Micro Health Insurance in Rural Cambodia:

An evaluation of the impact on the stabilization of incomes and enhancement of agricultural productivity and asset accumulation

Final Evaluation Design

December 31, 2007

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1) Background and Goals of the Evaluation

This report describes the strategy that will be implemented in the evaluation of the SKY Micro Health Insurance program in rural Cambodia. This document is an update to the evaluation design presented in the proposal to BASIS dated January 25th, 2007.

The primary goal of the SKY evaluation is to measure the impacts of SKY on health, utilization, and economic outcomes of its target population. At the household level, health outcomes of interest include primary care utilization, health-seeking behavior, and measured health status. Economic outcomes include families' vulnerability to health shocks due to high medical costs, loss of income while ill or incapacitated, sales of productive assets, and reductions in investments.

We propose to evaluate the health and economic effects of the SKY program on households using a randomized controlled trial. The central methodological tool of the evaluation is randomization of premium levels that will induce random variation in the likelihood of insurance take-up. Randomization allows us to estimate the causal effects of health insurance, as distinct from all other characteristics that vary across insured and non-insured households. A pre-intervention baseline survey of approximately 3,500 households with over 15,000 individuals and follow-up surveys of the same households will be conducted over the 4 year experimental period. The survey will cover the multiple areas that the program aims to influence: health status, health-seeking behavior, asset vulnerability, investment and saving decisions, and risk management. Drawing upon the randomized research design, we can compare the changes in outcomes over time across insured and non-insured households to estimate the causal effect of health insurance.

In addition to identifying and estimating the causal effects of health insurance on several important outcomes, the proposed evaluation will also yield insight into other crucial questions for insurers and policymakers. First, how does household composition affect take-up and effectiveness of health insurance? Key to the SKY program is a social mission of providing insurance to all rural families, regardless of size or income. By examining the demographic, health, and economic characteristics of families who take up insurance at different premium levels, we can estimate how the profiles of the insured change with respect to the premium that is offered. Understanding who is purchasing insurance will give us greater understanding of how well target groups are being reached at a given premium.

Second, how does household composition shape the effectiveness of insurance? For example, households differ in many observable and unobservable ways which affect take-up of health insurance as well as the extent to which insurance influences outcomes. Understanding how household characteristics—in particular, gender and age composition—shape health utilization behavior is a critical element in learning about the effects of health insurance. These questions will be addressed with quantitative household surveys as well as qualitative surveys and interviews.

We will also study the extent to which insurance is attractive largely to the cautious, or to those who expect high medical costs. A major issue that voluntary insurance programs must contend with is when people who self-select to purchase insurance are those who expect to have high claims (known as "adverse selection"). Such self-selection can raise costs and threaten the financial sustainability of socially useful insurance. At the same time, another group of people that may buy health insurance are those who are very risk averse with both their health and their finances. These people may buy insurance to protect themselves financially, but may also be

very healthy. If that is the case, this positive selection may balance out adverse selection and allow an insurance company to pool risks and thus remain financially viable without subsidies.

Examining influences on take up can also help to determine reasons for relatively low take up in some SKY-targeted areas. One concern is that households that could be benefiting from the program are failing to enroll. Some hypothesized reasons for low take up are low trust of public health care institutions (with whom SKY exclusively deals), inconvenience of public health facilities, low predicted utilization of health facilities, low previous experience with large health shocks or expenditures, low predicted health risk, preference for self-insurance methods (loans, savings, etc.), lack of understanding of health insurance, low trust of institutions in general, budget constraints, a high value given to current consumption, and a preference against trying new products. Understanding the causes of low take-up will allow us to draw conclusions regarding whether households that do not buy SKY are making reasonable decisions or if SKY should explore ways to insure these households, and if so, how this can be done. These results should also help inform the business plans of micro-insurance providers in many nations.

Another aim of this study is to examine the effects of the SKY program on health care providers. For example, as SKY expands, is there a measurable effect on health center revenue as households substitute away from private providers to public facilities? Does the quality of service provided at health centers improve as demand increases? Are there significant changes in staff behavior? Improvements in quality would represent interesting and important positive externalities of the program: improvements in health care provision to non-insured households. These questions will be studied using surveys and in-depth interviews of health facility staff, as well as surveys of SKY and non-SKY households.

2) Randomization Procedures

It is not easy to evaluate how health insurance affects peoples' health and economic outcomes. The key obstacle to causal inference is that those who choose to purchase insurance typically differ in many observable and unobservable ways from those who do not. Purchasers of health insurance may, for example, be more cautious in other aspects of their lives, and may therefore enjoy superior health status independent of their access to insurance. Conversely, households that take up may be ones which expect higher than average medical costs in the future. In this case, a simple comparison of the health outcomes of those who do and do not purchase insurance might show that the insured are less healthy—even if the causal effect of insurance were to increase health substantially.

In our preferred research design, we will use a randomized controlled trial to evaluate how health insurance affects individuals and households, avoiding the problems of causal inference in non-experimental data. The key idea is that randomization allows us to identify the impact of health insurance independently from all other factors that may affect a household's decision to take up insurance. Unlike many randomized controlled trials, no household will be denied access to insurance. Rather, by subsidizing the premium of a randomly-selected group of households, we allow for the estimation of the effect of insurance on households without substantially altering the existing structure of the SKY program.

Coupon Randomization

In this section we describe the preferred evaluation research design, which utilizes the randomization of coupons for premium reductions to isolate the impact of health insurance on the outcomes of interest.

In general, SKY insurance is sold in increments of 6-month cycles. Households agree initially to sign up for a six month cycle, paying the first month plus two "reserve" months up front. While a household can stop insurance payments at any time, failing to pay 2 consecutive cycles before the end of the cycle results in the loss of one month of reserve payment. When the SKY program first rolls out into a region, SKY holds a village meeting to describe the insurance product to prospective customers. Village meetings are held periodically after the initial introductory meeting to attract new customers and keep people interested in the product.

