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Informal Groups and Health Insurance Take-up Evidence from a Field Experiment

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SUMMARY

This paper presents the results of 20 randomized experiments aimed at understanding the low take-up of in-patient health insurance observed in developing countries. Take-up does not increase when participants receive information about the product, or an assistance to register, or small subsidies of 2, 10, or 30%. Take-up does not increase when the same information is provided by local respected community leaders, when participants are offered an in-kind gift (a chicken) if they register, when participants are offered the possibility to contribute lower and more frequent payments, or the possibility to pay by cellphone. A full subsidy generates a mere 45% take-up (with no retention after one year). In contrast to these low take-up rates, presenting the same information without any subsidies to existing informal groups raises take-up to 12% (still 7% after one year), as well as trust and knowledge of the product. Social networks play a major role in the adoption of health insurance. This paper provides a cost-effective way to increase take-up of health insurance, while subsidies are found to be largely ineffective at raising take-up in the long run.

1. Introduction

Recent randomized experiments in developing countries have shown that health insurance presents numerous benefits. Health insurance reduces catastrophic health expenditures (Baicker *et al.*, 2013; King *et al.*, 2009) and out of pocket payments (Finkelstein *et al.*, 2012; King *et al.*, 2009; Powell-Jackson, Hanson, Whitty, & Ansah, 2014), it increases utilization of health services (Asuming, 2013; Manning *et al.*, 1988; Powell-Jackson *et al.*, 2014), it improves health (Asuming, 2013; Baicker *et al.*, 2013; Powell-Jackson *et al.*, 2014) and well-being (Finkelstein *et al.*, 2012).

Yet, demand for health insurance is very low. For example, when existing microfinance clients were required to purchase health insurance at the time of renewing their loan, a large fraction of borrowers preferred to give up microfinance in order to avoid purchasing health insurance (Banerjee, Duflo, & Hornbeck, 2014). The low demand for health insurance, despite its numerous benefits, raises a significant puzzle.

In this paper, together with the main health insurance provider in Kenya, the National Hospital Insurance Fund (NHIF), we implemented 20 randomized experiments to determine how to increase health insurance coverage among the poor. We present the results from two complementary studies, where the debriefing from the failure of traditional interventions in Study 1 is used to design an innovative intervention in Study 2.

In Study 1 implemented in 2011, we followed the existing literature (Asuming, 2013; Das & Leino, 2011; Dercon, Gunning, & Zeitlin, 2011; and Thornton *et al.*, 2010) and offered: information about NHIF, assistance to register, and subsidies of 2, 10, or 30%. We also offered in other treatment groups the possibility to pay lower but more frequent payments, the possibility to pay by mobile money (M-Pesa), or protection from fines in case of default of payment of insurance premiums. Each intervention was offered to separate sub-groups randomly selected out of our sample of 1,803 small-scale farmers living at the poverty line in rural Kenya.

We find no significant effect of any of those interventions on take-up, even when the interventions were delivered by local community leaders, for whom we purchased NHIF, and who were financially motivated, or not, to register people. These findings are consistent with the existing literature, which has found mixed results about these interventions. Specifically, delivering information about insurance has been found to have a positive (Asuming, 2013), null (Dercon *et al.*, 2011), or negative (Das & Leino, 2011; Thornton *et al.*, 2010) effect on take-up, while offering assistance to register has been found to have a positive (Thornton *et al.*, 2010) or null (Asuming, 2013) effect on take-up.

In line with the existing literature, we also find that large subsidies significantly increase take-up. A 100% subsidy generates a 45% take-up. Yet surprisingly, take-up is not 100%: 55% of the sample turn down free health insurance. Moreover, the retention rate

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is close to zero once the subsidies are discontinued. Overall, these findings indicate that more fundamental factors beyond lack of information, transaction costs, or the price of coverage, are influencing the poor take-up rate of health insurance.

We then depart from the existing literature by providing an innovative new intervention informed by qualitative evidence gathered after the failure of these traditional interventions. Debriefing with individuals who chose not to take up health insurance even when it was free revealed a lack of trust, and poor understanding of the product. Our respondents described insurance as a "risky proposition": if the insured event does not occur, they would not get any money back, and if the insured event does occur, they were not sure whether the NHIF will cover their claims. In this context of uncertainty, even if the product is free, any remaining transaction costs may outweigh unclear benefits.

The intuition of Study 2 is that close friends may explain the system better, and even share their experience if they have tested the system before (i.e., made a claim and were reimbursed), in meetings where the NHIF product is discussed. In this regard, these friends could offer reassurance about the reliability of health insurance. An ideal forum for this to take place may be the existing tight-knit informal groups, a widespread phenomenon in developing countries.[1] These groups meet regularly with a system of fines punishing absence, lateness, or lack of contribution. This maximizes attendance and involvement of all members in group discussions, thereby providing a good environment for social learning to occur. Other than social learning, imitation and peer pressure (for example from the healthiest to the sickest households, to avoid contributing informally to their hospital bills) may also increase take-up.

To test this proposition, in Study 2 organized in 2012, we implemented a randomized intervention based on these groups. In another geographic area than Study 1, we randomly selected 208 households, and gathered information on their most important informal group, obtained authorization from their group leader, and visited their informal group at their usual meeting time and place. In these groups, we offered the same information and assistance to register as in Study 1. Our experiment is best viewed as an encouragement design, where we make salient the topic of health insurance in groups, to provide an environment for group members to talk and share their stories. It is not clear whether such an intervention would have any effect on take-up: discussions about NHIF may have happened organically before the meetings; early adopters of NHIF may not share their positive experience in the absence of any incentives to do so; or there may be no positive experiences to report. Alternatively, presenting about formal insurance may remind people of their informal risk-sharing arrangements in these groups, which could reduce take-up.[2] The impact of presenting to groups on take-up is therefore an empirical question.

We find a 12% take-up (7% take-up after one year) among individuals randomly selected to receive a presentation *together with their informal group*. This is more than any traditional interventions of Study 1. We find that organizing group meetings is more cost-effective than full subsidies, since group members were required to pay the full price of health insurance. Organizing group meetings is also more sustainable, since take-up dropped to zero when subsidies were discontinued. *Without any subsidies*, this simple intervention almost brought this community to the take-up rate of Ghana (18% in the lowest income quintile for a more generous product, i.e., out-patient and subsidized), one of the highest rate of voluntary health insurance coverage, and generally considered the success story of Sub-Saharan Africa. Additionally, we find significant spillovers of organizing meetings: by initially targeting 208 households, we reached 2,029 of them, with a 12% take-up rate.

In a follow-up survey organized in 2013–14, we find that informal group meetings improve trust and knowledge of NHIF. This may come from the extensive discussions witnessed among group members. Debriefing with the group leaders after the meetings indicated that in 24% of the groups, at least one group member was registered with the NHIF prior to the presentation, had required hospitalization in the last year, got reimbursed by the NHIF, talked about their experience with the group, and helped convince other members to register. Debriefing with our participants indicated that 20% of them received a positive piece of advice from an early adopter.[3]

Study 2 provides a unique contribution to the literature on health insurance take-up in developing countries. The closest paper examined "study circles" of nine randomly selected peers formed to discuss insurance (Dercon *et al.*, 2011). The authors find no effect of these study circles on take-up. In our paper, peers are not selected randomly, but belong to pre-existing informal groups, which may explain the different findings. People may trust more close friends than randomly selected peers.

Our paper generates important implications for developing countries. Developing nations are increasingly looking toward universal health insurance coverage as a way to increase the health of their population and decrease poverty rates,[4] without decreasing prices[5]. This paper finds that presenting information on health insurance to informal groups increases formal health insurance take-up in a cost-effective way. This methodology is applicable to other contexts since informal groups are a pervasive phenomenon in developing countries, under the name of Rotating Savings and Credit Associations (Roscas), Chit funds, self-help groups, sub-castes in India (Mobarak & Rosenzweig, 2012), Tontines in West Africa, susu in Ghana (Besley *et al.*, 1993), Idirs in Ethiopia (Dercon *et al.*, 2014). Their properties have been extensively studied in the literature (Deaton, 1990; Townsend, 1994; Udry, 1991).

This paper is organized in the following way: Section 2 provides background information on the NHIF. Section 3 presents the data. Section 4 presents Study 1, while Section 5 presents Study 2. Section 6 provides a discussion on the likely mechanisms through which Study 2 works. Section 7 presents a cost-benefit analysis, while Section 8 discusses the external validity of the findings. Section 9 concludes.

