or not they experienced a health shock, individuals over the age of 64 are the most likely to seek all types of care for a major health shock (col. 3 – 6), followed by the working-aged, those under 6, and the excluded category of individuals aged 6 to 15.

However, when we look at only those who have had a health shock (col. 7 – 10), so that the frequency of health shocks does not come into play, we find that those over 64 are often the least likely to seek care. Note that almost all individuals (96%) receive some kind of care for a health shock. For both females and males, the youngest are the most likely to receive care, followed by the working-aged and those over the age of 64. For public care, the difference between the working-aged and those over 64 is significant at $p < 0.05$; between the working aged and under 5, $p < 0.01$. Differences for hospital care are not significant.

Comparing care by gender, females over the age of 64 are less likely to receive public or hospital care following a health shock than males (col. 9 - 10). Differences for public care is significant at $p = 0.13$, but other differences are not. However, if we increase the sample size to include households that received the large discount as well, the difference becomes significant for both public and hospital care. Differences in private or any care are not significant even when including households that received the large discount.

In the same tables, we also investigate whether wealth influences health and utilization of health services. Individuals in households that are in the highest enumerator-ranked wealth category are more around 2.0 percentage points less likely to be in self-reported poor health (col. 1, significant only if we include the sample who received large discounts, not shown) and 2.1 percentage points less likely to have a major health shock (col. 2, $p < 0.01$). Over all households (with and without a health shock), wealthier households are significantly less likely to use care (col. 3 – 6), but are no more or less likely to receive care at public or private facilities or hospitals following a health shock (col. 7 – 10).

Individuals in the poorest households are 14.0 and 3.2 percentage points more likely to be in poor health or have a

[2] The significance of differences between coefficients for each age/gender group is not presented in the table.

major health shock, respectively, than individuals in other households, holding everything else constant ($p < 0.001$). They are also more likely to use public or public hospital care following a major health shock (col. 9 and 10). While these differences are not significant, increased use of hospital care for the poor becomes significant when we include households with a large discount ($p = 0.051$, not shown). Out of all households (col. 3 – 6), poorer households are around 1 to 3 percentage points more likely to use care than the excluded category (households rated in the middle for wealth).

5.3. Qualitative Survey Responses

To begin to understand why households buy SKY, we administered a survey of SKY insurance agents and member facilitators at the start of the study to ask these SKY staff members why they thought households bought SKY.

Insurance agents stated that households join SKY if they have a lot of illness in the family, have had positive experiences with public facilities, understand the benefits of SKY, and are better educated. They also thought that some households buy SKY because SKY agents stationed at public health centers and hospitals can help them deal with problems that arise. Insurance agents believed households dropped or did not buy SKY because they did not understand the benefits, did not foresee using SKY's services, had other financial commitments, and because the health centers had a poor selection of medicines and health center staff was low quality and rude (Domrei Research and Consulting and University of California, Berkeley, 2010a; Domrei Research and Consulting and University of California, Berkeley, 2010b).

In addition, we administered a small household-level qualitative survey at the time of the baseline survey that asked SKY and once-SKY households why they bought SKY immediately, waited to buy, or bought and then dropped SKY. Some respondents stated that they did not join SKY at first because they did not trust SKY, did not understand the product, or they could not afford the premium. One household waited to buy SKY so that they could first observe SKY activities. Households that dropped SKY did so because hospital staff was rude, because of poor quality care, lack of drugs at public facilities, or because it was too difficult to travel to the hospital when sick.

Many households seemed to not understand the concept of insurance. One household dropped SKY because they were told it did not make sense to have insurance because people are never sick every month of the year. One respondent stated that he understood SKY, but later dropped because nobody was sick. The respondent later re-joined SKY after an explanation from an insurance agent.

The following quotes from these qualitative surveys illustrate some of the motivations behind the decision to purchase SKY.

"My family didn't join SKY immediately because I didn't have enough money to pay the premium."

"I got some advice from my cousin and neighbor that because my family has a lot of members and because we have children with diseases (one has cancer of the nose and one more has typhoid with stomach ache and heart disease) we should become SKY members because SKY insures many diseases, especially serious diseases."

"I dropped out of SKY because I had a problem with blood pressure and I was treated at [the nearest] hospital. At the hospital, the staff and the nurses were not friendly and were careless, and the place was dirty. I stayed there for three days and got only three tablets of medicine. It is the same as during the Pol Pot regime."

6. Regression Results

Tables 7 through 9 present the results of the selection probit analysis. We present results in a way that facilitates interpretation. The regressors could have been included in many different combinations, and thus the specific regressions presented are somewhat arbitrary. However, unless noted, the significant results presented are robust to inclusion of dependent variables in many different combinations.

6.1. Traditional Influences on Take-up

Table 7 focuses on traditional influences on take-up: distance to health facilities, and measures of risk aversion and health risk. The influence of expected health care costs on take-up (adverse selection) is explored in Polimeni and Levine (2011). These covariates are included in the regressions presented below but not shown.

Being offered the steeply discounted price increases purchase of SKY by around 38 percentage points (col. 1-3). This coefficient underestimates the impact of the premium because we include over-sampled low coupon buyers in the regression. If we exclude over-sampled households that purchased SKY without a discount, the effect of the 80% price discount is closer to a 41 percentage point increase in purchase. Price elasticity for purchasing SKY within the first 6 months after the SKY village meeting is 7.7 (Table 6), meaning that demand for insurance is rather elastic in rural Cambodia. Polimeni and Levine (2011) discuss the financial implications of the change in premium for SKY.

As with other measures of adverse selection, we discuss take-up by households with older or younger household members in Polimeni and Levine (2011), but mention these results again in light of the more in-depth exploration of health and health utilization by age described above. Despite the results in Table 5 showing that members over the age of 64 are most likely to seek health care (because of their higher rate of illness, and despite the lower rate of health care use following an illness), households with a member over the age of 64 are no more likely to purchase SKY (Table 7, col. 1).

In Table 7 we also explore other characteristics that may lead households to predict higher utilization of health facilities. One reason a household would not expect to use SKY-covered facilities is if they live far from public facilities, or if it is costly to get to these facilities. Our results (col. 2) show that the cost of taking a moto (a small motorcycle) to the local public health center has a negative impact on SKY purchase. A US$1 increase in cost (around 2 standard deviations from the mean of US$0.39) decreases take-up by around 3.7 percentage points. However, including walking or moto time to the public health center instead of the cost of taking a moto (not shown) does not induce any significant change in SKY take-up. Distance from the village to the nearest referral hospital does not influence take-up of SKY.

A household that thinks of facilities as being of poor quality may be less likely to utilize these facilities and thus less likely to purchase SKY. Our results show that households living near a facility of higher quality, according to our clinic survey quality scale, are more likely to purchase SKY. The average health center scored 0.786 on our quality scale consisting of 25 quality checks, with a standard deviation of 0.091. Regression results (col. 2) show that an increase of 1

in the score leads to a 35.5 percentage point increase in probability of SKY purchase. A more realistic increase of 0.08 in the quality score (for example, going from a score of 19 out of 25 - the average health center score - to 21 out of 25), would lead to a 2.84 percentage point increase in take-up of SKY insurance (equal to 0.355 multiplied by 0.08).

A household may anticipate low use of public facilities if these facilities have short hours of operation. We find no significant impact of facility hours on take-up of SKY (column 2). This coefficient increases to 0.027 and gains some significance (to $p = 0.30$) if we remove the quality score from the regression.

A household that is risk-averse may be more likely to buy SKY. We present results of two measures of risk aversion in Table 7. The first is a hypothetical question in which respondents are asked to choose between several lottery gambles. We control for households that were either confused by the question or were hyper risk-avoiders, preferring a guaranteed gift of US$500 over a gamble of US$500 or US$1,000. There is no significant effect of this hypothetical question on purchase of insurance (col. 3).

Our second question on risk aversion, which asks about actual gambling behaviors, yields results that are contrary to traditional theory: households in which the respondent or spouse "plays games of chance for money" (i.e. gambles) are 5.75 percentage points ($p < 0.05$, col. 3) more likely to buy SKY insurance than decliners.

We also look at health risk behavior, which we consider separate from financial risk aversion. A household that takes risks with their health may be considered less risk-averse, but may also be more willing to buy SKY to cover potential health care costs. However, there is no evidence that a household that would choose a riskier job (in terms of health) is more likely to buy SKY. There is also no significant evidence that a household that exhibits behaviors that are risky to health, measured by a respondent or spouse having had an accidental injury, is more likely to buy SKY. (Similarly, households that never cover water jugs are no more likely to buy SKY. We include this as a measure of trust of Western practices, but it can also be considered a measure of health risk behavior.)