The randomized evaluation will be implemented as SKY visits villages to sell insurance. At the end of each meeting, SKY will hold a "Lucky Draw" lottery in which a random subset of households receives coupons for discounts on the insurance premium. SKY originally introduced the Lucky Draw as a marketing technique.

The randomization of premiums will provide a discount to some households. Of households that attend the village meeting, 20% of households, up to a maximum of 12 households per village, will win a coupon for 5-months free insurance in the first 6-month cycle, with the option to renew for a second 6-month cycle with a coupon for 3-months free. It was decided that 20% was the appropriate percentage of coupons to distribute after discussions with GRET in which they indicated that this is the maximum number of coupons reasonable to distribute. A higher amount of coupons would make winning less of a unique prize, and a lower amount of coupons would decrease statistical power. The cap of 12 was established to maintain a manageable sample size per village.

While the initial coupon design called for 5-months free only in the first 6-month cycle, the coupon now also includes 3-months free in the second 6-month period. In this way we hope to keep enrollment high for the large coupon winners, at least until the first follow up survey can be implemented.

The remaining households in attendance at the meeting will be entitled to a coupon for a 1-month discount on insurance, which is the usual policy for the SKY program.

For a detailed description of payment schedules of high coupon winners, see *Appendix A: Coupon Benefits and Rules*.

Details: Village Meeting Procedures

At each meeting, a SKY representative records the name of one representative of each household in attendance. SKY's Field Coordinator introduces SKY in the typical fashion, explaining the product and to what it entitles the buyer.

Also in attendance at each meeting will be an Evaluation Representative, trained by the SEGA/Domrei team. This representative will be fluent in Khmer and will be responsible for ensuring the correct implementation of the Lucky Draw procedures by helping SKY staff and by preparing all necessary lottery materials prior to the Lucky Draw. While the Field Coordinator is explaining SKY, the Evaluation Representative will count the number of households at the village meeting. The Evaluation Representative will then determine the appropriate number of coupons to be available in the Lucky Draw. For example, if 50 households are in attendance, the Evaluation Representative will count out 10 high-valued coupons (20% of the total) and 40 low-valued coupons (80% of the total).

At the end of the meeting, the Field Coordinator announces that there will be a "Lucky Draw" for coupons, and explains to what each coupon entitles the bearer. Next, the names from the attendance list are called off one by one, and attendees come to the front of the room to draw coupons from a bag. Strict measures are taken to ensure that there is no cheating. In addition,

because high and low coupons are clearly distinguishable by their colors, everyone at the village meeting can immediately observe which coupons are received by each participant. The outcome for each draw is recorded next to the person's name on the attendance sheet. For details on meeting procedures, see *Appendix B: Lucky Draw Process at the Village Meeting*.

3) Sampling and Survey Collection

Sampling Design

Our survey sample created from the randomization will consist of 50% coupon winners and 50% non-winners. To create this sample, we interview all coupon winners, and randomly select an equal number of non-winners to interview.

The survey team will interview households between one and six weeks after the village meeting. Since we only want to interview households that have had the opportunity to purchase insurance, we need to make sure insurance agents visit the households we intend to interview. Thus, in practice, we choose who we will be interviewing at the village meeting and ask SKY Insurance Agents (IAs) to visit these households before the 21st of the month. The Evaluation Representative makes up this list of households at the end of each village meeting.

To create the list of non-winners to interview, the Evaluation Representative first counts the number of winners (W) at the meeting. Then, out of the list of non-winners (who entered the Lucky Draw), the Evaluation Representative randomly chooses W to be interviewed. IAs are required to visit all winners plus the W non-winners before the 21st of the month. (Administrative bonuses to IAs depend on the completion of these visits.) Both the IA and the Evaluation Representative keep copies of this list, as well as the master list of attendees.

In addition to the 2W winners and non-winners, around 1-2 attendees that did not join the Lucky Draw will be randomly selected to be interviewed. The IA is not required to visit these households before the 21st of the month. Some households who have bought insurance before the Domrei survey team arrives that were not already selected to be interviewed (these will be low-coupon households) will also be interviewed.

Survey Collection

Following the village meeting, IAs will visit the required households to answer questions about the program, register new customers, and collect premiums. At this time, households can redeem their Lucky Draw coupons. Shortly after the 21st of the month, the IAs will report back to the head office with a list of all households they were able to visit before the 21st and whether or not each of the households bought insurance.

In the one to six weeks following the 21st, the Domrei survey team will collect data from the villages visited that month. Villages will be visited as soon as possible following the 21st of each month. For efficient planning of data collection, villages from two months' worth of meetings will be conducted simultaneously[1]. For example, villages in which meetings were conducted in December and January will both be surveyed beginning January 14. Villages where meetings were conducted in December will be surveyed before the 21st, and villages with January meetings will be surveyed immediately following the 21st.

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[1] Exact survey dates will be modified as we gather new information regarding the most efficient way to gather the relevant information.

From the data from the baseline survey and SKY's records of which households opted to take up insurance, we will be able to answer the questions regarding selection into insurance that are described above. For example, we can learn which household characteristics predict take-up. Furthermore, since the premium is randomly assigned, we can examine how premium affects the baseline characteristics of insured versus non-insured households.

Twelve to thirteen months after each village meeting we will carry out follow-up surveys of all households originally interviewed. Domrei Research and Consulting is experienced in collecting panel data in rural Cambodia and has been successful in maintaining high response rates.