2. Background

The take-up of health insurance is extremely low in developing countries (e.g., 10% in Kenya; Xu, James, Carrin, & Muchiri, 2006). In this background section, we explain and discard a number of

[1] Informal groups can be Rotating Savings and Credit Associations (ROSCAs) (Anderson & Baland, 2002), clan or family groups, church groups, Chit funds or self-help groups in India, Tontines in West Africa, susu in Ghana (Besley, Coate, & Loury, 1993). These informal groups have been extensively studied in the economics literature (Deaton, 1990; Townsend, 1994; Udry, 1991).

[2] Formal and informal health insurance are substitutes, and informal insurance should crowd out formal insurance. This may be different from weather insurance. Dercon, Hill, Clarke, Outes-Leon, and Taffesse (2014) and Mobarak and Rosenzweig (2012) formally show that formal and informal weather insurance are complements, since informal insurance may cover any remaining basis risk generated by index insurance. They find that take-up in informal groups increases when the group leader is trained to understand this point (Dercon *et al.*, 2014), or when the network indemnifies more, not less, against farmer-specific losses (Mobarak & Rosenzweig, 2012). Our paper is different, since formal and informal health insurance are substitutes, and reminding people of their informal insurance may decrease, not increase, take-up.

[3] E.g., "I was told by my friend that when she was admitted in the hospital, the bill was covered by the insurance company".

[4] For example, Kenya has currently set a goal of universal health coverage for its population by 2030 in its current development blueprint, "Kenya Vision 2030".

[5] The NHIF increased its rate in 2013 from 1,920 Ksh (approximately 25 USD) to 6,000 Ksh (approximately 78 USD) per year.

obvious explanations for this low take-up rate: the lack of actuarially fair insurance products, and the existence of medical fees waiver programs for the poor that would reduce the need to purchase health insurance.

(a). Availability of insurance products

The low take-up rate cannot be explained by the lack of available products. The National Hospital Insurance fund (NHIF), a state corporation established in Kenya in 1966, provides a generous in-patient health care coverage for all Kenyans. The NHIF product is compulsory for individuals working in the formal sector, and costs a proportion of their income. The same product is voluntary for individuals in the informal sector, and costs 1,920 Ksh (≃25 USD) per year[6] (regardless of income), payable quarterly, half yearly, or annually.

This product is more expensive than in Ghana and Rwanda, the only two countries in Sub-Saharan Africa that achieved significant coverage with respectively 54 and 92% of the total population enrolled in 2012 (Lagomarsino, Garabrant, Adyas, Muga, & Otoo, 2012). In Ghana, only 18% of the lowest income quintile are covered. The premiums for the informal sector are 8$ per year per household in Ghana, and 1.7$ per year per person in Rwanda, for inpatient as well as outpatient services (Asuming, 2013; Lu, Chin, Lewandowski, Basinga, & Hirschhorn, 2012). This is significantly more generous than NHIF in Kenya, at 25$ per year per household for inpatient services. However, the premiums in Ghana and Rwanda are heavily subsidized. In Ghana, voluntary household contributions represented less than 5% of Ghana's National Health Insurance Scheme's revenues (Lagomarsino *et al.*, 2012). In Rwanda, significant external donor support was received. In fact, in 2006, with the support from donors such as the Global Fund to Fight AIDS, Tuberculosis and Malaria, the enrollment fees for the poorest 16th percent of the population were dropped (Kalk, Groos, Karasi, & Girrbach, 2010). The NHIF in Kenya is following a different path with a more expensive in-patient product. If take-up of this product can be significantly raised, it may provide valuable lessons for a more financially sustainable path than in Ghana or Rwanda.

The NHIF covers the entire household for all diseases. Concerning the reimbursement of claims, there are three different categories of hospitals. In Category A hospitals (government hospitals), insured individuals must simply present their membership card upon admission, after which the NHIF pays for maternity stays and all medical treatments, including surgery. In Category B hospitals (private and mission hospitals), there is full and comprehensive coverage; however, where surgery is required, insured individuals may be required to co-pay. In Category C hospitals (private hospitals), the NHIF pays specified daily benefits. Martin and Pimhidzai (2013) find no significant differences in public versus private facilities in objective measures of the quality of service delivery.[7] There is no age limit for NHIF coverage, and no exclusions based on health.

The registration process is quite tedious,[8] and may represent a significant barrier to take-up, especially when working with a population with low education levels (as is the case in our sample).

(b) Actuarial fairness of NHIF

To get an estimate as to whether the NHIF product is actuarially fair, we use our data collected on 1,803 households in the rural community of Kianyaga in Kirinyaga County, Kenya. In our sample, 25% of the household members (either household head, spouse, or children) reported that they had received treatment in a hospital in the last two years, for an average cost of 17,114 Ksh per hospitalization. This translates into an expected annual cost of hospital treatment of $0.25/2 * 17,114 = 2,140$ Ksh, more than 1,920 Ksh, the price of NHIF insurance. This calculation is likely an underestimate of the true costs of medical treatments, since 12% of the households stated they felt the need for hospitalization in the last two years, but did not go because it would be too expensive. These households would have gone to the hospital an additional 3.4 times during the past two years, on average.

Based on these estimates, the product appears to be actuarially fair. Of course, such calculations are subject to various issues (measurement error in health costs, inability to differentiate between formal and informal medical expenditures, etc.), and should be considered cautiously.

(c) Waivers and exemptions

This low take-up rate cannot be explained by a belief that poor people would be treated for free. In theory, there exists in Kenya a system of waiver and exemption, i.e. an automatic excuse from payment based on some proxies for financial hardship. However, in practice, waivers or exemptions are rare. Instead of waivers, some hospitals in Kenya practice hospital detainment: patients are detained in guarded wards until they can pay (Federation of Women Lawyers–Kenya, 2007). These detainments can last for months, and patients are kept in dire conditions. These detainments would be avoided with the NHIF insurance.

In light of these arguments (availability of the actuarially fair NHIF insurance product that reimburses medical fees in health care facilities that practice hospital detainment in the absence of payment), the low take-up of NHIF in Kenya is a puzzle. In the next section, we present the sample used in this paper, which allows us to formulate three other potential reasons for the low take-up: lack of information, transaction costs, and credit constraints.

3. Data

The data were collected in 2010 from 1,803 households in Kirinyaga County, Central Province, Kenya. This particular wave of the data collection was part of a longitudinal dataset collected in 2007, 2010, and 2012, on the same participants. Respondents were initially selected in 2007 for their potential interest in a community-based rural micro-hydro electrification project, not in health insurance.[9] The electrification project has not materialized yet, which makes this particular community a typical community in Africa, considering only 7% of rural households were electrified in Kenya in 2013, 18% in Sub-Saharan Africa (International Energy Agency, World Energy Outlook 2013). In fact, this community shares many common features with the rural areas of the Central Province of Kenya, and more generally Kenya, as can be seen from Table Appendix 8. For example, basic socioeconomic characteristics, such as age, marital status, asset ownership, access to water, are in the same order of magnitude as in the 2009 Census.[10] We also compare our sample to the 2005 Kenya Integrated Household Budget Survey (KIHBS) and the 2008 Demographic and Health Survey (DHS), and conclude that our sample

[6] This equates to 2% of the total yearly expenditure per household of 94270 Ksh (1180 USD) in the rural community that we study.

[7] the diagnosis of seven conditions that can avert a large share of child and adult morbidity and mortality, clinicians' adherence to clinical guidelines in five tracer conditions, and clinicians' management of maternal and neonatal complications.

[8] filling out a long form, providing photocopies of the national identification card for all adults and birth certificate for all children, as well as color passport photographs of all family members.

[9] We will discuss in a later section the implications of this feature of the sampling for the external validity of our findings.

[10] In Table 8, we report the Cohen-d values and *p*-values of *t*-tests. *T*-tests are significant because of the large sample size (2,873,620 observations in the rural areas of Central province). For example, spouse age is 40.28 in our sample, 39.52 in the Census. This difference is statistically significant, but of a small magnitude as evidence by a cohen-d of 0.05.

shares common features with the rural areas of Central Province of Kenya, an area comprised of almost three million people.

In our sample, people live at the poverty line of 1 USD per day per capita. Contributing 25 USD per year for the NHIF may be difficult for such households. This idea is supported by the comparison of the 257 early adopters of NHIF in Column (1) of Table 1, to the control group for Study 1 of 365 non-adopters in Column (2). Early adopters are significantly wealthier, and have better access to loans and savings than non-adopters, as shown in Column (3).

Non-adopters have on average 8 years of education. Baseline knowledge of NHIF is also low. Column (2) Table 1 shows that only 31% of our respondents (who did not already have NHIF) knew about NHIF, which is surprising considering that the NHIF is the most reputed governmental insurance company, and has existed since 1966.