Table 8 examines how self-insurance influences take-up of insurance. We expect households that have easy ways to pay for health shocks without SKY will be less likely to purchase SKY. We have already shown that wealthier households are more likely to purchase SKY, which does not support this hypothesis. Holding wealth and other variables constant, we examine whether the ways in which a household could pay for a hypothetical health shock increase or decrease the likelihood of SKY purchase. It is a bit difficult to interpret individual responses to this question because even a difficult way to pay for care is better than no way at all, and because households were asked to list any ways they could pay for care and could list more than one way to pay for care. In addition, as the survey took place after households had had the opportunity to buy SKY, "SKY would pay" is included as an option and although households were prompted to list alternatives to SKY paying for care, a few households chose only this option. Thus, we run three separate regressions to check the robustness of results, and include "SKY would pay" as a regressor in all regressions.

Coinciding with theoretical predictions, households that could pay for a large health expense with a no-interest loan (presumably from family or a friend) or that have a family, friend or association (e.g., a rotating savings group) that could help pay for health care are less likely to purchase SKY, although these results are not significant (Table 8, col. 1). Similarly, the ability to cover expenses with cash, doctor credit or health equity funds reduces the likelihood of

insurance purchase (results not significant). Households that could pay for health care expenses with savings or a loan with interest are more likely to purchase insurance, although the difference is not significant.

We also run the regression looking at households that list only what we consider to be expensive ways to pay for care (col. 2). Households that would only be able to pay for care with the sale of assets or borrowing with interest are more likely to purchase SKY, although not significantly so. A household that would have to seek extra work would be less likely to purchase SKY (not significantly). Households that list no inexpensive ways to pay for care (could not pay with cash or savings, could not get help from family, friends or a savings association, could not borrow without interest, and are not health equity fund members) are 2.5 percentage points more likely to purchase SKY (col. 3, P = 13.8).

The hypothetical question asks for any ways to pay for care, so many households chose more than one option. Column 3 looks at the number of options a household lists to pay for care, holding constant whether the household stated that SKY would pay for care. Households that list more options are less likely to buy SKY, but not significantly.

6.2. Other Influences on Take-up

Table 9 includes other influences on insurance purchase that are less in line with traditional theory. All previous regressors, except for self-insurance measures, are included as controls but are not shown. The exception is the final column, which does not control for health utilization measures to ease interpretation of coefficients.

Households that are in the wealthiest subjective wealth category are 6.7 percentage points more likely to buy SKY (col. 1, P < 0.01). The poorest are not significantly more or less likely to buy SKY. Discount rate (preference for the present over the future) has no significant impact on the purchase of health insurance (col. 1).

Measures of understanding of insurance did not influence SKY purchase as we had predicted it would (col. 2). Compared to the excluded category of 5 or more years of education (4.7 years is average), having a respondent with 1 to 4 years of education increased take-up of SKY by 4.2 percentage points (p < 0.05), as did having 0 years of education (not significant). We included measures of education in several ways (not shown) and years of education always had a negative impact on SKY purchase.

Illiterate households were less likely to purchase SKY, but this result is not statistically significant. Households in which respondents did not understand the hypothetical risk aversion question (choosing the option with a certainly lower payout) were similarly less likely to purchase SKY, but not significantly so (Table 7, col. 3). Tests of joint significance of these three variables also yielded no significant results.

Knowing someone who had a health shock increases purchase of SKY, even if that person is not in your household. Having a neighbor with a large health expense increases SKY purchase by 5.0 percentage points (col. 3, p < 0.05), even though this neighbor would not be covered by the household's purchase of SKY. The point estimate of this variable is somewhat sensitive to the inclusion of other regressors, and sometimes becomes only marginally significant. Knowing a family member who spent more than US$100 on a health shock in the last year increases SKY purchase by 4.2

percentage points (P < 0.05). We include controls for spending more than US$100 on a member living in the household (an in-family individual with a US$100 health expense), so the assumption is that these results hold for even a family member living outside of the household, who would not be covered by the household's purchase of SKY.

There is also the possibility that households are buying SKY, not because they know someone who is ill, but because they know someone else who bought SKY, which is more likely if they know someone who is ill. Future analyses will examine this possibility.

Families with children under the age of 6 who have had all the WHO-recommended vaccines are 7.1 percentage points (p < 0.01, col. 4) more likely to buy SKY. We interpret vaccinations to be a signal of trust in Western medicine, which will increase expected utilization of public health centers compared to traditional healers or drug sellers. At the same time, covering water jugs, which can be interpreted as a reluctance to take a health risk or as adherence to Western medicine, has no significant impact on insurance purchase (col. 4). The coefficient of this measure does not change when we eliminate potentially collinear regressors such as other risk measures (results not shown).

Above we describe the likelihood that members of different ages and genders will be in poor health, and likelihood of these members using health facilities. We found that the elderly are most likely to be ill (Table 5, col. 1 and 2), but least likely to receive care following an illness (col. 7 – 10). Females of working age are more likely than males to be ill (col. 1 and 2) and about as likely to receive care following an illness (col. 7 - 10).

Based on health levels, adverse selection theory would predict that households with elderly members should be most likely to purchase SKY. However, we found above (Table 7) that households are not more likely to purchase SKY when they have older members.

Now we test whether households are more or less likely to purchase SKY depending on the characteristics of the ill members in the household. If past health care utilization predicts future use, based on observed patterns of health care utilization, households would be more likely to purchase SKY for ill males over age 64 than ill females over age 64 (because males at this age use more public care following a shock), and less likely to purchase SKY for the ill elderly than for the ill in other age groups, whether male or female.

Indeed, we find that households with an older ill member are significantly less likely to purchase SKY than households with a working-aged member in poor health (Table 9, col. 5, p < 0.01, significance for this difference not shown in table) and are also less likely to purchase SKY than households with a young member in poor health (p = 0.17, significance for this difference not shown in table). As expected because of higher utilization rates, households with older ill males are more likely to be in households with insurance than are households with older ill females, but this difference is not statistically significant. Households with an ill female member of working age (16 to 64) are around 3.7 percentage points more likely to purchase SKY than households with an ill working-aged male (p = 0.15, significance not shown in table).

7. Robustness Tests

The regressions above were run many times using different combinations of independent variables. Significant results presented in the tables above do not change meaningfully depending on which other independent variables are included in the regressions. In addition, the following robustness checks were run. Appendix Table A.1 presents the results of testing changes in the sample, and the results of adding village-level indicator variables. The first column of this table presents results from the full sample (as presented in our main results) for comparison purposes. Self-insurance measures are not included in regressions for this table, but self-insurance measures do not change with changes in the sample (not shown). For all other regressors, only significant coefficients are shown in the table, although all variables from the above tables were included in the regressions. Appendix Table A.2 interacts wealth and health.

Keep in mind that column 1 of Appendix Table A.1 includes all regressors at once, whereas the main results added a few regressors at a time. Thus, the coefficients for some variables change meaning somewhat. For example, because we are including a covariate for "all vaccines fulfilled for members under 6", the coefficient on "at least one member age 5 or under" is now interpreted as having a member 5 or under that did not receive a vaccine. The coefficients on other variables also may have also changed slightly, but overall results and significance remain the same.

7.1. Interview Lag and Delayed SKY Purchase

Due to delays in survey implementation, some households were not interviewed for up to 274 days after the village meeting. The data on pre-meeting health shocks may be less accurate for these households due to poor recall. This also means that some questions, in particular, self-reported poor health, are reported several months after the start of SKY. This should not lead to problematic bias, because if anything, SKY members should have increased health over time, so that any late responses would tend to bias downwards the illness of the insured. As a robustness check, we include only households that were interviewed within 3 months (93 days) of the SKY village meeting (Appendix Table A.1, col. 2).

We also look at only households that purchased SKY within 2 months (63 days) of the village meeting (Appendix Table A.1, col. 3). For these households, health at baseline may be more likely to influence take-up of SKY. Households who bought after this date are left out of the regression. In a separate regression we restrict the sample to include only early buyers (and decliners) and early surveys (Appendix Table A.1, col. 4.)

With these added filters we have less than a third of the original sample, so significance drops for many variables, although most point estimates do not change sign for significant coefficients. Coefficients that do change sign are for variables that are only marginally statistically significant at best.

Quality of health facilities is a positive influence on take-up for early interviews (col. 2) and early buyers (col. 3), but becomes negative when we look at early buyers and early interviews (col. 4). However, as this is a village-level measure, this may be due to the small number of villages in these regressions: significance for column 4, for example, drops to p = 0.52.

7.2. Village Controls

If we include a variable for each village in the sample (Appendix Table A.1, column 5), there are some small changes in the results, but point estimates do not change sign. For example, the coefficients on salience variables (knowing family or a neighbor ill) are reduced or are no longer significant. This makes sense. Households may buy SKY if they have a member that is ill, or if they know someone that is ill. In villages with many ill members, there will be high take-up of SKY. In these same villages, households are more likely to know someone that is ill. Thus, living in certain villages is collinear with knowing someone that is ill. A regression of the percentage of households with poor health in a village on the percentage of households who know someone that is ill (results not presented) shows that the average number of households with poor health is positively correlated with the average number of households knowing someone who is ill.