The follow-up survey will contain similar questions to the baseline survey, focusing on changes in health and economic status and utilization of health care services. Traditionally, recall for health shocks is capped at one month for small health expenses. To increase recall for utilization in the 12 months since the initial SKY meeting, we will experiment with distributing log books at the time of the baseline survey. In these log books, which will contain a daily calendar, households will be asked to mark down each time a household member is ill, each time they visit any type of health facility, including traditional healers and drug stores, and the amount they spend on drugs and health care for each visit.

In addition to the basic modules, SKY members will be administered an additional module in the follow-up survey, including questions about their experience with the SKY program. Using the follow-up and the baseline data, we can learn how SKY affects health-seeking behavior and health care utilization, as well as how health insurance affects economic outcomes, such as out-of-pocket expenditures. A second follow-up a year later will repeat most of the same topics, again emphasizing changes in health outcomes and expenditures[2].

4) Targeted Regions

SKY will be holding village meetings in several regions over the course of the thirteen months from November 2007 to December 2008 (the period during which the baseline survey will be administered). At the end of November, SKY began visiting two new districts: Koh Thom (in Kandal province) and Kompot (in Kompot province) and began revisiting one district they have visited in previous years: Ang Roka (in Takeo Province). Sometime between April and July, SKY will begin its roll out to two new districts in Takeo province: Donkeo and Kirivong.[3]

The goal of the evaluation is to measure the impact of SKY in areas where it would typically be offered. We chose which regions to evaluate taking into account two factors: 1) Quality of health facility: SKY partners with public facilities, and typically only contracts with facilities that are over a minimum standard of quality; and 2) Variation in region: Rather than interview households in just one province, a more representative evaluation can be obtained by visiting households in several provinces.

The bulk of the sample will be located in new SKY areas in Takeo province. To increase sample size, and to get a more representative sample, we will also visit several other regions. Some of these regions will have slightly lower facility quality than areas in the planned Takeo expansion; others are regions in Takeo where SKY has been present before. With this in mind, we chose the following regions to target for the evaluation (see Table 1)[4].

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[2] We will assess after the first year whether to continue with the current plan or focus more on the qualitative aspect of the evaluation. Note that any additional data collected in a second follow-up survey will add to statistical power.
[3] See *Appendix C: Cambodia Map with Provincial Boundaries.*
[4] Targeted regions and distribution of households across regions are both subject to change.

Table 1: Targeted Regions

	Total Meetings Held Nov '07 - Dec '08	Total Lucky Draws	% of Villages Surveyed
Takeo Province Total	**128**	**128**	**73%**
Ang Roka villages (older villages)	32	32	18%
Kirivong villages	48	48	27%
Donkeo villages	48	48	27%
Kandal Province Total	**74**	**24**	**14%**
Koh Thom villages	74	24	14%
Kampot Province Total	**50**	**24**	**14%**
Kampot villages	50	24	14%
All Villages	**283**	**176**	**100%**

Table 1 shows an approximation of the distribution of the targeted sample across regions. The column entitled "Total Meetings Held" indicates the number of village meetings SKY plans to hold in each district or province and "Total Lucky Draws" indicates an approximate number of Lucky Draws held in the given district. The final column, "% of Villages Surveyed", indicates the approximate percentage of the sample that will come from each area[5]. Note that we do not hold Lucky Draws at every village meeting, and that we only survey villages in which we hold a Lucky Draw.

5) Pilot Study, Additional Data, and Power

Pilot Results

In January and February of 2007, SKY implemented a pilot test of the coupon design. The purpose of this pilot was to investigate whether offering large coupons was a feasible way to increase take-up of insurance, and if so, how much we could expect take-up to increase. We were also able to work out some kinks in the design of both the coupons and the Lucky Draw process.

SKY implemented the Lucky Draw process in 34 meetings in January and February. On average, 55 households attended each village meeting. Of those, 41 on average participated in the Lucky Draw.

In the January and February meetings, 20% of households participating in the Lucky Draw received a coupon for 5-months free insurance. Another 20% received a coupon for 3-months free. The remaining 60% of the households received a coupon for one month of free insurance. In total, take-up by 1-month coupon winners was approximately 6%, as compared to take-up by 5-month winners of 40%. 3-month coupon winners did not increase take-up enough for an impact evaluation, so we decided to eliminate the 3-month option from future Lucky Draw meetings. Detailed results of take-up are presented in columns A through C of Table 2, below.

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[5] Number of targeted villages and lucky draw meetings are approximate. Plans will inevitably change according to SKY's roll-out schedule and logistical concerns.

Table 2: Coupon Take-up and Drop-out

	Coupons Offered [A]	Bought SKY [B]	% Take-up [C]	Percent dropped on or before month 7 [D]	Percent dropped on or before month X* [E]
January					*X=10*
1-month coupons	358	26	7%	27%	46%
3-month coupons	166	31	19%	16%	45%
5-month coupons	182	75	41%	1%	35%
February (Renewal Coupons Offered to Winners)					*X=9*
1-month coupons	390	20	5%	65%	75%
3-month coupons	140	20	14%	20%	50%
5-month coupons	143	55	38%	16%	36%
Both Months					*X=9*
1-month coupons	748	46	6%	43%	52%
3-month coupons	306	51	17%	18%	47%
5-month coupons	325	130	40%	8%	28%

* Note that drop-out data is only available for February through month 9.

February and combined drop-out data thus stops at month 9.

Because follow-up surveys will take place 12 months after the initial Lucky Draw meeting, low drop out among high coupon winners is as important for our evaluation as high take-up, since it allows us to maintain a high level of differentiation in insurance status between the low and high coupon groups. In addition, an important GRET concern was that households that initially received a high coupon would be unwilling to pay for SKY once they no longer had a coupon. Observing drop-out relative to low coupon holders allows us to gauge whether this will be a problem.