The nearest NHIF office is located in Kerugoya, an hour away by car from Kianyaga and even longer for those who live far from a main road (see Figure 1). Individuals have to travel to the NHIF office to submit their registration form, and then every three months if they choose to pay for the product quarterly. Each trip would require our respondents to take a whole day off of work. Beyond the logistical difficulties, going to an office in an urban center may bring up social considerations such as embarrassment over one's clothing or shoes. These transaction costs may represent a significant hindrance to taking up.

Figure 1 shows a map of the seven hospitals that are in close proximity to Kianyaga, and includes the time and the cost of travel. For major health shocks, the most relevant hospital is Embu Provincial Hospital (one of eight provincial hospitals in Kenya, providing specialized care which includes intensive care, life support, and specialist consultations), an hour by car from Kianyaga. Overall, people reported having a positive experience in hospitals. Conditional on being admitted, 85% of the respondents were satisfied with their visit at the hospital, and 90% found the staff to be friendly. The waiting time was on average two hours (median: 30 min), and only 3% reported having to pay a bribe (of 450 Ksh on average). People who had not been admitted also had a very good perception of hospitals, with 85% of respondents believing that the hospital staff was friendly. The estimated waiting time of these respondents was 3.7 h (median: 1 h), and only 7% said they would need to pay a bribe (of an average estimated value of 240 Ksh).

The low take-up rate cannot be explained by a preference for traditional healing. Traditional healing is only a minor phenomenon in this community. Qualitative interviews with herbalists confirmed that in the case of an accident or an emergency, or if there is in-patient care needed, the herbalist will refer the patient to a hospital. Herbalists are mainly consulted for out-patient services. In our survey we find that when suffering from a medical condition (e.g., fever, diarrhea, abrasions, burns), only 4% used traditional medicine, whereas 70% used modern medicine.

The low take-up rate cannot be explained by risk-taking attitudes. We use the risk aversion instrument of Holt and Laury (2002), and find that our sample is slightly risk averse.[11]

[11] Specifically, we measure the number of safe choices in a series of 11 choices between more or less safe lotteries; the first choice was between a guaranteed 100 Ksh (safe), or equal chances to get 100 Ksh or 200 Ksh (risky). In subsequent choices, the safe amount is increased by 10 Ksh from 100 Ksh to 200 Ksh. In the end, a random number between 1 and 11 is drawn, and actual payments were given to the respondent according to the choice made. Risk-neutral individuals choose risky lotteries at first, switch at 150 Ksh, and pick safe lotteries thereafter, such that the proportion of safe lotteries chosen by risk-neutral individuals is 0.5 (Holt & Laury, 2002). In our sample, the proportion of safe lotteries is 0.53 among early adopters, and 0.56 among the control group of Study 1, indicating that our sample is slightly risk averse.

This discussion of our sample highlighted three potential factors (lack of knowledge about NHIF, high transaction costs, and poverty) which may represent significant challenges to health insurance take-up, and provide the basis for the experimental design of Study 1.

4. Study 1: Information, transaction costs, and price interventions

It is quite clear theoretically how providing information about NHIF insurance, lowering transaction costs, or reducing the price of the product may increase take-up (see Appendix A for a theoretical framework).

(a) Participants

In 2011, Study 1 was implemented in Map 1 (see Figure 2), a random subset of our sample. Map 1 includes 1009 of our respondents who did not have NHIF prior to this study. Out of this sample, we randomly selected 644 to receive various interventions, while 365 formed the control group and received no interventions. Column (4) of Table 1 shows the socioeconomic characteristics of the treatment group for Study 1, while Column (5) shows the difference in the control group for Study 1 in Map 1.

None of the basic socioeconomic characteristics (age, education, wealth, household size) are significantly different. Table 1 also shows that households were similar in terms of health, as indicated by the number of past hospital visits, weeks missed at work due to health reasons, and expectations of future hospital visits. Relative to the control group, the treatment group knew slightly more, but trust equally the NHIF. Participants in the control and treatment group had equal access to formal or informal insurance. Seventy-eight percent of the control group had at least one household member involved in a group providing hospitality,[12] similar to the treatment group. Finally, risk aversion is similar in treatment versus control group. We control for all these variables in our regressions.

(b) Experimental design

Table 2 shows the exact sample sizes used in all interventions. The sample sizes of each interventions are small, and Study 1 is best thought of as a pilot to detect a promising intervention with a large effect size. We defined a large effect size as a 20% take-up rate, slightly higher than the 18% take-up rate achieved in the lowest income quintile of Ghana, one of only two countries in Sub-Saharan Africa that achieved significant coverage. An effect size of 20% was also deemed feasible considering Thornton *et al.* (2010) found an overall 20% take-up rate after their interventions. For policy implications, 20% may actually represent a lower bound considering Ghana and Rwanda reached 54 and 92% take-up in the general population, and Kenya targets universal health coverage, i.e. 100% take-up rate. Table Appendix 9 shows the statistical power associated with detecting a 20% effect size. All cells have a statistical power of at least 80%.

(i) Information about the NHIF

Information about the NHIF was given to all individuals in any treatment group. In practice, we distributed an NHIF brochure (Figure 3), containing all relevant information about the product. The brochure was supplemented with a cartoon (Figure 4) to capture the very basic concept of insurance, designed and piloted by com-

[12] "Hospitality" is a payment obtained from the informal group in case of hospitalization.

Table 1
Balance of observable characteristics (*p*-value in brackets)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Early adopters		Non-adopters								
		Control 1		Treatment 1		Informal Group Meeting			Control 2	
			Diff. (2)-(1)		Diff. (2)–(4)		Diff. (2)–(6)	Diff. (9)-(6)	Other (9)	Diff. (2)–(9)
Socioeconomic characteristics										
Age	43.62	46.74	3.12***	47.30	−0.56	48.24	−1.50	−1.13	47.12	−0.38
			(0.01)		(0.57)		(0.23)	(0.36)		(0.73)
Total years of school completed	10.53	8.16	−2.37***	7.95	0.21	7.86	0.30	0.32	8.18	−0.02
			(0.00)		(0.41)		(0.35)	(0.36)		(0.95)
Female household head	0.09	0.19	0.10***	0.17	0.02	0.23	−0.04	−0.07**	0.16	0.03
			(0.00)		(0.51)		(0.27)	(0.03)		(0.24)
Household size	3.58	3.67	0.09	3.64	0.03	3.84	−0.17	−0.08	3.76	−0.09
			(0.45)		(0.77)		(0.21)	(0.54)		(0.42)
Daily expenditure per cap (USD)	1.56	0.98	−0.58***	1.05	−0.06	0.94	0.04	0.04	0.97	0.01
			(0.00)		(0.40)		(0.56)	(0.63)		(0.89)
Household farms?	1.00	0.99	−0.01	1.00	−0.01*	1.00	−0.01	0	1.00	−0.01*
			(0.23)		(0.09)		(0.29)	(0.66)		(0.08)
Head is plot owner?	0.81	0.80	−0.01	0.82	−0.01	0.78	0.02	0.03	0.81	−0.01
(1 = Yes, 0 = No)			(0.72)		(0.56)		(0.48)	(0.33)		(0.79)
Area of plot cultivated (acres)	1.35	1.16	−0.20**	1.30	−0.15*	1.40	−0.24**	−0.13	1.26	−0.10
			(0.05)		(0.08)		(0.03)	(0.22)		(0.20)
Total loans outstanding (000 Ksh)	13.31	4.43	−8.87***	5.73	−1.29	4.70	−0.27	0	4.70	−0.26
			(0.00)		(0.42)		(0.85)	(1)		(0.84)
Total savings (000 Ksh)	16.94	7.60	−9.35***	8.41	−0.81	9.49	−1.89	−0.49	8.99	−1.39
			(0.00)		(0.51)		(0.28)	(0.79)		(0.30)
Work in formal sector?	0.19	0.02	−0.17***	0.04	−0.02	0.04	−0.01	0.02	0.05	−0.03**
(1 = Yes, 0 = No)			(0.00)		(0.17)		(0.29)	(0.33)		(0.02)
Health										
Hospital in last 2 years for you,	0.34	0.23	−0.11**	0.26	−0.03	0.29	−0.06	−0.07	0.22	0.01
spouse or children?			(0.01)		(0.43)		(0.16)	(0.1)		(0.88)
Weeks missed from	1.09	1.70	0.61**	1.90	−0.19	1.74	−0.04	−0.34	1.40	0.30
work/school/daily duties			(0.01)		(0.36)		(0.89)	(0.15)		(0.16)
Prob you, spouse, child hospital	2.33	2.82	0.49***	2.57	0.25*	2.55	0.27	−0.07	2.48	0.34**
next year (0 to 10 = Most likely)			(0.01)		(0.09)		(0.18)	(0.72)		(0.04)
Formal insurance										
Know NHIF? (1 = Yes, 0 = No)	0.85	0.31	−0.54***	0.37	−0.06*	0.29	0.02	0.13***	0.42	−0.11***
			(0.00)		(0.06)		(0.57)	(0.00)		(0.00)
Trust insurance companies?	3.36	3.24	−0.13*	3.31	−0.08	3.31	−0.08	−0.06	3.25	−0.02
(1. Not at all-4. Very much)			(0.08)		(0.19)		(0.34)	(0.45)		(0.81)
Have another insurance?	0.07	0.02	−0.04***	0.02	0.00	0.02	0.00	−0.01	0.01	0.01
(1 = Yes, 0 = no)			(0.01)		(0.96)		(0.88)	(0.46)		(0.31)
Informal insurance										
Social networks insurance	0.56	0.70	0.13***	0.68	0.01	0.70	−0.00	−0.02	0.68	0.01
			(0.00)		(0.67)		(0.99)	(0.7)		(0.67)
Any group with hospitality in HH?	0.86	0.78	−0.08**	0.81	−0.04	0.86	−0.08**	−0.06*	0.80	−0.02
(1 = Yes, 0 = No)			(0.01)		(0.15)		(0.02)	(0.08)		(0.42)
Risk-Aversion										
Number of safe lotteries chosen	0.53	0.56	0.03	0.54	0.01	0.50	0.05*	0.05*	0.56	−0.00
			(0.33)		(0.64)		(0.10)	(0.1)		(0.96)
Number of observations	257	365		644		208			329	