7.3. Wealth Interactions

In the main results section, we found that wealthier households were more likely to buy SKY. It is possible that wealthy households may buy SKY even when a member is not currently ill (i.e., for pure insurance/consumption smoothing reasons in the case of a health shock), but that poorer households buy SKY only when they have a very ill household member because of budget constraints. Alternatively, the poorest households, even with the sickest members, may forgo all care and not purchase SKY at all.

To test this, we interact wealth with subjective health variables.

Table 10 gives summary statistics by wealth and health. Holding nothing else constant, for all wealth levels, households with a member in poor health are more likely to buy SKY, but wealthier households are even more likely to purchase SKY when they have a member in poor health. The wealthier are also more likely to purchase SKY if no member is in poor health.

Looking at this from a different perspective, SKY households of all wealth levels are more likely to have a member in poor health than households without SKY at the same wealth level, but there are fewer members in poor health in wealthier households for both buyers and non-buyers.

When we interact wealth and poor health in regression form (Appendix Table A.2), we find that while the rich as a whole are more likely to buy (the coefficients on "highest ranked wealth" and "poor health X highest ranked wealth" are jointly positive and statistically significant), the rich that are healthy are not more likely to purchase SKY (the coefficient on "highest ranked wealth" is not statistically significant). We interpret this as meaning that the rich are not significantly more likely to buy for pure insurance reasons ("just in case"), but the poor are more likely to abstain from buying SKY because of budget constraints.

7.4. Coupon Status

A companion paper (Polimeni and Levine, 2011) compares selection results for high coupon versus low coupon households. Comparisons on baseline characteristics are limited due to the low number of households that purchased SKY with a low coupon (the higher price). Results for health status show that low and high coupon households are equally likely to buy SKY for members in poor health as measured by the baseline survey.

Conclusion

We collected baseline data from over 5,000 households in rural Cambodia as the voluntary health insurance program SKY was introduced to the region. We used a simple logistical model of take-up on baseline characteristics to examine how households' baseline characteristics influence the decision to purchase insurance. Households had not previously been exposed to insurance, so baseline estimates of health and health utilization were not influenced by prior insurance status. We find evidence of both traditional and less traditional incentives to purchase SKY.

In results not shown, we find significant evidence of adverse selection: households that have a member in poor self-reported health, or have a member that has used public health facility care for a major health shock in the months preceding the SKY village meeting are more likely to purchase SKY (results presented in Polimeni and Levine, 2011).

Interestingly, we find that simply knowing someone in poor health, even if they would not be covered by a household's purchase of SKY (e.g., a neighbor), induces an increase in SKY purchase. We interpret this as a salience effect: knowing someone ill and witnessing high health expenses increases the perceived likelihood of illness in the minds of potential insurance purchasers. However, we cannot rule out the possibility that knowing someone who is ill is correlated with knowing someone who has purchased SKY (since increased illness increases SKY purchase), and therefore that it is not knowing someone who is ill but rather knowing someone who has purchased SKY is what is increasing the purchase of insurance. It is also possible that, especially if an illness is contagious or due to a common external factor, knowing someone who is ill is in fact correlated with a household's own probability of getting ill, and that purchase is not due to salience but instead to a real increased risk of illness.

As in other studies of developing countries, we find some evidence of age and gender inequalities in SKY purchase. Households are less likely to purchase SKY for ill household members aged 65 or older than for younger ill members. This is rational when we consider that, while older individuals are more likely to be ill, they are less likely to receive treatment for their illnesses. Contrary to adverse selection theory, although the elderly are more likely to utilize health care overall (because of a higher rate of illness), households with an elderly member are not more likely to buy insurance.

Households that take risks with their health are also no more likely to purchase SKY.

Also contrary to traditional theory, and in line with some recent studies in developing countries (Gine, Townsend and Vickery, 2007), we find no evidence that households that are more risk-averse are more likely to buy SKY. In fact, the limited evidence we have indicates that the less risk-averse

households are the ones purchasing SKY insurance. We interpret this as a "first mover" effect, whereby households that are willing to take risks with their money are also more willing to spend money on an untested new product. In a related explanation, Bryan (2010) proposes that ambiguity aversion, whereby households fear they will not get paid when they most need it, decreases the demand for some types of insurance, and that without holding ambiguity aversion constant, it will appear that risk-averse households are less likely to purchase insurance. Our result means that, unlike some recent evidence that finds that risk aversion can counteract adverse selection (positive selection), we do not find this to be the case for SKY.

This is an important result: that the risk-averse purchase more insurance is a long-accepted theory in insurance literature. Recent studies theorize that purchase due to risk aversion may even offset some adverse selection. Our results add one more piece of evidence that this theoretical hypothesis is not always empirically true.

Households were less likely to buy when the cost of travel to the local public health facility was higher. They were more likely to buy if the nearest SKY-partnered health facility was measured to be of higher quality, although this result was not robust to some changes in sample. This result is in accordance with traditional models of adverse selection, as households near higher quality facilities may be those that are most likely to utilize these SKY-covered services. It is interesting to note that unlike some previous studies that found little relationship between measured quality and utilization, our quality measures are all attributes of the health centers that are relatively observable to households, such as the availability of equipment and cleanliness of the facility. These attributes, along with other factors such as politeness of staff and waiting times, may be more important to households than staff training and diagnostic skills.

We found some evidence that households with limited ways to cheaply self-insure are more likely to purchase insurance, but the results were not statistically significant. However, the wording of our question makes it difficult to interpret responses and thus this result must be viewed with caution.

Individuals in wealthier households are less likely to be in poor health and have lower utilization than poorer households, but these households are more likely to buy SKY than poorer households. This can be interpreted as evidence of positive selection, if we consider that wealth is negatively correlated with the probability of health shocks but positively correlated with the purchase of insurance (Fang, Keane and Silverman, 2008). Poorer households with an ill member are less likely than richer households with ill members to purchase SKY, presumably due to budget constraints.

Education, cognitive ability and discount rate (relative preference for the present versus the future), which had been shown in other studies to offset adverse selection (Fang, Keane and Silverman, 2008), did not have any statistically significant effects on take-up of SKY insurance. It is surprising that the ability to understand SKY, which we measure by education of the health decision-maker, ability to understand a risk aversion question, and a literacy and numeracy test, does not have a positive impact on take-up of SKY. It was clear from questions at the SKY village marketing meetings and from our in-depth qualitative interviews that some households did not understand the concept of insurance. In addition, 82% of our sample did not seem to understand the hypothetical risk aversion question, and answered that they would prefer a guarantee of US$500 over a 50/50 chance of US$500 or US$1,000. Thus, although our results do not show a positive impact of education or understanding on SKY take-up, we believe this may in fact be an important reason that households remain uninsured. It is possible that our measures of cognitive ability are not

accurately capturing a household's understanding of SKY insurance, or that greater understanding of insurance is correlated with some unmeasured factor that is negatively influencing SKY purchase.

In sum, while we find some support for traditional models of insurance take-up (adverse selection), our evidence also gives support for less traditional influences on insurance purchases (budget constraints, salience of illness, age preference), and provides evidence that counters the long-accepted theory that the risk-averse will be more likely to purchase insurance.

Our results cover a single insurer in a few regions of one nation. We examine 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, our study examines a program that is very new in this region. As time goes on, understanding of insurance will probably rise. This may affect take-up of insurance and adverse selection in the long run. It is important to see how results would vary with different products, different health care systems, and so forth. In addition, we relied largely on survey measures of risk aversion and other behavioral factors. It would be useful to measure these factors more objectively with behavioral measures or experimental games.

It is important to understand how the baseline characteristics of households, which we interpret as expected utilization of health care, translate into differences in utilization once SKY has been purchased. In a related paper (Polimeni and Levine, 2011), we find evidence of adverse selection in utilization above and beyond self-selection based on factors we were able to observe at the baseline.

Our results suggest that insurers in developing countries must contend with the same adverse selection issues as those in developed countries if they are to become financially sustainable without donor support. In addition, they must contend with barriers to take-up that are less traditional, and may be unique to a developing country context. Insurers must take these characteristics into account when determining how to market their product to consumers. Finally, if insurance is to be used as a policy tool, policy makers must understand how to cover the target population.