Table 2 reports drop-out at two points during the months since the Lucky Draw meeting. Column D reports drop-out up to and including the seventh month, the effective end of the first SKY cycle.[6] Drop out for 5-month coupon holders is very low up to this point. There is no indication at this point of higher drop-out among high coupon winners.

Drop out increases when we look at Column E, our most recent statistics for drop-out. For January we have data up to the tenth month after the initial Lucky Draw. By the tenth month, drop out jumped to 35% for 5-month coupon winners, but is still below the drop-out rate for 1-month households, which stands at 45%.

For the February households, we experimented with offering renewal coupons to households who had originally been recipients of the 5-month coupon. Coupons for 3-months off of the second six-month cycle were offered to these households at the end of the first SKY cycle. The intention was to decrease drop-out among these households relative to the 1-month households, encouraging coupon winners to stay ensured for a full second six-month cycle.

The results are shown in column E of the table above. Drop-out for 5-month households in February is similar to that in January households, at 36%, which would lead one to believe that the renewal coupons did not work. However, comparing winners to non-winners within

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[6] Note that the 7th month was free for 5-month winners due to an existing SKY rule providing a free month to those pre-paying for six months. All 5-month coupon holders paid one month up front and thus were considered to have pre-paid 6 months. In the actual study, pre-payment using a coupon will not count towards a free month.

February villages, 5-month household dropout (36%) is not nearly as high as drop out for 1-month coupon households, which is at 75%. Thus, while the renewal coupons did not work as well as we had hoped, it is possible that they kept drop out among the 5-month group from obtaining the high level exhibited by both the 1-month and 3-month groups.

Overall, we were able to allay GRET's fears that high coupon holders would drop once they were forced to pay higher prices. In fact it is a pleasant surprise to see that high coupon holders actually had *lower* drop out than low coupon holders, a result that we will explore if it persists in the main study.

Insurance Agent Interviews

In August 2007 all SKY insurance agents (IAs) and member facilitators were interviewed to learn more about the process of selling insurance, and to elicit opinions of the Lucky Draw process. Questions were asked regarding how households are targeted for SKY membership, major reasons cited for drop out, the type of people who join SKY, and the Lucky Draw procedures.

From this qualitative survey we took home many lessons that have influenced the way the randomization and Lucky Draw process will be implemented. For example, we learned that some IAs do not visit all households that attend the village meeting. Instead, they focus on households that have already expressed interest in SKY, and on households that won a large coupon for insurance. Thus, since all households are not visited before the SKY enrollment deadline of the 21st of the month, we had to implement a policy requiring IAs to visit a certain random group of households that would later be included in our survey sample. Giving each household an equal opportunity to sign up for SKY is necessary to get unbiased results for both the selection and impact study.

We also learned that adverse selection is potentially a major issue for SKY: IAs often target households that they know to have a sick household member, and IAs and member facilitators often sell insurance at the health center, since it easier to convince sick people to join SKY. In addition, SKY members often drop insurance if they did not get sick in the previous cycle, thus increasing selection over time. A high amount of selection into insurance emphasizes the need for a randomized evaluation, since a non-random evaluation would entail comparing buyers and non-buyers and will lead to highly biased results. If some selection can be limited by requiring that IAs not discriminate in their offers to households interviewed in the surveys, the possibility of a non-randomized analysis becomes more plausible.

Finally, the IAs gave positive feedback regarding the Lucky Draw process. Most IAs stated that the large coupons make it easier to recruit new SKY members, and they allow households to try insurance even if they have some distrust of the program. On the other hand, some IAs felt that the high coupons would create a disincentive to pay normal premiums once the large coupons had expired. Drop-out results do not substantiate this fear.

Qualitative Household Interviews

In November 2007 the survey team interviewed nine SKY and non-SKY households from villages that had participated in the January and February 2007 Lucky Draw meetings. The results of these surveys inform the quantitative survey and the evaluation methodology. We supplemented these interviews with a number of informal conversations with both rural Cambodians and those familiar with Cambodian health and health care practices.

The most important result of the formal interviews was the lack of complaints from Pilot Village households regarding the Lucky Draws. Thus we have confidence that the Lucky Draw is not causing distress among current and potential SKY members.

The most important result for the quantitative survey concerned how households deal with large health expenses in the absence of health insurance: When a family member has a large medical bill, they need access to money quickly, since most doctors do not provide credit. Even if a micro-credit lender is locally available, they may not be available to lend money, either because they do not provide loans for health care, or because it is the wrong time in the loan cycle.

Thus, families will often borrow from a local lender, who is more convenient and offers flexible terms, but also charges very high interest rates. Families will try to service this debt by finding additional work or borrowing from relatives. They will often spend years paying high interest rates on these loans without significantly decreasing the principal, and will sometimes sell smaller assets to try to pay down these loans.

Finally, when other asset sales will not cover the loan and all other options have been exhausted, they will try to find a buyer for family land.

The ways in which a typical rural Cambodian household deals with health shocks has implications for measurement of SKY's economic impacts. Specifically, to capture the effect of health shocks on the family we must be able capture change in both assets and debt. As people commonly borrow from one lender to repay another (loan shopping) and combine loan purposes, we must be careful not to lose health-related debt due to a switch in lenders or the rolling over of a previous debt into a new loan for another purpose.

At the same time, not all families will match this model. Families with significant financial savings or rich relatives may show no changes in productive assets or in debts, so changes in savings will be the best way to measure the economic impact of SKY for these families. Asset-poor families will not go to an expensive health provider in the first place. For these families the likely outcomes of an uninsured large health shock are mortality and disability, so we must capture impacts on these outcomes as well.

As an additional way to measure the economic impacts of SKY, we will use recall data that elicits methods of paying for major health shocks.