"Control 1" is the control group of Study 1 in Map 1. "Treatment 1" is the treatment group for Study 1. It includes all interventions from Study 1, i.e. information, assistance to register, small subsidies, community leader, 160 Ksh per month and large subsidies. "Informal Group Meetings" is the main intervention of Study 2. "Control 2" is the control group of Study 2 in Map 2.

munity members. Our fieldworkers, hired from this community, were trained to give a thorough explanation complete with examples, without pressuring respondents to purchase coverage. We also provided a sheet that displayed pictures of the required documentation needed to register. After the presentation was complete, the fieldworkers answered all questions by repeating the information contained in the cartoon and brochure.

(ii) Assistance to register

To address the concern of high transaction costs, we offered in a randomized sub-sample information (brochure and cartoon) and a "Partial Assistance" to register (i.e., we filled out the application form, and took the passport pictures with our webcam). We offered to do this at participants' houses, or in our office if they wished to do so.

In another randomized sub-sample, we offered "Full Assistance", which included information and the partial assistance described above, as well as taking participants' applications to the NHIF office to register on their behalf.

(iii) Small subsidies

To estimate the price elasticity, we offered information about the NHIF together with random subsidies of 2, 10, and 30%. As evidenced in Table 2 detailing the experimental design, the subsidies

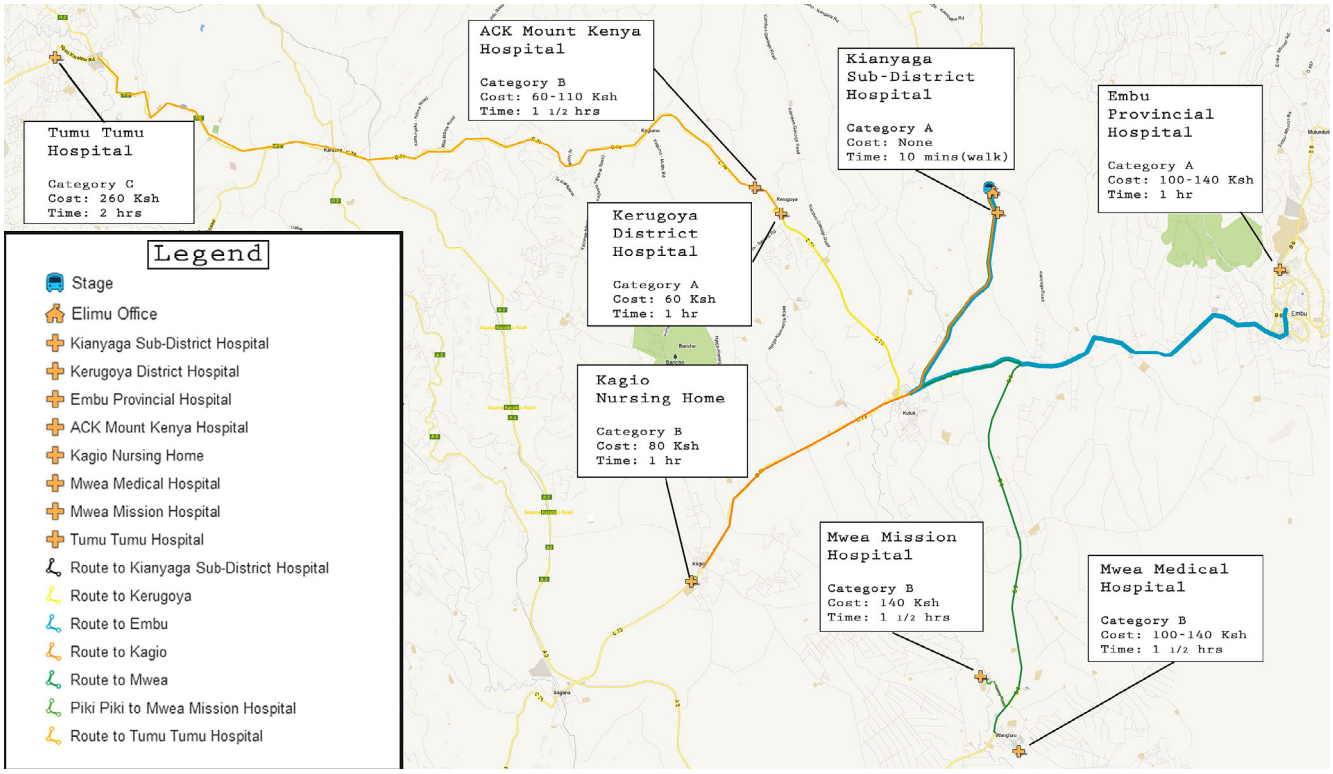

Figure 1. Map of hospitals (with time and cost of travel).

were implemented orthogonally to our information and assistance to register interventions, in a 3 (information, information and partial assistance, information and full assistance) $\times$3 (subsidies of 2, 10, 30%) design, to investigate all possible combinations of interventions. In practice, an insurance subsidy coupon that detailed the exact price to be paid was provided to participants. Participants could redeem this subsidy at the NHIF office by paying only the remaining portion.

(iv) Interventions delivered by community leaders

The interventions described above may be unsuccessful if people do not trust a message delivered by outsiders.[13] To address any concerns of distrust, we implemented the following intervention in a randomized sub-group. We offered free NHIF insurance to two community leaders (one woman and one man), elected by the people to represent them in another development project. These leaders were older, respected community members and well-known by everyone living in their immediate area. Since we wanted to gauge whether their social influence would spur take-up, the leaders offered the same information on the NHIF product (i.e., the brochure, the cartoon, and the map to the office) in the place of our fieldworkers. We provided full assistance to those willing to register.

Moreover, different incentives were given to either the community leader or the individuals receiving interventions (see Table 2 for exact sample sizes):

- the community leader was given an incentive of 10% (of the price of the NHIF insurance, i.e., 192 Ksh) per person registered
- individuals receiving interventions were offered an in-kind gift[14] in case of registration (in our case, a chicken, of approximate value 400 Ksh, a sign of respect in this community)
- individuals receiving interventions were offered a subsidy of 10% (of the price of the NHIF insurance, i.e., 192 Ksh) in case of registration

(v) Monthly payments

As explained above, people can pay 1,920 Ksh ($\simeq$25 USD) per year, or 480 Ksh ($\simeq$8 USD) per quarter. This may be difficult for farmers living at the poverty line of 1 USD per day per capita. Lower but more frequent payments may increase insurance take-up. To test this proposition, we offered randomly selected individuals information about the NHIF and the possibility to pay the monthly price of 160 Ksh. People had to visit our office every month to deliver the payment, which we then forwarded to NHIF.

(vi) Monthly payments by M-Pesa

To reduce even further transaction costs, we collaborated with NHIF to organize a payment system by cellphone, through M-Pesa. Cellphones are now ubiquitous in Kenya, even among the rural poor: as of 2009, 47% of Kenyans had a cellphone and 80% of people report having access to a cellphone either through direct ownership or sharing (Aker & Mbiti, 2010). M-Pesa is a money transfer application on mobile phones. As of 2009, M-Pesa subscriptions in Kenya were up to 8 million people, with nearly 40% of all Kenyans reporting to have used M-Pesa's services (Aker & Mbiti, 2010). Paying by M-Pesa allows NHIF members to forgo the inconvenient trip to an NHIF office. We thus offered in another

[13] All the interventions described above were implemented by local fieldworkers from this community, hired by the kenyan NGO Elimu, which has been operating in this community for eight years.