Tables

Table 1. Treatment behavior of ill households

	2000			2005		
	First Treat.	2nd Treat.	3rd Treat.	First Treat.	2nd Treat.	3rd Treat.
% of People Seeking Treatment (by provider type)						
(a) Public	18.8%	4.0%	1.2%	22.0%	6.0%	2.1%
(b) Private medical practitioners	33.0%	6.7%	2.1%	46.7%	13.1%	5.0%
(c) Private non-medical providers	34.0%	10.0%	3.4%	21.6%	7.7%	3.2%
Total % Seeking Treatment	**85.8%**	**20.7%**	**6.7%**	**90.3%**	**26.8%**	**10.3%**

Table 2. Summary of Hypotheses

Measure	Variable description	
Traditional		
Premium	Household received a large coupon for SKY	+
Expected Health Costs :		
-Subjective Health	Household has at least one member in poor health, as reported by respondent	+
- Recent Health Shock	Household member has had a major health shock (death, 7 days unable to work, or cost of over US$100) in the three months prior to the SKY village meeting.	+
- Past Use of Public Care	Household member used public care for a major health shock in the three months prior to the SKY village meeting	-
- Past Use of Private Care	Household member used private care for a major health shock in the three months prior to the SKY village meeting	+
- Stunting and Wasting	Household has a stunted or wasted child under age 6	+
Demographic characteristics	Number of household members Indicator variable for under 6 Indicator variable for over 64	+/-
Distance to Public Care	Cost of moto to local health center Kilometers to nearest public referral hospital (square root)	- -
Facility Quality	Local health center weekly number of hours open (divided by 100) Average clinic survey score for cleanliness and availability of drugs and equipment	+ +
Risk Aversion	Financial: Risk aversion ranking of 1-4 based on hypothetical choice of certain versus riskier monetary pay-offs Financial: Respondent or spouse likes to gamble	+/- +/-
Risks with Health	In health: Respondent or spouse has ever received care for an accidental injury In health: Respondent chooses the highest pay but riskiest job over safer options in a hypothetical question.	+/- +/-
Self-Insurance	Various ways to pay for a hypothetical US$100 health care bill. Could only pay by selling an asset Could only pay with extra work Could only pay by borrowing with interest Household could pay for hypothetical US$100 health care bill with cash, savings, family help, or borrowing w/ or w/o interest Number of ways to pay for care of a hypothetical US$100 health care bill	+ + + - +/-
Other	f	+
Budget Constraints	Poorer household, by subjective wealth ranking Wealthier household, by subjective wealth ranking	- +
Discount Rate	Household has the highest discount rate as measured by a hypothetical question asking the respondent to choose between a smaller pay off in two weeks time or a larger pay off in one year.	+ -
Understanding of Insurance	Education of health-decision maker: 0 years 1-4 years Omitted: > 4 years Answered all literacy/numeracy test questions correctly Confused by risk question: Chose guaranteed US$500 over a 50/50 chance of US$500 or US$1,000 in hypothetical risk question	- - + + -
Salience	Respondent has a neighbor with a large health shock in the past 12 months Respondent has (out-of-household) family with a large health shock in the past 12 months (we include a control for in-household shocks in the past 12 months)	+ +
Trust of Western Medicine	All children under age 6 are up-to-date on vaccinations Respondent always covers water jugs	+ +
Gender and Age Preference	Male household member in poor health, as reported by respondent. Working-aged, younger, or older household member (age 15-65, under 6, over 64) in poor health, as reported by respondent	+/-/-, respecti-vely

Table 3. Summary statistics (traditional Influences on take-up)

	Pooled Mean	Standard Deviation	Buyer Mean	DeclinerMean	Clustered T-Test
Premium					
Offered a Deep Discount	0.481	0.500	0.761	0.340	-20.192 ***
Risk Aversion/Health Risks					
Respondent or spouse needed care for accidental injury	0.134	1.870	0.132	0.135	0.045
Would accept 25% salary increase for riskier job	0.068	0.252	0.064	0.070	0.823
Hypoth. Local Risk Aversion: 1-4, least to most risk averse. Confused also = 4.	1.213	0.710	1.222	1.208	-0.744
Plays games of chance for money (gambles)	0.101	0.301	0.113	0.095	-1.704 +
Self-Insurance					
Could sell asset to pay for a large health expense	0.464	0.499	0.455	0.469	0.523
Family, friend or association would pay for a large health expense	0.159	0.366	0.153	0.163	0.942
Health Equity Fund would pay for a large health expense	0.001	0.039	0.002	0.001	-0.237
Could use cash to pay for a large health expense	0.300	0.458	0.300	0.299	0.100
Would pay for a large health expense with savings	0.091	0.287	0.099	0.086	-1.296
Could borrow with no interest to pay for a large health expense	0.197	0.398	0.167	0.211	3.948 ***
Could borrow with interest to pay for a large health expense	0.413	0.492	0.397	0.421	1.612
Doctor would give credit for a large health expense	0.001	0.033	0.001	0.001	1.088
Would get extra work to pay for a large health expense	0.046	0.210	0.039	0.050	1.593
SKY would pay for a large health expense	0.059	0.236	0.173	0.003	-49.734 ***
Health Facility Quality					
Health Center total open hours/ 100,actual (survey week)	0.953	0.500	0.973	0.943	-1.897 +
Equipment (positive/total outcomes)	0.786	0.091	0.795	0.782	-3.245 **
Health Facility Distance					
Cost of moto from village to health center (USD)	0.392	0.505	0.374	0.401	1.738+
Sqrt distance from village to referral hospital (km)	3.122	1.467	3.122	3.122	0.150
Observations	**5229**		**1754**	**3475**	

Notes: T-tests clustered at the village level. + p<0.10, * p<0.05, ** p<0.01, *** p<0.001. Health facility quality measures are from the clinic survey. Distance to health centers is from interviews with village leaders. Distance to regional hospital is from village meeting data. Hypothetical risk aversion and accidental injury are from the second-round survey. All other data are from the baseline survey. Sample is all SKY decliners and all SKY buyers who first purchased SKY after the village meeting

Table 4. Summary statistics (other measures)

	Pooled Mean	Standard Deviation	Buyer Mean	DeclinerMean	Clustered T-Test	
Salience						
Family member had a > US$100 health shock in the last year	0.194	0.396	0.211	0.186	-2.343	*
Knows a neighbor with a > US$100 health shock in the last year	0.138	0.345	0.148	0.133	-1.277	
Trust of Western Medicine						
All vaccines received for members under 6, 0 if not under 6, pre-meeting	0.259	0.438	0.273	0.251	-1.890	*
Household always uses covers for water jugs	0.068	0.252	0.064	0.070	0.823	
	0.276	0.447	0.282	0.274	-0.580	
Understanding of Insurance						
Confused by risk aversion question: chose US$500 over a 50/50 chance of US$500/1,000	0.823	0.382	0.816	0.826	0.807	
Education of health decision-maker (years)	4.651	3.419	4.674	4.640	-0.535	
Answered all literacy/numeracy questions correctly	0.151	0.358	0.156	0.148	-0.754	
Budget Constraints						
Highest ranked wealth by enumerator	0.139	0.346	0.161	0.128	-3.047	**
Lowest ranked wealth by enumerator	0.124	0.329	0.112	0.130	0.983	*
Discount Rate						
Prefers US$20 now over US$60 or US$120 in 12months	0.654	0.476	0.655	0.654	0.421	
Gender and Age Preference	P	P	P	P	P	
Male household member, under 6, in poor self-reported health	0.074	0.261	0.084	0.068	-2.064	*
Female household member, under 6, in poor self-reported health	0.061	0.240	0.072	0.056	-2.117	
Male household member, age 6 to 15, in poor self-reported health	0.091	0.288	0.100	0.086	-1.509	
Female household member, age 6 to 15, in poor self-reported health	0.085	0.279	0.102	0.077	-3.081	**
Male household member, age 16 to 64, in poor self-reported health	0.303	0.460	0.352	0.279	--5.773	***
Female household member, age 16 to 64, in poor self-reported health	0.480	0.500	0.557	0.442	-7.309	***
Male household member, over 64, in poor self-reported health	0.083	0.276	0.097	0.076	-2.372	*
Female household member, over 64, in poor self-reported health	0.138	0.345	0.139	0.138	-0.061	
Observations	**5229**		**1754**	**3475**		

Notes: T-tests clustered at the village level. + p<0.10, * p<0.05, ** p<0.01, *** p<0.001. Use of water jug covers,hypothetical risk aversion question, and literacy test are from the second-round survey. All other data are from the baseline survey. Sample is all SKY decliners and all SKY buyers who first purchased SKY after the village meeting.