Qualitative research with GRET

We have also had multiple interviews and conversations with GRET/SKY staff to determine which measures they believe SKY can impact. SKY believes that by providing a steady source of funding to public health centers, SKY helps improve the quality of public health facilities. Through this improvement, and via decreased per-visit cost of care, utilization of public health facilities can increase for both treatment and preventative care. Increased utilization of public health facilities can increase health status, while lower expenses for health care can decrease health related and overall debt and increase liquid assets. We are using these expected impacts to inform our surveys.

We have also been looking at results of previous quantitative surveys to determine which measures we will have the statistical power to study. For example, while some sources indicate that immunization rates are high, recent Domrei household surveys using evidence from households' written immunization records have shown that immunization rates are not as high as previously thought. By increasing public facility visits, and thus increasing exposure to public health campaign messages, SKY believes they have the potential to impact immunization rates.

Power Calculations

The pilot tests administered in January and February allowed us to update our expectations of statistical power for the impact evaluation of SKY. Table 3 and Table 4 list the assumptions used to calculate statistical power and the corresponding minimum detectable effect sizes of some sample outcome variables. Note that these outcome variables are representative of the type we will measure in the actual survey, but are not the precise outcome measures we will use. Choice of outcome measure to use in power calculations was guided by the availability of data from which to make assumptions of baseline means.

Table 3: Assumptions for Power Calculations

Parameter	Assumed values
Takeup: small coupon	6%
Takeup: large coupon	40%
Dropout @ six months, small coupons	52%
Dropout @ six months, large coupons	28%
Members per household	5
Intra-household correlation in outcomes	0.1
Sample Size: large and small coupon winners interviewed	1500

Table 4: Power Calculations

Indicator	Initial mean assumption	Minimum detectable effect (treatment effect on the treated)	MDE (average treatment effect)
	[1]	[2]	[3]
% of individuals using a public health facility in the last 4 weeks	5.14%	2.48pp	0.84pp
% of individuals ill last 4 weeks	20.17	-4.28	-1.45
% of individuals with expenditure over 5000 riel in last 4 weeks	10.12	-3.18	-1.08
% households with at least one member using a public facility in last 4 weeks	21.07	16.42	5.58
% households with at least one member reporting ill in last 4 weeks	70.92	-17.99	-6.12
% of households with out of pocket expenditure over 52,000 riel in the past 4 weeks	10.00	-10.58	-3.60
% of individuals using a public health facility in the last 12 months	20.90	12.54	4.26

Source of initial mean estimates:
Survey of contracted districts in Takeo, 2005, except 12-month data which is from the Vietnam Health and Living Standards Survey, 2004.

Column [1] of Table 4 shows our assumption of the baseline level of the given outcome variable. In our calculations we assume that people who don't buy insurance maintain this level of the given outcome measure on average. Column [2] shows the amount that this baseline level needs to change in high-coupon households that buy insurance in order for our evaluation to detect a significant impact. Column [3] shows the corresponding minimum detectable difference

between the average outcome of high and low coupon groups that can be measured with the given sample size and assumptions.[7]

For example, the first row shows the minimum detectable impact for household members utilizing a public facility in the last 4 weeks. We assume that 5.14% of all individuals have recently visited a public health facility at baseline. After purchasing insurance, some households may increase their utilization of public facilities. We will be able to detect this change if individuals in households that purchase insurance increase utilization by 2.48 percentage points (column [2]), that is, these individuals must increase utilization so that 7.62% of individuals have visited a public facility in the last 4 weeks by the time of the follow-up survey. When we compare the average utilization of households that receive a large coupon to those that did not, we will be able to detect an increase if individuals in households that received a large coupon have utilization that is 0.84 percentage points higher than households that received a small coupon. That is, 5.98% of individuals in households with large coupons (who are more likely to have bought insurance) will have to have utilized a public facility in the last 4 weeks in order to measure an increase from the control assumption of 5.14%.

According to these calculations, we should be able to capture changes in utilization given our sample size and drop out assumptions. In other words, it is reasonable to expect that the percent of individuals visiting a public health facility in a given four week period will increase from 5.14% to 7.62% due to insurance purchase, and that it will increase from 20.9% to 33.4% for utilization in a 12 month period. Also, it is reasonable to expect that SKY can cause a decrease in the percentage of individuals spending more than 5000 riel on health care in the past 4 weeks from 10.12% to 6.94%. Impacts at the household level will be harder to measure, as will impacts on health levels, which will take a longer time to impact.

Conclusions from Pilot Activities

The pilot tests and qualitative surveys indicate that the Lucky Draw can be successfully implemented, and that the planned coupon randomization scheme has a good chance of succeeding in providing us with a valid control group to use for an impact evaluation of the SKY program. Take-up of insurance is quite a bit higher in the high coupon group than the low coupon group. Drop out is high in both the low and high coupon groups, but is a good deal higher in the low coupon group. Both of these facts bode well for statistical power.

The qualitative surveys of insurance agents have allowed us to hone our Lucky Draw survey design to fit in well with the current SKY implementation. In addition, IAs and member facilitators are happy with the Lucky Draw process, and a small-scale qualitative survey did not elicit any complaints from households from the pilot villages. Qualitative interviews taught us lessons for the quantitative survey. Importantly, the interviews also indicated the possibility of substantial self-selection selection into the SKY program, meaning that a randomized evaluation is highly preferable to a non-randomized design.

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[7] Note that for 12 month recall data at the time of the second survey, the calculation assumes that a person is counted as a SKY member if they had SKY at any time before the time of the first follow-up survey. Thus, any SKY impact will need to have happened within the months that households were SKY members.