[14] An idea suggested by the CEO of the NHIF.

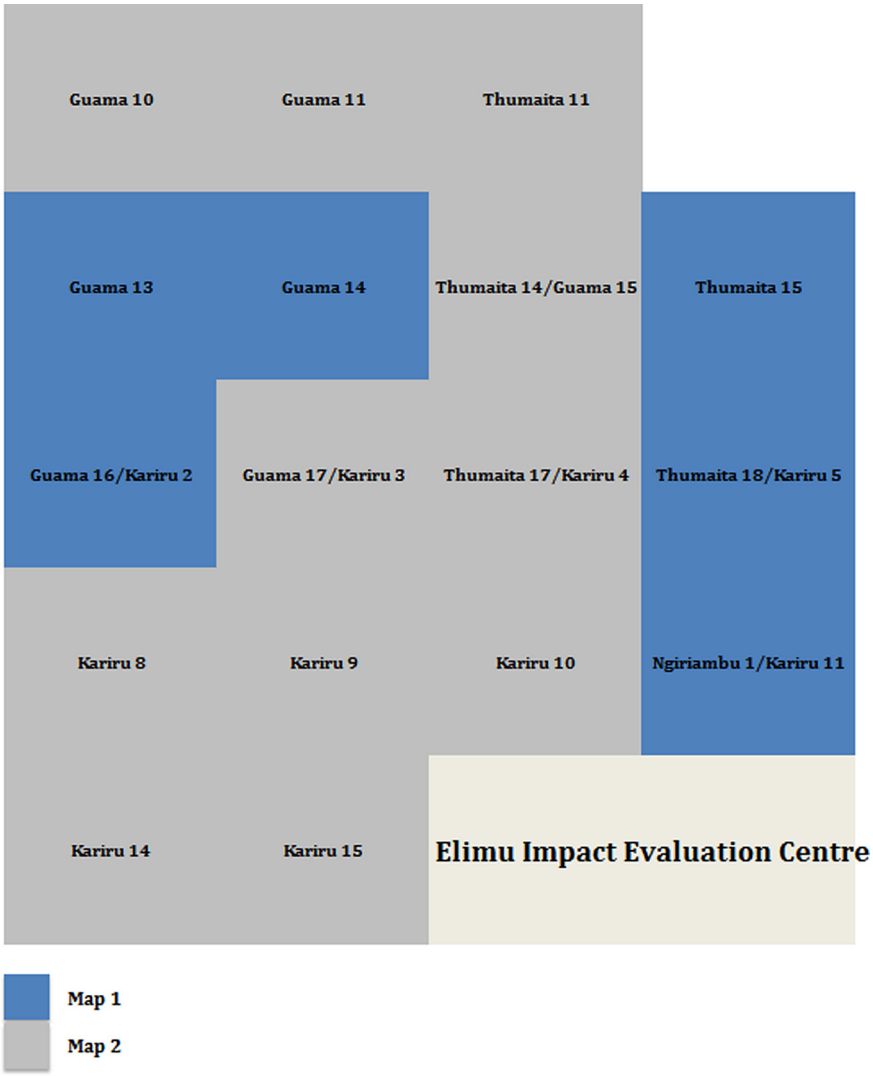

Figure 2. Map.

Table 2
Experimental design and results of Study 1

	Information	Partial Assistance	Full Assistance	Total
Subsidy: 2%	16 (1,0)	27 (0,0)	11 (0,0)	54 (1,0)
Subsidy: 10%	25 (0,0)	14 (0,0)	17 (0,0)	56 (0,0)
Subsidy: 30%	24 (1,0)	20 (0,0)	21 (1,0)	65 (2,0)
Total	65 (2,0)	61 (0,0)	49 (1,0)	175 (3,0)
Community leader			72 (3,0)	
+ Subsidy: 10%			21 (2,0)	
+ Chicken			46 (1,0)	
+ Incentive to Community leader: 10%			17 (1,0)	
Total commmunity leader			128 (6,0)	
160 Ksh per month			32 (1,0)	
+ Payment by M-pesa			33 (0,0)	
+ Cover in case of non-payment			106 (2,0)	
Total 160 Ksh per month			171 (3,0)	
Subsidy: 90%			88 (26,1)	
Subsidy: 100%			82 (40,1)	
Control group Study 1			365 (7,1)	

Note: Number of participants by treatment arm (in brackets, first number is take-up of NHIF right after intervention, second number is take-up one year after).

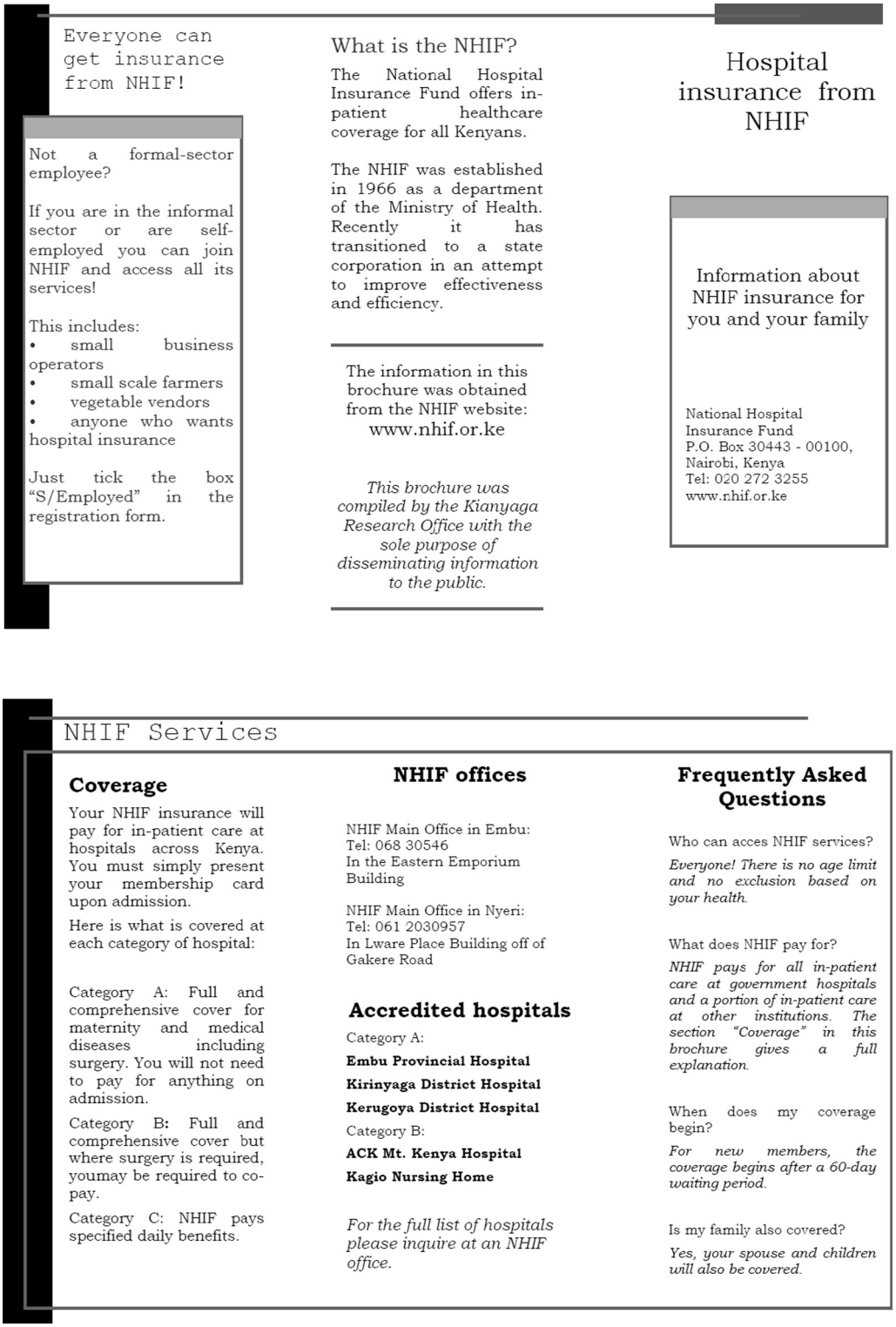

Figure 3. Brochure.

randomized sub-group information about the NHIF and the additional possibility to pay the monthly premiums by M-Pesa (see Table 2 for exact sample sizes).