Table 5. Health and utilization regressed on characteristics of members

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Poor health	Shock Pre-Meeting	Any Care	Public/ Private	Public	Hospital	Any Care	Public/ Private	Public	Hospital
Male age 16 to 64 (d)	0.148*** [0.0128]	0.0421*** [0.00932]	0.0429*** [0.00935]	0.0403*** [0.00904]	0.0278*** [0.00709]	0.0249*** [0.00617]	0.00822 [0.0107]	0.0162 [0.0246]	0.0697 [0.0481]	0.120* [0.0481]
Female age 16 to 64 (d)	0.274*** [0.0122]	0.0794*** [0.00949]	0.0805*** [0.00949]	0.0728*** [0.00920]	0.0478*** [0.00726]	0.0345*** [0.00621]	0.0184 [0.0120]	-0.00036 [0.0240]	0.0873+ [0.0453]	0.103* [0.0435]
Male over 64 (d)	0.548*** [0.0212]	0.220*** [0.0304]	0.212*** [0.0303]	0.194*** [0.0296]	0.114*** [0.0255]	0.0934*** [0.0237]	-0.0214 [0.0283]	-0.0355 [0.0465]	0.0394 [0.0718]	0.113 [0.0720]
Female over 64 (d)	0.609*** [0.0152]	0.218*** [0.0251]	0.217*** [0.0251]	0.201*** [0.0247]	0.0794*** [0.0188]	0.0718*** [0.0180]	0.0116 [0.0123]	0.00085 [0.0334]	-0.0732 [0.0609]	0.0475 [0.0602]
Male under 6 (d)	0.184*** [0.0220]	0.0390** [0.0147]	0.0415** [0.0148]	0.0405** [0.0145]	0.0400** [0.0127]	0.0296** [0.0114]		0.0392 [0.0282]	0.170* [0.0677]	0.148* [0.0739]
Female under 6 (d)	0.0944*** [0.0228]	0.00408 [0.0142]	-0.0637 [0.0143]	0.0122 [0.0142]	0.0267* [0.0124]	0.00914 [0.00926]			0.248*** [0.0732]	0.0806 [0.0825]
Household in wealthiest subjective ranking (d)	-0.0199 [0.0157]	-0.0207** [0.00755]	-0.0180* [0.00757]	-0.0169* [0.00737]	0.0128** [0.00466]	-0.00365 [0.00364]		0.0279 [0.0233]	-0.0383 [0.0456]	0.0232 [0.0402]
Household in poorest subjective ranking (d)	0.140*** [0.0186]	0.0324*** [0.00900]	0.0328**** [0.00901]	0.0261** [0.00865]	0.0180** [0.00672]	0.0118* [0.00487]	0.00537 [0.0107]	-0.0313 [0.0246]	0.0269 [0.0411]	0.0258 [0.0352]
Observations	**13 602**	**13 607**	**13 607**	**13 607**	**13 607**	**13 607**	**1 081**	**1 310**	**1 359**	**1 359**
Pseudo R-Squared	**0.085**	**0.031**	**0.031**	**0.028**	**0.023**	**0.026**	**0.025**	**0.009**	**0.104**	**0.007**

Notes: Regression uses individual-level observation.LHS variables: Col. (1): Indicator for poor self-reported health; Col. (2): Indicator for a major health shock pre-meeting; Cols. (3-6): Indicators for receiving any care, public or private care, public care, or hospital care, respectively, following a health shock pre-meeting (includes zeros for members with no major health shock); Col. (7-10): For individuals with a major health shock pre-meeting, indicators for use of any care, public or private care, public care, or hospital care, respectively. Major health shock is defined as a shock causing adeath, 7 days of disability, or that results in a health expense of 100 $.or more. + p<0.10, *p<0.05, **p<0.01, ***p + p<0.10, *p<0.05, **p< 0.001. Marginal effects;standard errors in brackets. Robust standard errors clustered at the village level. All data is from the baseline survey. Sample are all households that did not receive a large discount for insurance. (d) for discrete change of indicator variable form 0 to 1.

Table 6. Price elasticity of demand

	Regular Price	Large Discount
Price, in months, for 6 months of insurance	5	1
Purchase within 6 months of meeting	172	1233
Number of households receiving price offer	2536	2539
% SKY	6.8%	48.6%
Price Elasticity of Demand	-7.7	

Notes: Sample includes randomized sample, not over-sampled buyers. Take-up is the number of households purchasing within 6 months of the village meeting, even if a household drops within this period. Price elasticity of demand equals (% Change in Take-Up) / (% Change in Price).

Table 7. Influence of Traditional Selection Measures (Household Demographics, Clinic Characteristics, and Risk Characteristics) on SKY Purchase

	(1)	(2)	(3)
Characteristics of Households:	**Demographic**	**Clinic**	**Risk**
Offered a deep discount (d)	0.382*** [0.0191]	0.383*** [0.0189]	0.385*** [0.0189]
At least one member over 64 (d)	-0.0193 [0.0176]	-0.02 [0.0174]	-0.0164 [0.0177]
At least one member age 5 or under (d)	-0.000861 [0.0179]	-0.00107 [0.0179]	-0.00351 [0.0180]
Cost of moto from village to health center (USD)		-0.0368* [0.0185]	-0.0361+ [0.0189]
Average score for inventory, hygiene,and equipment (positive/total outcomes)		0.355* [0.147]	0.369* [0.151]
Health center total open hours / 100,actual (survey week)		0.00233 [0.0295]	-0.00583 [0.0303]
Sqrt distance from village to referral hospital (km)		0.00183 [0.0105]	0.00514 [0.0111]
Hypoth. local risk aversion: 1-4, leastto most risk-averse. Confused also = 4			0.00912 [0.0139]
Confused by risk aversion question: Chose US$500 over a 50/50 chance of US$500/1,000 (d)			-0.015 [0.0249]
Plays games of chance for money (gambles) (d)			0.0575* [0.0263]
Would accept 25% salary increase forriskier job (d)			-0.00667 [0.0276]
Respondent or spouse needed care for accidental injury			-0.0166 [0.0250]
Observations **Pseudo R-Squared**	**4898** **0.144**	**4871** **0.147**	**4740** **0.149**

Notes: LHS variable: 1 if bought SKY, 0 if declined (SKY administrative data). + p<0.10, * p<0.05, **p<0.01, ***p<0.001. Marginal effects; standard errors in brackets. Robust standard errors clustered at the village level. Clinic hours and hygiene, inventory and equipment score are from the clinic survey. Distance to health facilities is from interviews with village leaders. Hypothetical risk aversion and accidental injury are from the second-round survey. All other data are from the baseline survey. Subjective health and health care utilization measures are included in the regression but not presented. Sample is all SKY decliners and all SKY buyers who first purchased SKY after the village meeting. (d) for discrete change of indicator variable from 0 to 1.

Table 8. Influence of self-insurance measures on SKY purchase

	(1)	(2)	(3)	(4)
Characteristics of Households:	**Ways to Self-Insure**	**Difficult Ways**	**Any Difficult Way**	**Number of Options**
Could sell asset to pay for a large health expense (d)	0.00594 [0.0208]			
Family, friend or association would pay for a large health expense (d)	-0.0125 [0.0242]			
Could mortgage land to pay for a large health expense (d)	-0.0957 [0.0857]			
Health Equity Fund would pay for a large health expense (d)	-0.111 [0.185]			
Could use cash to pay for a large health expense (d)	-0.0158 [0.0178]			
Would pay for a large health expense with savings (d)	0.0331 [0.0271]			
Could borrow at no interest to pay for a large health expense (d)	-0.0289 [0.0218]			
Could borrow with interest to pay for a large health expense (d)	0.0106 [0.0185]			
Doctor would give credit for a large health expense (d)	-0.166 [0.165]			
Would get extra work to pay for a large health expense (d)	-0.0373 [0.0355]			
SKY would pay for a large health expense (d)	0.709*** [0.0152]	0.703*** [0.0147]		
Selling asset only option to pay for health expense (d)		0.0238 [0.0238]		
Extra work only option to pay for health expense (d)		-0.0687 [0.105]		
Borrowing with interest only option to pay for health expense (d)		-0.0687 [0.105]		
Limited self-insurance options (no family, borrow w/o interest, etc.) (d)			0.0253 [0.0170	
Number of ways to pay for a hypothetical health shock				-0.00716 [0.0107]
Observations	**4739**	**4778**	**4778**	**4739**
Pseudo R-Squared	**0.231**	**0.225**	**0.225**	**0.229**

Notes: LHS variable: 1 if bought SKY, 0 if declined (SKY Administrative data). + p<0.10, * p<0.05, ** p<0.01,***p<0.001. Marginal effects; standard errors in brackets. Robust standard errors clustered at the village level. All data are from the baseline survey. Regression includes all regressors in the previous table, plus controls for rich and poor households, not presented here. Sample is all SKY decliners and all SKY buyers who first purchased SKY after the village meeting. (d) for discrete change of indicator variable from 0 to 1.