6) Threats to Design and Alternatives to Randomization

Our primary study design will be the randomized controlled trial. At the same time, this analysis has low levels of statistical power for some outcomes (e.g., health). Furthermore, problems that further reduce statistical power are always a possibility.

Potential Issues with Randomized Intervention Design

- **Low uptake and/or high dropout in high-value coupon group**

Low take-up and/or high dropout in the high-value coupon group are the most likely problems we will face. To spot such a challenge quickly, we will monitor how well the coupons increase uptake each month. We will also monitor the average 6-month and 12-month renewal rates of coupon holders regularly.

Our first response to low take-up or high dropout will be to explore reasons for the low effectiveness of high coupons. We will then adjust the intervention to increase uptake and renewal in an attempt to restore statistical power. Among the margins we may adjust are marketing interventions that accompany the coupon, coupon value, coupon duration, and the share of Lucky Draw meeting attendees who receive the coupon.

- **Noisy measures of outcome variables**

Many outcome variables of interest in this study are likely to be inexactly measured. In addition to putting a great deal of effort into carefully designing our measures of health expenditures, to limit measurement error, we will re-interview all cases of high health care expenditures where the respondents did not also report corresponding symptoms and health care activity. We will also re-interview 100% of respondents with the very highest heath care expenditures. We will also re-interview cases with very large changes in asset values. Most of these re-interviews will be performed by field editors and field supervisors a few hours after the first interview.

Alternatives to Randomized Evaluation

Regardless of statistical power, before the first follow-up we will have analyzed the self-selection of those who purchase SKY insurance. Most importantly we will look at how baseline health status (H_{hv0}) of household h in village v at the baseline (0) predicts initial uptake. Our measures of baseline heath will include current health (both self-reports and measures of malnutrition such as stunting and wasting) of specific members of the household (for example, the household head, the sickest member of the family or the youngest child), average current health of the household or health of certain members of the household (children, for example), past health expenditures and health care utilization, and expectations of future health problems.

To test for self-selection in uptake of insurance, we will estimate SKY uptake as a function of baseline health measures (H_{ih0}) as well as household characteristics such as coupon value, education, and wealth (X_{hv0}), and community characteristics (***village***$_v$). We will include the complete set of month dummies (***month***$_t$) because the roll-out occurs over several months; in this regression the 0 subscript refers to baseline values:

(1) $SKY_{hv0} = F(\Sigma_j \, \beta_j \, X_{jh0} + \Sigma_i \, \delta_i \, H_{ih0} + \Sigma_t \, \mu_t \, month_t + \, \Sigma \, \alpha_v \, village_v)$

Here F(.) corresponds to a probit, logit or linear probability model. We will model the village effects using multiple functional forms such as the conditional logit, random effects probit, conditioning on the village mean SKY membership in a logit, including fixed effects in the nonlinear models, and including fixed effects in the linear probability model. We will cluster all estimates by village and use estimators robust to heteroskedasticity.[8]

It may be that we find only modest levels of self-selection on our baseline health measures (after conditioning on other observable factors such as demographics and education). In that case, we can use non-experimental methods to analyze how SKY members differ from their neighbors who do not purchase SKY. For example, we can run the standard regression (using OLS or probit) testing how well SKY insurance coverage (SKY_{hvt}) predicts household outcomes (Y_{hvt}) such as sales of productive assets:

$$(2) \ \ Y_{hvt} = F(\gamma \ SKY_{hvt} + \Sigma_j \ \beta_j \ X_{jhvt} + \Sigma_i \ \delta_i \ H_{iht} + \Sigma_t \ m_t \ month_t + \ \Sigma_v \ \alpha_v \ village_v \ )$$

A similar regression will examine individual-level health outcomes with additional individual-level controls such as age and sex interactions, education, and baseline health.

While no single test of "importance" exists, the basic test is to see if the estimated effects of SKY insurance (γ in equation 2) changes substantially when we do not condition on the baseline health measures. Intuitively, if the observed health-related factors are not very important in affecting both self-selection into SKY and later outcomes, we are reassured that *unobserved* health-related selection factors also do not affect SKY membership enough to bias the causal effects of SKY insurance on outcomes estimated in equation 2.

We will also use a propensity score estimator that achieves the same goals as equation 2 with weaker assumptions about functional form. This estimator matches each SKY member with one or more nonmembers having a similar predicted probability of SKY coverage (as estimated in equation 1). We can then compare outcomes Y_{hvt} of SKY members and matched nonmembers.

We can also create a matched sample using predicted SKY membership from an estimate of equation 1 that does not include the observable baseline health measures. If the two matched estimates are similar, then there is not self-selection based on observable baseline health that also affects later outcomes.

Conversely, if these observed health-related selection factors are modestly important in determining self-selection into SKY, we will remain concerned that *unobserved* health characteristics also affect both SKY membership and later health. If the degree of observed self-selection is modest, we will use the method of Altonji, et al., to estimate how self-selection based on unobservable factors affects SKY membership and, thus, outcomes.[9] Their method assumes that observed and unobserved characteristics that are equally important in determining SKY membership are also equally correlated with the outcomes (Y). With that strong assumption, and

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[8] We will perform a similar analysis for other factors that affect self-selection, ranging from attitudes towards risk and confidence in western medicine to wealth and distance from the local clinic. We will also perform similar analyses of SKY renewal, looking for self-selection based on baseline characteristics. We emphasize how baseline health may affect initial SKY uptake because that relationship is the most likely to lead to important biases.

We will also explore if there are factors such as distance to the private clinic that affect SKY uptake but are plausibly not related to future health outcomes and asset sales. If we can find such a variable, we will use it along with coupon value to instrument for SKY membership. Such additional instrumental variables should increase the statistical power of the analysis, at the expense of extra assumptions not required by the experiment.