(vii) Cover intervention

NHIF imposes a fine of five months of coverage (800 Ksh ≃10 USD) in case one misses a payment. This may deter some to take-up in the first place if they feel unsure they will be able to contribute each installment. To address this issue, we offered in a randomized sub-group to cover for individuals if they were unable to pay the 160 Ksh payment one month. We offered the information about the NHIF as well.

(viii) Full subsidy

In another randomized sub-group, we offered information, and full assistance to register, and subsidies of 90 or 100%. Participants

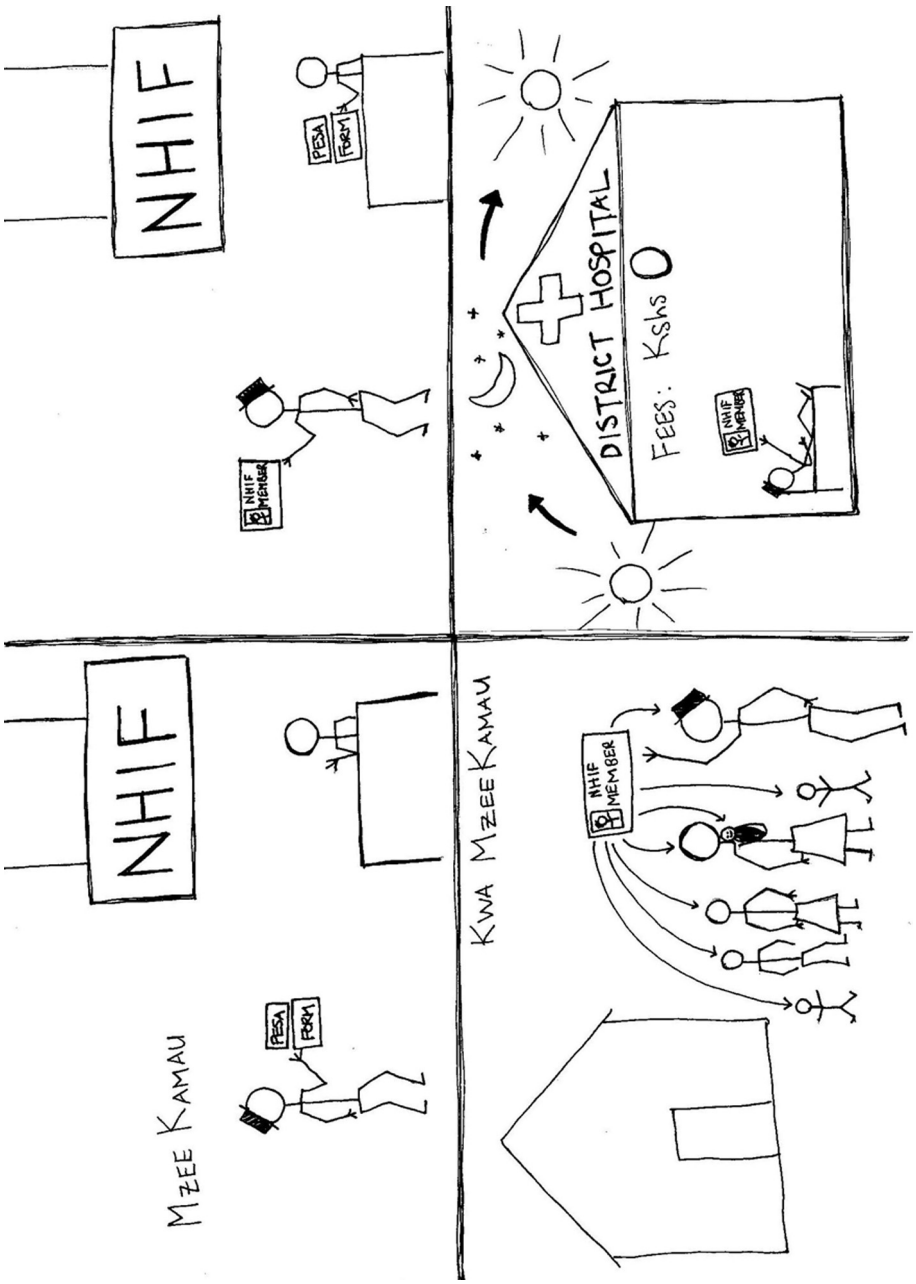

Figure 4. Cartoon.

still had to visit our office with the proper documents (national identification card for all adults and birth certificate for all children) for us to organize the rest of the registration.

(c) Results

Table 2 presents (in brackets) the number of people who took up and retained the product one year following the interventions (when all interventions were discontinued). Consistent with the existing literature that finds conflicting findings about information and price as potential determinants of health insurance take-up (Asuming, 2013; Das & Leino, 2011; Dercon *et al.*, 2011; Thornton *et al.*, 2010), all interventions were largely ineffective at raising take-up, except for large subsidies. Table 3 indicates that subsidies of 90 and 100% generated a take-up of 27 and 45%, respectively. However, retention rates the following year (after the discontinuance of these subsidies) collapsed to almost 0%. In any case, offering a subsidy of 100% is not a viable option for the Kenyan government, who is determined to increase, not decrease, contributions to the NHIF.

To test the statistical significance of these results, we perform the following regression:

$$
\begin{aligned}
TakeUp_i = {} & \alpha_0 + \alpha_1 Subsidy\_2\% * Information \\
& + \alpha_2 Subsidy\_2\% * Information\_And\_Partial\_assistance \\
& + \alpha_3 Subsidy\_2\% * Information\_And\_Full\_assistance \\
& + \alpha_4 Subsidy\_10\% * Information \\
& + \alpha_5 Subsidy\_10\% * Information\_And\_Partial\_assistance \\
& + \alpha_6 Subsidy\_10\% * Information\_And\_Full\_assistance \\
& + \alpha_7 Subsidy\_30\% * Information \\
& + \alpha_8 Subsidy\_30\% * Information\_And\_Partial\_assistance \\
& + \alpha_9 Subsidy\_30\% * Information\_And\_Full\_assistance \\
& + \alpha_{10} Information\_And\_Community\_leader \\
& + \alpha_{11} Information\_And\_Community\_leader * Subsidy\_10\% \\
& + \alpha_{12} Information\_And\_Community\_leader * Incentive\_leader\_10\% \\
& + \alpha_{13} Information\_And\_Community\_leader * Chicken \\
& + \alpha_{15} Information\_And\_160Ksh\_permonth \\
& + \alpha_{16} Information\_And\_160Ksh\_permonth\_byM\_Pesa \\
& + \alpha_{17} Information\_And\_160Ksh\_permonth\_and\_Cover \\
& + \alpha_{18} Information\_And\_Full\_assistance\_And\_Subsidy\_90\% \\
& + \alpha_{19} Information\_And\_Full\_assistance\_And\_Subsidy\_100\% \\
& + Interventions\_Study2 \\
& + X_i + u_i \qquad (1)
\end{aligned}
$$

where i corresponds to individual i. The dependent variable is a dichotomous variable equal to 1 if the individual takes up NHIF insurance, 0 otherwise. Probit regressions are used to take into account the dichotomous nature of the dependent variable. Marginal effects are presented, and are calculated at a value zero for the other interventions, and at the mean of the control variables. $Subsidy\_2\% * Information$ is a dichotomous variable equal to 1 if the individual received the information intervention described earlier, as well as a 2% subsidy, 0 otherwise. We define similarly the other treatment variables. $Interventions\_Study2$ pertain to Study 2, and will be explained below. We present results with and without all control variables X_i of Table 1.

Confirming the basic results of Table 2, Table 3 shows that none of the interventions were successful at raising take-up, except for 90 and 100% subsidies. In fact, some coefficients are not even estimable since there is exactly zero take-up in some treatment groups.[15]

The fact that take-up is not 100% with 100% subsidy is indicative that other factors than mere information, transaction costs, or price are at play. In the next section, we detail what these reasons might be, which enabled us to design and implement a new intervention to increase take-up.