Table 9. Influence of other selection measures on SKY purchase

	(1)	(2)	(3)	(4)	(5))
Liquidity/ Characteristics of Households:	**Patience**	**Understands Insurance**	**Salience**	**Trust of Western Medicine**	**Gender/Age**
Highest ranked wealth by enumerator (d)	0.0674** [0.0229]	0.0674** [0.0228]	0.0676** [0.0228]	0.0683** [0.0231]	0.0656** [0.0231]
Lowest ranked wealth by enumerator (d)	0.00515 [0.0230]	0.00368 [0.0230]	0.00644 [0.0232]	0.00848 [0.0237]	0.00422 [0.0241]
Prefers US$20 now over US$60 or US$120 in 12 months (d)	0.00805 [0.0170]	0.00783 [0.0170]	0.00905 [0.0168]	0.00964 [0.0167]	0.00789 [0.0169]
Health decision-maker has 0 years of education (d)		0.0177 [0.0214]	0.0204 [0.0215]	0.0197 [0.0217]	0.0176 [0.0216]
Health decision-maker has 1 to 4 years of education (d)		4695 [0.0203]	0.0424* [0.0203]	0.0411* [0.0202]	0.0389+ [0.0201]
Answered all literacy/numeracy questions incorrectly (d)		-0.0233 [0.0163]	-0.0218 [0.0164]	-0.0215 [0.0165]	-0.0198 [0.0163]
Knows a neighbor with a > US$100 health shock in the last year (d)			0.0498* [0.0252]	0.0514* [0.0255]	0.0498* [0.0253]
Family member had a > US$100 health shock in the last year (d)			0.0415* [0.0206]	0.0416* [0.0206]	0.0411* [0.0206]
Control: Household member spent over US$100 on a given individual, past 12 m (d)			-0.0161 [0.0257]	-0.0104 [0.0260]	-0.00787 [0.0258]
Household always uses covers for water jugs (d)				-0.0231 [0.0159]	-0.0239 [0.0160]
All vaccines fulfilled for members under 6, 0 if no under 6, pre-SKY (d)				0.0707** [0.0245]	0.0696** [0.0244]
Male household member, under 6, in poor self-reported health (d)					0.0548+ [0.0296]
Female household member, under 6, in poor self-reported health (d)					0.0163 [0.0338]
Male household member, age 16 to 64, in poor self-reported health (d)					0.0267 [0.0189]
Female household member, age 16 to 64,in poor self-reported health (d)					0.0632*** [0.0181]
Male household member, over 64, in poor self-reported health (d)					0.0113 [0.0347]
Female household member, over 64, in poor self-reported health (d)					-0.034 [0.0322]
Observations	**4739**	**4739**	**4739**	**4695**	**4695**
Pseudo R-Squared	**0.15**	**0.151**	**0.153**	**0.153**	**0.155**

Notes: LHS variable: 1 if bought SKY, 0 if declined (SKY administrative data). + p<0.10, * p<0.05, ** p<0.01, *** p<0.001.Marginal effects; standard errors in brackets. Robust standard errors clustered at the village level. Use of water jug covers and literacy tests are from the second-round survey. All other data are from the baseline survey. Regression includes all regressors in the previous table, not presented here. Gender/age regression does not control for household-level self-reported health or health shocks (all other regressions do, not shown). Sample is all SKY decliners and all SKY buyers who first purchased SKY after the village meeting. (d) for discrete change of indicator variable from 0 to 1.

Table 10. SKY purchase, by wealth and poor health

	Poorest	Medium	Wealthiest
		Percent Purchasing SKY	
No Poor Health	24%	24%	27%
Poor Health	31%	37%	43%
		Percent with a Member in Poor Health	
No SKY	78%	66%	63%
SKY	**83%**	**78%**	**78%**

Notes: Sample includes decliners or buyers that first purchased SKY after the village meeting. "Poor health" is defined as having at least one household member in self-reported poor health.

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Appendix

A. Supplementary Tables

Table A.1. Robustness checks

	(1)	(2)	(3)	(4)	(5))
	All HHs	Early Surveys	Early Buyers	Early Surveys and Buyers	Village FE
Offered a Deep Discount (d) [0.0192]	0.386***	0.369*** [0.0278]	0.366*** [0.0178]	0.325*** [0.0297]	0.439*** [0.0133]
At least one member over 64 (d) [0.0177]	-0.0115	-0.0206 [0.0260]	-0.0202 [0.0152]	-0.0144 [0.0227]	-0.0116 [0.0176]
At least one member age 5 or under (d) [0.0247]	-0.0498*	-0.03230 [0.0437]	-0.0302 [0.0224]	-0.0157 [0.0363]	-0.0374 -0.0374
Cost of moto from village to health center (USD)	-0.0342+ [0.0179]	-0.0453 [0.0543]	-0.0392 [0.0261]	-0.0262 [0.0451]	
Average score for inventory, hygiene and equipment (positive/total outcomes)	0.382* [0.151]	0.0125 [0.226]	0.135 [0.122]	-0.135 [0.210]	
Health Center total open hours / 100, actual (survey week)	-0.00741 [0.0304]	0.042 [0.0344]	0.034 [0.0259]	0.0535 [0.0375]	
Sqrt distance from village to referral hospital (km)	0.00513 [0.0110]	-0.0165 [0.0199]	-0.00998 [0.0107]	-0.0308+ [0.0180]	
Plays games of chance for money (gambles) (d)	0.0498+ [0.0264]	0.0227 [0.0346]	0.0377 [0.0250]	0.0195 [0.0340]	0.0702* [0.0280]
Highest ranked wealth by enumerator (d) [0.0231]	0.0683**	0.134*** [0.0388]	0.0700** [0.0233]	0.133*** [0.0399]	0.0840*** [0.0235]
Lowest ranked wealth by enumerator (d) [0.0237]	0.00848	-0.0123 [0.0480]	-0.0387+ [0.0203]	0.00384 [0.0462]	-0.0167 [0.0247]
Health decision-maker has 0 years of education (d)	0.0197 [0.0217]	0.0483 [0.0396]	-0.00623 [0.0207]	0.0199 [0.0360]	0.00787 [0.0220]
Health decision-maker has 1 to 4 years of education (d)	0.0411 * [0.0202]	0.0364 [0.0351]	0.0327+ [0.0193]	0.0431 [0.0311]	0.029 [0.0182]
Answered all literacy/numeracy questions incorrectly (d)	-0.0215 [0.0165]	-0.0136 [0.0259]	-0.0214 [0.0148]	-0.00458 [0.0219]	-0.0249 [0.0165]
Knows a neighbor with a > US$100 health shock in the last year (d)	0.0514* [0.0255]	0.0853* [0.0388]	0.0253 [0.0221]	0.0472 [0.0371]	0.0246 [0.0233]
Family member had a > US$100 health shock in the last year (d)	0.0416* [0.0206]	0.038 [0.0313]	0.0374+ [0.0203]	0.0247 [0.0279]	0.0328+ [0.0199]
Household always uses covers for water jugs (d)	-0.0231 [0.0159]	-0.00687 [0.0281]	-0.0322* [0.0137]	-0.00364 [0.0245]	-0.0321* [0.0162]
All vaccines received for members under 6, 0 if no under 6, pre-SKY (d)	0.0707** [0.0245]	0.0902+ [0.0465]	0.0404+ [0.0222]	0.0569 [0.0395]	0.0628* [0.0269]
Observations	**4695**	**1611**	**4222**	**1485**	**4684**
Pseudo R-Squared	**0.153**	**0.177**	**0.183**	**0.185**	**0.254**

Notes: LHS variable: 1 if bought SKY, 0 if declined (SKY administrative data). + p<0.10, * p<0.05, ** p<0.01, ***p<0.001. Marginal effects; standard errors in brackets. Robust standard errors clustered at the village level, except in Col. (5), where village-level fixed effects are included (not shown). Clinic hours and hygiene and inventory and equipment scores are from the clinic survey. Distance to health facilities is from interviews with village leaders. Hypothetical risk aversion, accidental injury, use of water jug covers, and literacy tests are from the second-round survey. All other data are from the baseline survey. All previous regressors, except for self-insurance measures, are included in regressions, but only significant regressors are shown. Col. (1) and (5) use the full sample of households that declined insurance or bought for the first time after the village meeting. Col. (2) includes only households that were surveyed within 93 days of the village meeting. Col. (3) includes only households that purchased SKY within 63 days of the village meeting. Col. (4) includes only households that were surveyed within 93 days and bought SKY within 63 days of the village meeting. (d) for discrete change of indicator variable from 0 to 1.

Table A.2. Wealth/health interaction

	Wealth Interaction
Offered a Deep Discount (d)	0.379*** [0.0185]
Household Member in Poor Health (d)	0.132*** [0.0153]
Highest Ranked Wealth by Enumerator (d)	0.0296 [0.0375]
Poor Health X Highest Ranked Wealth (d)	0.0522 [0.0429]
Observations **Pseudo R-Squared**	**5228** **0.143**

Notes: LHS variable: 1 if bought SKY, 0 if declined (SKY administrative data). + p<0.10, *p<0.05,**p<0.01,***p<0.001. Marginal effects; standard errors in brackets. Robust standard errors clustered at the village level. All data are from the baseline survey. Sample is all SKY decliners and all SKY buyers who first purchased SKY after the village meeting. (d) for discrete change of indicator variable from 0 to 1.