[9] "Selection on Observed and Unobserved Variables: Assessing the Effectiveness of Catholic Schools," J. Altonji, T. Elder, and C. Taber. *Journal of Political Economy*, Vol. 113, February 2005.

a few less controversial ones, we can create an upper-bound estimate of the causal effect of SKY membership on health, asset sales, and other outcomes.

At the same time, it may be that the observed baseline health measures are strongly important in determining self-selection into SKY. For example, we may find that with no controls for baseline health, SKY membership predicts statistically significantly *poorer* health in follow-up surveys, but the relationship disappears or is reversed when we condition on (or match on) the observed baseline health measures. In that case, no non-experimental method will permit us to be confident we can measure the causal impact of SKY on outcomes. If, at the same time, the randomized coupon intervention will not achieve sufficient statistical power, we will not be able to estimate a credible impact of SKY on the outcomes.

If we find that baseline health characteristics very strongly influence selection into SKY, a rigorous impact evaluation will not be possible without randomization. But this does not preclude our ability to draw important policy lessons from the project. That is, if SKY is purchased very disproportionately by those with poor health and high future health care expenditures, voluntary private insurance such as SKY cannot be financially sustainable.

Assuming the goal of SKY is to be a financially sustainable insurance program, the policy implication would be clear:

- o Do not grow SKY or related micro-health insurance unless and until a solution for adverse selection is found; and
- o Continue to explore some combination of:
  - ▪ Voluntary private health insurance, with an emphasis on addressing adverse selection and/or
  - ▪ Alternatives to voluntary private health insurance such as those found in well-functioning health systems within the OECD (e.g., mandatory private insurance, universal public insurance, or universal public sector coverage).

On the other hand, if an alternative goal of SKY is to be an efficient way of providing a subsidy to unhealthy households, the evaluation can be used to measure how well this goal is being obtained. For example, we can show whether the unhealthiest households are being targeted, and use the baseline and follow up surveys to make estimates of whether and how much SKY decreases the amount of untreated medical care for these families. Thus, instead of finding that SKY can become a financially sustainable insurance policy, we may find instead that it is a relatively inexpensive way to provide a needed subsidy to the poor.

7) Updates to the Qualitative Evaluation Design

Plans for clinic surveys and surveys of village leaders remain similar to that described in the original proposal to BASIS. However, since that proposal, the details of the qualitative household surveys have been further developed. These plans are described here.

Village Monographs

In addition to the panel data on SKY and non-SKY households produced by the quantitative surveys, we will also be interviewing households using more in-depth qualitative questionnaires. Qualitative research is based on a small number of observations, and these observations are purposely selected so that the research can describe the widest variety of situations, irrespective of their relative frequencies. The qualitative surveys can help us to get a more focused picture on

the impact of SKY by allowing us analyze more deeply why households exhibit the behaviors measured by the quantitative survey.

We assume that community dynamics play an important role in the decision to join or drop out of SKY. For this reason we will conduct the qualitative research in a small number of villages.

The village monographs have three purposes:
1. Investigate evaluation design assumptions (2007)
2. Observe the dynamics of SKY membership over time (2007-2011)
3. Test evaluation instruments (e.g. scenarios to measure discount rates and risk aversion, survey questionnaires).

Domrei researchers will collect information in six villages that have already been exposed to SKY, including two villages in Kandal, where SKY has been present the longest.

Table 5: Qualitative Villages Targeted

Province	Takeo	Kandal	Total
Current SKY villages	2	2	4
Future SKY villages	2	0	2
Total number of monographs	**4**	**2**	**6**

The research team will start by drawing detailed village maps on which they locate all the households. Researchers will interview all past and present SKY members in the village, ten non-members, and all the health care providers in and around the villages – both public (covered by SKY) and private sector[10].

The same researchers will return regularly to the four Takeo villages to document changes in membership, attitudes and health seeking behavior (2008-2010). Instruments can be tested in the Kandal villages.

Monograph Objectives for 2008
- o To describe the history of SKY in these communities
  - ▪ How was SKY perceived at first? Who joined first? Why?
  - ▪ How did perceptions of SKY change over time? Who joined next? Who dropped out? Why?
  - ▪ What kind of village-level dynamics around SKY (for example, social learning and shifts in norms), health issues, healthcare, etc. did people observe? How did these dynamics change over time?
- o To profile past and current SKY members (socio-economic status, literacy and education, health status): Are SKY members wealthier than non-members? What are the obstacles to joining/renewing membership?
- o To better understand decision making processes of (joining SKY, dropping out of SKY, health seeking behaviors)
  - ▪ How do people assess health risk?
  - ▪ What are people's current assessments of SKY, of the SKY health providers?
  - ▪ Have health seeking behaviors changed since SKY arrived in the village? Are more people going to the public health center? Have they noticed

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[10] Note that SKY insurance agents were interviewed in a separate survey described above.

improvements in the quality of care at the health center? Are they more demanding in terms of quality of care?

- ▪ To investigate the impact of SKY on health providers in and around the village

Instruments will include a structured socio-economic module and a list of open ended questions. Researchers will probe the respondent to avoid vague and un-informative answers. Interviews will be recorded with the informants' authorization. The researchers will write up their detailed notes (in Khmer) immediately after the interview. Before leaving the village, they will compile their findings into a detailed village report, in Khmer, using a pre-defined template. Detailed notes and the most informative interview notes will be translated into English at Domrei, double-checked and completed by the researchers, checked by the PI, and shared with the SEGA team. The Domrei team will then draft the research report based on the six village monographs.

Domrei will report findings as they are produced. Findings will be shared electronically as research notes, discussed at steering committee meetings and compiled as a self-contained report once a year. In the first year, priority will be given to topics that inform the evaluation design.