Table 3
Treatment effects

	(1) Take-up
STUDY 1:	
Subsidy: 2% * Information	−0.00
	(0.025)
Subsidy: 2% * Information and Partial assistance	.
Subsidy: 2% * Information and Full assistance	.
Subsidy: 10% * Information	.
Subsidy: 10% * Information and Partial assistance	.
Subsidy: 10% * Information and Full assistance	.
Subsidy: 30% * Information	0.01
	(0.035)
Subsidy: 30% * Information and Partial assistance	.
Subsidy: 30% * Information and Full assistance	0.05
	(0.049)
Information and Community leader	−0.00
	(0.019)
Information and Community leader * Subsidy: 10%	0.11
	(0.092)
Information and Community leader * Incentive leader: 10%	0.05
	(0.075)
Information and Community leader * Chicken	−0.01
	(0.015)
Information and 160 Ksh per month	0.01
	(0.032)
Information and 160 Ksh per month by MPESA	.
Information and 160 Ksh per month and Cover	−0.01
	(0.011)
Information and Full assistance and Subsidy: 90%	0.27***
	(0.049)
Information and Full assistance and Subsidy: 100%	0.45***
	(0.056)
STUDY 2:	
Informal Group Meeting	0.10***
	(0.025)
Control Study 2	0.04***
	(0.015)
Observations	1,335
Pseudo R-squared	0.21

Probit regressions, robust standard errors in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. "." indicates zero take-up in treatment group. In such cases, the treatment group perfectly predicts failure, and the probit model drops that treatment group from the analysis. Marginal effects are presented (at a value zero for the other interventions, and at the mean of the control variables).

(d) Discussion

Qualitative debriefing with people choosing not to take up the NHIF product revealed a lack of trust and poor understanding of the product. People were "unsure whether [their] claims would be honoured" (sentences in quotation marks indicate verbatim answers from debriefing). The credibility of the NHIF was put into question by some respondents who needed to "be assured that [their] funds will be managed well". Respondents wondered about "the steps to follow when NHIF defaults paying bills", suggesting that default by NHIF was a clear possibility. Moreover, many individuals asked if there were repayments of premiums in case one stays healthy,[16] indicating a poor understanding of the product. Consequently, instead of reducing risk, people felt that insurance was in fact increasing risk. In this context, it is understandable why only 45% took up with a 100% subsidy, since the remaining minimal transaction costs (providing documentation, coming to our offices, picking up the NHIF card) may outweigh uncertain benefits.

These obstacles to take-up are confirmed by microinsurance practitioners. In their survey, Brown and Churchill (2000) note that "Virtually all the micro-insurers in this study indicated that households are slow to understand the concept of insurance and are reluctant to commit to making premium payments for an uncertain benefit" (p. 91). The authors argue that the level of uncertainty is higher with insurance than with savings or credit. With savings, the customer is unsure whether the institution will safeguard their deposits, but the customer may test the relationship at any time by withdrawing funds. With credit, the roles are reversed since it is the lending institution which is unsure whether the borrower will repay the loan. By contrast, with insurance, the client will not know whether the insurer will keep its promise until some uncertain time in the future when the policyholder makes a claim, and this relationship cannot be tested until this time (Brown & Churchill, 2000), which may happen later in the case of in-patient versus out-patient health insurance. In the following section, we describe an intervention that may

[15] In those cases, the probit model drops that treatment group from the analysis since there is no variation in the outcome, and the treatment group perfectly predicts failure.

[16] "Suppose I contribute for many years and I lead a very healthy life without getting sick, what happens in this case?"; "Is NHIF money refundable if I pay continuously for about 20 years?"

address the issue of poor understanding and uncertainty about insurance repayments that plagues formal health insurance take-up in developing nations.

5. Study 2: An intervention based on informal groups

The intuition of Study 2 is that close friends may better explain and reinforce confidence in the system, especially if they have experienced it before. As one of our respondents put it: "I have no previous experience with insurance, but I have a friend who has NHIF. When that man's wife fell ill, NHIF paid the bill in full. Therefore, I trust the company and understand how it works". An intervention that would somehow encourage advice-giving by close friends may raise formal health insurance take-up.

A critical issue to design a successful intervention is to target the relevant reference group, i.e., determine which peers matter (Manski, 1993). To define the reference group, the existing literature usually asks individuals who their friends are (Bandiera & Rasul, 2006; Conley & Udry, 2010; Cai, de Janvry, & Sadoulet, 2013) or use villages (BenYishay & Mobarak, 2013) or departmental colleagues (as in Duflo & Saez, 2003).

A key innovation of our paper is that we focus on naturally occurring informal groups for this intervention. We provide below some basic facts about informal groups, and explain why they are an appropriate reference group for such an intervention.

(a) Background on informal groups

The 1,803 households in our survey participate in a total of 2,995 groups. Eighty-nine percent of households have at least one group. The average size of the groups is 38 individuals. Informal groups consist of ROSCAs (Rotating Saving and Credit Associations) (34%), clan or family groups (23%), women's groups (15%), or church groups (9%).

When asked what the main service of the group is, respondents answer social support (63%), credit/savings (27%), and spiritual (3.5%), with only 1% indicating insurance as the main service. In practice, group members usually pay a registration fee (mean = 320 Ksh), a yearly membership fee (mean = 254 Ksh), contribute savings (mean = 271 Ksh per month), and receive dividends from loan repayments by others (mean = 130 Ksh per month).

These groups are stable,[17] and meet on average 1.6 times a month. A system of fines sanctions the breach of basic group rules. For example, in all groups, there is a penalty for absence (mean = 61 Ksh), lateness (mean = 15 Ksh), and lack of contribution (mean = 72 Ksh). Attendance and involvement of group members at these meetings is thus very high.

(b) Conceptual framework for a group intervention

Instead of presenting information on the NHIF to individuals as in Study 1, the intuition of Study 2 is to present the same information to other individuals *together* with their informal groups. This may spur group members to talk about NHIF, and exchange stories of past experiences. In our sample, approximately in line with the Kenyan national average, these informal groups contained on average 12% of people who have registered with NHIF before. Talking to respected friends who have gone through the system may inform and reassure people about the promise of the NHIF to reimburse claims (see Appendix B for greater details).

It is unclear whether such group presentations will affect take-up. Group members may have already been sharing stories before our intervention.[18] Alternatively, people might not share their stories after the intervention, especially since they were not incentivized to do so.[19]

Other than social learning, this intervention could increase take-up through other mechanisms such as imitation or peer pressure. People could simply be imitating what other group members do. Peer pressure may occur because of a unique feature of these informal groups: 83% of the real groups already provide informal health insurance, called "hospitality". In these groups, each member contributes a fixed amount (usually 200 Ksh) when one group member is admitted to a hospital.[20] If the majority of group members were healthy, these healthy group members would benefit from not having to pay hospitality to the few sick members.[21] These sick members could register with the NHIF, thereby exerting a positive externality on all other healthy group members. Healthy group members could then compensate the sick member to incentivize them to register with the NHIF. This would generate a "win-win" situation for group members (but would of course exacerbate adverse selection for the NHIF considering only the sickest members register) (see Appendix C for a formal derivation).

For these reasons, presenting to existing informal groups, rather than to individuals, may increase take-up. We describe in the next section the intervention designed to test this proposition.

(c) Experimental design

(i). Informal group meetings

In 2012, we implemented Study 2 in Map 2, i.e., a different geographical area than Map 1 (see Figure 2). Map 2 included 537 households who did not have NHIF prior to this study, nor had received any interventions under Study 1. As Map 1 and Map 2 were a random selection of a subset of maps, there are no overall differences between respondents in Map 1 (Column (2) and (4) of Table 1) or Map 2 (Columns (6) and (9)).

Table 4 presents the exact sample size for each intervention of Study 2. Out of the 537 households of Map 2, we randomly selected 208 households, and asked them to identify the most important social group that they belonged to (e.g., ROSCAs, clan or family groups, church groups). We then asked participants if they would like to have information on NHIF insurance presented to their group, and all reported that they would like a presentation. These respondents then referred us to the chairperson of their social group, and we asked the chairperson for approval to come and present about the NHIF. Ninety-two percent agreed to have a presentation at their next meeting. We scheduled that

[17] The average year of creation of these groups was 2004.

[18] We argue this is unlikely for two reasons. First, as mentioned above, the main purpose of these groups is not health insurance, but more a social gathering with a credit and savings dimension. Second, only 31% of our respondents (who did not already have NHIF) knew about NHIF before any of our interventions, an extremely low number given NHIF is the most reputable health insurance governmental agency in Kenya, established in 1966. This indicates that the NHIF was not a topic often discussed in these groups prior to our intervention. Nonetheless, we do not have data on discussions in the meetings before our intervention, and this remains a distinct possibility.

[19] In fact, BenYishay and Mobarak (2013) find no effect of non-incentivized peers on the take-up of two new agricultural technologies in Malawi. In contrast, they find that take-up increases when peers are incentivized, suggesting that financial incentives, absent in our experiment, fosters social learning.

[20] Group members get on average 2,859 Ksh if one of their household members is hospitalized. The group provides insurance for other reasons too: group members get on average 916 Ksh if one of their household members is sick, and 80% of the households receive aid in case of a funeral.

[21] Group members may be of varying health situation in a group since the primary reason of existence for these groups is not health insurance, but social support.