B. Theoretical Model

Previous research has theorized that several factors can influence insurance purchases. This section describes a simple model of take-up behavior that highlights the key factors that will affect the take-up decision and generates predictions for the empirical analysis. We focus on three sets of factors: health parameters, preference parameters, and access and supply-side factors. The design of this model borrows heavily from the model produced for rainfall insurance take-up in Gine, Townsend and Vickery (2007). The model was modified to fit the health sector. In the following model, household utility depends on both consumption and health, so that the household seeks care for health shocks and must pay for care via either out-of-pocket expenses or insurance. Several other features are added to the model, such as parameters representing a personal discount rate, the ability to understand insurance, and the ability to self-insure.

To start, assume that each household has utility dependent on consumption c and health *H: U(c, H)*.

Health depends on health status before care, d, and medical care, *M*:

Health status d equals 1 if sick and 0 if healthy. Thus, when ill, *H* = *H* [1, M], and when healthy, *H* = *H* [0, 0]. Assume that illness is 100% cured with care, and households always get care for illness. Thus, *H* [1, *M*] = H [0, 0]. Because care cures illness, health does not affect utility, and thus *U* (*c, H*) = *U (c*) for simplicity of notation.

A household must decide whether to buy insurance for a price π. Assume quadratic expected utility (see Gine, Townsend and Vickery, 2007), so *E [U (c)*] = *E (c) - γ • var(c). γ* is the weight that the household puts on the variance of consumption. The higher γ, the more risk-averse the household is to loss of consumption income.

Let Y equal income. Assume $Y = y$, and that the only possible shock to consumption is medical costs (m), so that $c = y - m$.

Medical costs m depend on whether the household is insured, and whether or not the household becomes ill. m equals m_{NI} (NI = no insurance) in the absence of insurance. m_{NI} equals 0 if healthy, which happens with probability (1 - p) or msick if unhealthy (probability p).

Let E $[m_{NI}] = m_{NI} = p \cdot {}_{msick}$, and variance of $m_{NI} = 0^2{}_m$. Assume no savings or borrowing, *so* $c = y - m_{NI}$ in the absence of insurance. With insurance, $m = \pi$, and thus $c = y - \pi$.

Let t be the fraction of medical costs not covered by SKY insurance, or costs a household perceives are not covered. SKY's official policy is to cover all medical costs at public health centers, all medical costs at public hospitals with a referral, and all drugs prescribed and purchased at public facilities. Transportation costs to hospitals are covered in case of emergency. However, there are several reasons a household may perceive that SKY will not cover all medical costs. t can be larger for a given household if a household must pay high costs for transportation to public facilities or if public facilities are far away, if a household uses mostly private facilities or drug sellers (not covered by insurance), if a household does not trust that SKY will pay for treatment, or if a household anticipates that they will need to make "thank you" payments to doctors.

t may also be higher if the household does not understand insurance, and thus does not understand that treatment costs will be covered by SKY. Taking into account t, consumption with insurance becomes $c = y - t \cdot m_{NI} - \pi$.

Some households may find it more difficult to pay for medical expenses in the absence of insurance. If a household must take out high-interest loans to pay for care, or if the household must sell productive assets, the cost of medical care is effectively higher. In contrast, if a household can cheaply self-insure, e.g., family can help pay for care, or if the household has savings, they do not have these added costs in the case of a medical shock. To model this, we inflate uncovered medical costs by a factor q $(q > 1)$, where q is higher for households with stricter liquidity constraints.

To take into account that the insurance premium is paid today but the payout from insurance is in the future, we can inflate by a personal discount rate δ $(\delta < 1)$. With this discount rate, $c = y - t \cdot q \cdot mNI - (1 + \delta) \cdot \pi$ for the insured. For the uninsured, $c = y - q \cdot m_{NI}$.

Finally, assume that there are some unobserved qualities of households that influence their decision to purchase insurance. For simplification, assume that these unobserved factors influence consumption so that $c = y - t \cdot q \cdot mNI - (1 + \delta) \cdot \pi + \varepsilon I$ for the insured and $c = y - q \cdot mNI + \varepsilon$NI for the uninsured.

A household buys insurance if their expected utility with insurance exceeds expected utility without insurance: $E[UI] > E[U]$. Substituting in utility = $U(c)$, we can simplify to the decision to buy insurance if:

$\pi < [(1 - t) \cdot q \cdot mNI + \gamma \cdot q2 \cdot (1 - t2) \cdot \varepsilon 2m] \cdot (1 - \varepsilon)\text{-}1 + \varepsilon^*$

where $\varepsilon^* = (\varepsilon I - \varepsilon NI) \cdot (1 - \varepsilon)\text{-}1$.

Thus, a household will buy insurance if the premium, π, is less than the expected future health care payments from the insurance company (the first term) plus the utility gain from reducing uncertainty about consumption (the second term), plus any unobserved influences on insurance purchase (ε^*). Both terms are reduced by the discount rate (ε) and by consumers' belief that SKY may renege on promised insurance or may not pay all costs (t), and increased by the value consumers place on avoiding liquidity constraints (q).

So far, the model includes two factors related to the ability or willingness to pay for either health care premiums or medical expenses: ε measures the extent to which a household discounts future income and q represents liquidity constraints on future possible health expenses (*i.e.*, the ability to self-insure). A third reason a household may not buy insurance is because of present budget constraints, or the inability to afford the insurance premium. Even if a household would not be able to self-insure in the future, they cannot purchase insurance if they cannot afford it.

For simplicity of notation, assume $q = t = 1$, and $t = 0$, and ignore unobserved characteristics, ε^*. As in Gine, Townsend and Vickery (2007) assume households have existing *wealth W*, and they must have that wealth before they can spend it either on insurance at price or on investment that increases income y. Thus, $W \geq \pi + I$. Let y be an increasing function of I with decreasing marginal returns to I, so f is concave: $y = f(I)$.

If wealth is sufficiently high, a household can choose whether to buy insurance and put their preferred amount in I. If wealth is not sufficiently high, a household that chooses to buy insurance must decrease investment: $I = W - \pi$ if they buy insurance, and $I - W$ if they don't buy.

Thus, consumption becomes $c = f(W - \pi)$ for the insured, and $c = f(W) - m_{NI}$ for the uninsured.

A budget-constrained household will buy insurance if $E[UI] > E[UNI]$, which is equivalent to:
$E[f(W - \pi)] - \gamma \bullet var[f(W - \pi) - \pi] > E[f(W) - mNI] - \gamma \bullet var[f(W) - mNI]$.

Simplifying, we get $f(W - \pi) > f(W) - mNI - \gamma\, 0^2_m$. Thus, a household buys insurance if $f(W) - f(W - \pi) < mNI + \gamma \bullet 0^2_m$.

We assumed decreasing returns on investment. Thus, for a given premium π, the foregone return from lower investment (that is, the difference f (W) - f (W - π)) declines as wealth increases.

Intuitively, willingness to pay for insurance increases because returns on investment are decreasing. Thus, the model predicts that when credit constraints are binding, households will be more likely to buy insurance the higher their income.

To summarize, the comparative statics predictions derived from this model are that a household will be more likely to buy insurance if expected medical expenses (m_{NI}) are higher; if insurance is expected to cover a higher percentage of medical expenses (t is lower); if risk aversion for income loss (γ) is higher; if variance of expected loss (0^2_m) is higher (not measured); if

the household cannot cheaply self-insure (*q* is higher); if the household is not present-biased (δ is lower); and if a household can afford the premium (*W* is not too low).

Further, recall that expected medical expenses $m_{NI} = p \bullet {}_{msick}$ (the probability of becoming ill times expected medical expenses when ill). Anything that increases either p or msick will also increase the probability of buying insurance.

We can break down *p* and m_{sick} in the following way. The probability of a household member becoming ill, p, will be higher if a household member is currently in poor health, has had a recent health shock, is stunted or wasted, is under age 6 or over age 64, or is accident-prone; if a household has many household members; or if household members take risks with their health.

Subjective probability of a health shock may also increase if an individual knows someone with a recent health shock (Tversky and Kahneman, 1974). We include this as a factor influencing p: a household that knows someone who has been very ill or had high medical expenses in the past will adjust the probability of shock or expectation of costs upwards.

We assume that expected medical expenses when ill (m_{sick}) are influenced by past health care utilization. Thus, a household that has had high medical expenses in the past will have higher expected future medical expenses.

If a household puts less weight on the health care of certain household members, such as the elderly, expected medical expenses will be lower for these household members, even when there is a high probability they are ill.