Appendices

Appendix A: Coupon Benefits and Rules

This appendix describes the benefits for winners of a large coupon, and compares the payment plan to that of non-winners.

Large coupon benefits:
- Pays for 5 months of the first 6-month cycle (2 months reserve, 3 months premium)
- Pays for 3 months of the second 6-month cycle
- At renewal time (Month 7), clients must have 2 reserves and make 1 payment to benefit from Cycle 2 coupons.
- Unlike non-winners, coupon winners do not receive an extra month free or a free T-shirt for 6-month pre-payment of the first 2 SEGA coupon cycles
- Families are allowed to switch to SKY2 in second cycle in some cases (in line with current procedures), but coupons are not valid for SKY2 product. SKY2 covers only hospitalization, but not clinic visits, and costs somewhat less than regular SKY.
- Coupon's value is determined by the family size during the cycle the coupon is used.
    - Clients are responsible for/are credited for changes in reserve due to family size changes between Cycles 1 and 2.

Payment Schedule for Large Coupon Winners:
- **Cycle 1 (M1-M6):** *Five months free - Winners pay one month's worth of premium when they sign up and next pay in months 5 and 6*
    - Two months of coupon go to reserve.
    - Three months of coupon go towards months 1, 2 and 3.
    - One month of premium is paid by individual up front (so that they have to pay something to join) and is recorded as an advance payment for Month 4.
    - Clients pay for Months 5 and 6 out of pocket.

- **Cycle 2 (M7-M12):** *Three months free - Winners pay one month's worth of premium when they renew and next pay in months 11 and 12*
    - The three months of coupon go towards months 7, 8 and 9.
    - In order to renew, individual must make a payment in Month 7. Payment is recorded as an advance payment for Month 10.
    - Clients pay for months 11 and 12 out of pocket.
    - Reserve payments remain from previous cycle.
        - If clients do not have 2 reserves remaining and pay for only one month at renewal time (without replenishing reserves), they will lose their Cycle 2 coupons.

Notes on Dropout:
- It is impossible for high-coupon winners to drop out "In-Cycle" (within a given 6-month contract period) because the first months during which payment is required (Month 4 and Month 7) are pre-paid and clients can use reserves in the last two payment months (Months 5 & 6 and Months 11 & 12) and remain covered.
- "Out-of-Cycle" dropout is possible between Cycles 1 and 2.

Table of Payment Schedule
(Standard Schedule of Regular Payment without Use of Reserves)

Note: C = Covered by Coupon. Even non-winners receive a coupon that covers one month of the required reserves.

The SKY System Will Record

WINNERS													
Month	Reserve Reserve	1	2	3	4	5	6	7	8	9	10	11	12
Payment	C C	C	C	C	*Pre-Paid in M1*	Pay	Pay	C	C	C	*Pre-Paid in M1*	Pay	Pay
OTHERS													
Month	Reserve Reserve	1	2	3	4	5	6	7	8	9	10	11	12
Payment	C Pay	Pay	Pay	Pay	Pay	Pay	Pay	Pay	Pay	Pay	Pay	Pay	Pay

The Individual Will Make Payments in the Following Months

WINNERS													
Month	Reserve Reserve	1	2	3	4	5	6	7	8	9	10	11	12
Payment	No Reserve Paid	Pay	No Pay	No Pay	No Pay	Pay	Pay	Pay	No Pay	No Pay	No Pay	Pay	Pay
OTHERS													
Month	Reserve Reserve	1	2	3	4	5	6	7	8	9	10	11	12
Payment	Pay 1 Reserve	Pay	Pay	Pay	Pay	Pay	Pay	Pay	Pay	Pay	Pay	Pay	Pay

Appendix B: Lucky Draw Process at the Village Meeting

This appendix describes the details of the December 2007 implementation of the Lucky Draw process.

1. Attendance is taken at the beginning of the meeting.
    a. Attendance taken at the family, not individual, level
    b. Throughout the meeting, Domrei staff record names of people who come late to the meeting.
2. Music videos are played over loudspeaker as people trickle in and the meeting is announced over loudspeakers by Field Coordinator and/or Village Chief.
3. SKY video is played as the meeting begins
4. The SKY Field Coordinator talks about SKY
5. While Field Coordinator is conducting meeting, Domrei staff count out the number of high and low coupons.
    a. The number of high coupons is equal to 20% of attendees for meetings of fewer than 60 people and equal to 12 for meetings of more than 60 people.
6. A question and answer session is held. Each attendee volunteering to answer a question about SKY receives a small bottle of shampoo when they answer (total of 5 bottles provided per meeting)
7. Lucky Draw begins
    a. Field Coordinator announces that the prize is a large coupon for insurance
    b. Brief explanation of: 1) the value of the coupons and 2) the fact that you can't trade them with others
    c. Family names are called off one by one from the roster. When a name is called off, participants pick a coupon out of a bag. Care is taken to make sure people can't see coupons as they are drawing.
    d. Coupons are colored, so everyone can see what color coupon is drawn.
    e. Domrei staff record what coupon they got as they draw
8. After the village meeting is over, Domrei staff randomly select low-coupon families IA's are required to visit in addition to the high-coupon families; the number of low-coupon families is equal to the number of winners. Domrei staff mark their names on the roster.
    a. These high and low coupon families are in the household survey sample.
9. Domrei staff map the village with the village chief. Included in the map are: a) location of any private doctors, traditional healers and pharmacists and b) location of families IA's are required to visit (that is, all the high-value coupon winners plus the low-value coupon winners that will also be surveyed).
10. IA's are given copies of village maps and the meeting roster with a list of households to visit.

Appendix C: Cambodia Map with Provincial Boundaries

Source: WHO, http://www.who.int/sysmedia/pdf/countries/khm.pdf, downloaded Nov. 25, 2007.