A household may believe that SKY will cover only a small fraction of medical costs (*t* is low) if this household: uses non-public (non-covered) health facilities for treatment (past use of public health facilities will raise *t*); prefers private facilities; believes public facilities are poor quality; must pay high costs for transportation to public care (includes cost of lost time); does not trust Western medicine; does not understand how SKY works; does not trust SKY to pay for treatment (not measured); or must make thank you payments (not measured).

In our analyses, we break down these factors into traditional measures and more recent extensions to these measures. Table 2 organizes theoretical results into traditional and other measures.

C. Description of Variables

Variables from the baseline survey, the village leader interview, the health center survey, and the village meeting interviews used in this paper and in some of the robustness checks in Polimeni and Levine (2011).

Table C.1. Baseline survey variables

Variable Name	Questionnaire Question	Description
Subjective poor health	How healthy is each household member? (excellent health, good health, poor health). Primary respondent to questionnaire gives subjective response for all household members.	1 if respondent describes health of any household member as "poor", 0 otherwise
Major health shock, 24 months pre-meeting	Three questions: In the last year, were there any health problems in your household that made someone unable to work or go to school for one week or more? In the last year did anyone in your household pass away? In the last year did anyone in your household spend more than 400,000 riels (US$100) on a single health problem?	1 if respondent answers "yes" to any of these three health questions, AND the month of the health shock was 2-4 months prior to the date of the SKY meeting
Visit public facility for a major health shock, 2-4 months pre-meeting	[If household member experienced major shock in the 2-4 months pre-meeting:] Did [sick member] seek treatment for this health problem? If yes, where? [respondent chose "health center" or "public hospital"]	1 if, following a major health shock in the 2-4 months pre-meeting, a household member visited a public health center or hospital for first or subsequent treatment, 0 otherwise
Visits a private facility for a major health shock, 2-4 pre-meeting months	[If household member experienced major shock in the 2-4 months pre-meeting:] Did [sick member] seek treatment for this health problem? If yes, where? [respondent chose "private doctor (village or town)"]	1 if, following a major health shock in the 2-4 months pre- meeting, a household member visited a private doctor for first or subsequent treatment, 0 otherwise
Household has a stunted or wasted child	Height, age and weight measured for all children age 5 and under	1 if household has a child that is stunted or wasted (z-score for height-for-age or weight-for-height is less than -2) according to WHO growth standards, 0 otherwise (including if household has no child age 5 or under)
Household size (used as a control only, not presented)	Household roster: Name of people who usually sleep here (slept in the house 5 out of the 7 nights immediately preceding the interview)	Number of household members listed in the household roster

Variable Name	Questionnaire Question	Description
Household has a member age 65 or older	Date of birth of each household member	1 if any household member is age 65 or older, 0 otherwise
Household member has a member age 5 or under	Date of birth of each household member	1 if any household member is age 5 or under, 0 otherwise
Risk-averse	Round 2 survey: Which would you prefer: (1) a gift of US$500 or (2) a game which gives you a 50% chance to win US$250 and a 50% chance to win US$1,000. [Also asked to choose between US$500 and US$250/US$850, US$500 and US$250/US$2,000.]	Hypoth. local risk aversion: 1-4, least to most risk-averse, confused also = 4. 1= chose US$250/ US$850 over US$500. 2 = chose US$250/ US$1,000 over US$500, but not US$250/ US$850. 3 = chose US$250/ US$2,000 over US$500, but not US$250/ US$1,000. 4 = chose US$500 over all gambles, or was confused by question (see explanation below).
Gambles	Do you or your spouse play games of chance for entertainment with money?	1 if plays games of chance for money, 0 otherwise
Household member has received care for accidental injury	Round 2 survey: Have you or your spouse ever needed health care because of accidental injury?	Round 2 survey: Have you or your spouse ever needed health care because of accidental injury?
Risky health behavior	Hypothetical question: I'm going to ask you to make some choices about taking a job at two different factories with different salaries. Suppose that 100 people work at each factory. Please tell me which job you prefer to take. (A) daily wage of 4,000 riels (US$1), no injuries, or (B) daily wage of 5,000 riels, 3 people injured in the past year, spent two days in hospital.	1 if family chose B, would accept salary increase for the riskier job, 0 otherwise
Household does not have ways to self-insure against health care costs	How could you pay for a 400,000 riels (US$100) health expense? (multiple answers possible out of cash on hand, savings, family gift this province, family gift other province, borrow no interest, borrow with interest, find extra work, SKY would pay, sell asset, other)	Several measures: Indicate variables for each option; an indicator variable for only costly options (no family gift, loan (with or without interest), help from association, cash on hand, savings); a count of the number of options listed
Poor household	Enumerator subjective wealth ranking: poorest/medium/better off	1 if enumerator rates household as poor, 0 otherwise
Better-off household	Enumerator subjective wealth ranking: poorest/medium/better off	1 if enumerator rates household as better-off, 0 otherwise
High discount rate	If a trusted relative wanted to give you a gift, would you choose US$20 now or US$120 in 12 months?	1 if prefers US$20 now over US$120 12 months from now, 0 otherwise
Education of health decision-maker (years)	Who makes the decisions about health care in your family? What is the highest grade this person completed? What is the highest grade you completed?	Education from 1 to 13 (13 = tertiary education). If respondent decides with another household member, use maximum education of the two members. Indicator variables for 0 years or 1 to 4 years used in regressions.

Variable Name	Questionnaire Question	Description
Respondent is illiterate and innumerate	Four literacy/numeracy questions: Draw a line from each picture to the correct word; Write the name of the village, commune and district where you live; Write the correct number of objects in the pictures, and what it the object is; Tell me what time it is (picture of a clock shown).	1 if respondent answers all literacy and numeracy questions incorrectly, 0 otherwise
Confused by risk aversion question	Second-round survey: Which would you prefer: (1) a gift of US$500 or (2) the chance of either US$500 or the lucky US$1,000? If respondent chooses US$500: Are you sure? In the second option you will get at least US$500 and you may get US$1,000. In option 1 you will always get US$500.	1 if confused by risk aversion question: chose US$500 over a 50/50 chance of US$500/US$1,000, even after options were explained furthere
Knows family with shock	Do you know anyone who has spent 400,000 riels (US$100) on health care in the last year? If yes, who? (family, neighbor, friend, other)	1 if family member had a US$100 health shock in the last 12 months (pre-survey), 0 otherwise
Knows neighbor with shock	Do you know anyone who has spent 400,000 riels (US$100) on health care in the last year? If yes, who? (family, neighbor, friend, other)	1 if a neighbor had a US$100 health shock in the last 12 months (pre-survey), 0 otherwise
Control: Individual expense of over 400,000 riels	For each household member(s) treated for a major shock in 12 months pre-survey, what was the total cost of treating ALL health problems (at any facility)	1 if a single household member spent over US$100 on health care in the past 12 months for a major health shock (used to eliminate household members from "knows family with health shock" question), 0 otherwise
All vaccines are up to date, pre-meeting	For each child age 5 and under, enumerator recorded dates of vaccines from yellow immunization card	1 if all children in the household are 100% up-to-date on vaccines prior to the village meeting, according to WHO standards, 0 otherwise (including if household has no child age 5 or under)
Always covers water jars	Round 2 survey: Do you use covers for your water jars? (no, has some covered, has all covered)	1 if household always uses covers for water jugs, 0 if they sometimes or never do. (Water jars collect rain for household consumption and use in cooking. Covering water jars keeps water clean and prevents the spread of disease (e.g., dengue fever by mosquitoes)
Male or female household member in poor health, as reported by respondent	How healthy is each household member? (excellent health, good health, poor health). Primary respondent to questionnaire gives subjective response for all household members.	1 if a male (female) household member is reported in poor health, 0 otherwise
Working-aged (age 15-64), younger (under 6), or older (over 64) household member in poor health, as reported by respondent	How healthy is each house- hold member? (excellent health, good health, poor health). Primary respondent to questionnaire gives subjective response for all household members.	1 if a household member of a given age group is reported in poor health, 0 otherwise

Table C.2. Village leader survey variables

Variable Name	Questionnaire Question	Description
Cost of moto to local health center	How much does it cost to go to [the nearest health center] by moto?	Moto cost to local health center, in USD

Table C.3. Health center survey variables

Variable Name	Questionnaire Question	Description
Total hours health center is open per week	On Monday [Tuesday, Wednesday, etc.], what time did the health center open? What time did the health center close?	Sum of total hours the health center was open during the week of the survey, divided by 100 (for ease of presentation)
Health center quality score	Drug inventory checklist, Equipment checklist, observable hygiene and cleanliness questions	Average of: (a) number of drugs in stock divided by total in list, (b) number of equipment available divided by total in list, and (c) number of negative hygienic practices divided by total number of hygiene questions

Table C.4. Village meeting variables

Variable Name	Questionnaire Question	Description
Km from village to regional hospital	Village meeting: how many kilometers from village to closest (public) regional hospital?	Square root of number of kilometers from village to public regional hospital