Table 4
Experimental design and results of Study 2 in Map 2

	Number households	Take-up (percent)	Attended real group (percent)	Take-up conditional on real group
Informal Group Meeting	208	12	69	16
Control group in Map 2	329	6	46	14
Control group in Map 1	365	2	15	11

presentation for the date, time, and place of their next group meeting.[22]

In these meetings, we delivered exactly the same information as in Study 1 (the brochure and cartoon). Two fieldworkers went to each presentation. When we arrived at the group meeting, one fieldworker took attendance and recorded the contact information of all group members who were present, as well as distributed biscuits, sodas, and the informational documents to each member. After introductions and attendance were completed, the other fieldworker began the group presentation. The same fieldworker presented in all meetings to ensure consistency in our message and presentation style. After the presentation was completed, the presenter answered questions from the audience (on average nine questions per meeting).[23] Replicating the response style in Study 1, we answered by repeating information contained in the brochure, cartoon, or registration documentation sheet. Consistent with Study 1, we offered full assistance to register all those willing to register.

(ii) Control group

The other 329 households of Map 2 formed a control group. Due to the fact that these households live in the same area, it is possible that some of them also attended group presentations. Another control group that may be used to measure the causal impact of attending group presentations is the control group of Study 1. Since it is located in Map 1, it is less likely that this control group attended group presentations.

(d) Results

(i) Attendance and take-up

In contrast to the individual interventions of Study 1, organizing informal group meetings shows encouraging results. Overall, 69% of our treatment group attended a group presentation, and 12% took up. Of those attending informal group meetings, 16% took up.

As shown in Table 4, we find that 46% of the control group of Study 2 attended a group presentation. This is less than the 69% attendance rate of the treatment group, which is logical since these individuals were not directly targeted to receive a group presentation. Yet, attendance was high since these individuals lived in the same area. Overall, 6% took up. Of those who attended, the take-up rate was 14%, close to the 16% take-up rate in the treatment group conditional on attending a meeting. This take-up in the control group of Study 2 represents a positive spillover from organizing group presentations.

The 12% take-up rate in the treatment group of Study 2 is higher than the 2% overall take-up rate in the control group of Study 1. Attendance rate was 15% in the control group of Study 1, much lower than in the treatment or control groups of Study 2 since they lived in another geographical area. Yet, it was still more than zero. Considering some individuals of the treatment group did not attend meetings, while some in the control group did, our estimates thus represent a lower bound on the true effects of these meetings.

(ii) Comparison of Study 1 and Study 2

The 12% take-up rate with informal group meetings is a large effect. It is almost half the registration rate with a subsidy of 90%, yet people have to pay the full price of insurance in that group. It is also significantly more than any of the interventions of Study 1, as visible in Table 3. Table 3 of the previous section already incorporated all the data and treatment variables of Study 2. In Table 3, "Informal Group Meeting" is a dichotomous variable equal to 1 if the individual was invited to an informal group meeting, 0 otherwise. As can be seen from Table 3, the take-up after being invited to a group presentation is 10 percentage points higher than in the control group of Study 1. The spillover effects are also statistically significant: the control group of study 2 is 4 percentage points more likely than the control group of study 1 to register.

Although some treatment groups of Study 1 taken in isolation may not have enough statistical power to detect a 12% effect size, their combinations do, as evidenced in Columns (5), (6), (7), and (8) of Table 9. For instance, consider the combination of information and subsidies of 2, 10, or 30%, i.e., the vertical combination of the first column of the experimental design. Table 2 shows that this group has 65 individuals, among which 2 took up (3% take-up). Appendix Table 2 Column (5) shows that this treatment group of 65 individuals has a statistical power of 95% for an effect size of 12%. Therefore, this combination of treatment groups has enough statistical power to detect a take-up rate of 12%, yet actual take-up is only 3%. The common denominator to this combination of groups is information and subsidy of 2%, since subsidies of 10 and 30% are greater than subsidies of 2%. Therefore, one can conclude that information together with a subsidy of 2% is largely ineffective at raising take-up, to the level of 12% raised by the informal groups.

Similarly, one may combine vertically the second column of the experimental design to show that the combination of information and partial assistance and a subsidy of 2% has enough statistical power to detect a 12% effect size, yet take-up is exactly zero. Overall, combining treatment groups generates enough statistical power to detect a 12% effect size. Combining vertically shows that neither Information, nor Information + Partial Assistance, nor Information + Full Assistance significantly increase take-up. Combining horizontally shows that neither subsidies of 2, 10, or 30% significantly increase take-up.

Similarly for the Community leader intervention, Table Appendix 9 shows that Community leader + "Subsidy: 10%" and Community leader + "Incentive to Community leader: 10%" may not have enough statistical power to detect a 12% effect size. Yet, Community leader, and Community leader + Chicken, as well

[22] On the morning of the scheduled group presentation (or the day before if the meeting was held in the morning), we contacted the chairperson to confirm the time and place of their group meeting one final time. We also ascertained an estimate of how many group members would be in attendance for the presentation. A fieldworker then purchased the appropriate amount of sodas (about 20 Ksh each) and biscuits (about 5 Ksh each) to distribute to each group member in attendance as a way to thank them for hosting us and agreeing to an NHIF presentation.

[23] The majority of the questions (43%) were on the benefits of the NHIF (e.g., which hospitals are covered, who is covered in the household, what diseases), 20% were on the cost of NHIF insurance (e.g., amount and frequency of payments, and penalty in case of delayed payment), 14% on the steps needed to register (e.g., documents, where to go), 6% on reimbursement in case one stays healthy, 5% on the group versus individual registration.

as the combination of all community leader treatment groups have enough statistical power to detect a 12% effect size.

Moreover, all other interventions: 160 Ksh per month, 160 Ksh per month + Payment by M-pesa, 160 Ksh per month + Cover in case of non-payment, the combination of all 160 Ksh per month interventions, and subsidies of 90 or 100% all have a statistical power above 79%. Therefore, all of these interventions could have a detected a 12% effect size, but show a very low take-up.

Considering all interventions of Study 1 generate a very low take-up, except for the high subsidies, we combine all treatment groups of Study 1 except high subsidies into one dichotomous variable called "Individual interventions". The word "individual" refers to the fact that all these treatments were targeted at individuals, not groups as in Study 2. We further combine "Subsidy: 90%" and "Subsidy: 100%" into one variable "Subsidy: 90 or 100%". We then perform regressions of the following form:

$$TakeUp_i = \alpha_0 + \alpha_1 Individual\_interventions_i + \alpha_2 Subsidy\_90\_or\_100\%_i + \alpha_3 Informal\_Group\_Meeting_i + \alpha_4 Control\_Group2_i + X_i + u_i \quad (2)$$

Column (1) of Table 5 clearly shows that all individual interventions were unsuccessful at raising take-up, while high subsidies and informal group meetings significantly raised take-up by 36 and 9 percentage points, with similar estimates as in Table 3.

(iii) Retention

In column (2) of Table 5, the dependent variable is take-up a year after the interventions, after all treatments were discontinued. Take-up a year after the individual interventions of Study 1 was exactly zero.[24] Similarly, take-up a year after a high subsidy was not significantly different from zero. While high subsidies are associated with high take-up rate in the short-term, their effect disappears once they are discontinued.

In contrast, take-up a year after the informal group meetings was still seven percentage points higher than in the control group of Study 1. This provides a first indication that people value health insurance more after group presentations than after temporary subsidies.

(iv) Instrumental variable estimates

The effects presented thus far are intent-to-treat estimates, i.e., the effect of being invited to a meeting. To recover the causal impact of attending a meeting on take-up, we instrument the endogenous decision to attend the meeting by the exogenous invitation to the meeting. Column (3) of Table 5 presents the OLS version of column (1), and shows that 9% of the invitees took up. Column (4) presents the first stage, showing that being invited to a meeting increases the probability to attend a meeting by 54 percentage points over a baseline of 16% attendance rate in the control group of Study 1, exactly in line with Table 4. Column (5) presents the IV results, and shows that attending a meeting increase take-up by 17 percentage points (the ratio of 9 to 0.54).

(v) Robustness checks

The next columns show that adding incrementally the control variables of Table 1, such as socioeconomic characteristics (Column 6), health (Column 7), formal insurance (Column 8), informal insurance (Column 9), and risk-aversion (Column 10), does not affect the main result of the paper, i.e. the significant effect of informal group meetings.

Overall, these results point to large direct and indirect effects of organizing group presentation. Take-up is higher for individuals directly targeted, as well as neighbors attending the meetings.

6. Discussion

To investigate why informal group meetings have a larger effect on take-up and retention than all other interventions in Study 1, we use an endline survey collected in 2013/2014 on the same sample. We track our baseline respondents through cellphone, plot numbers on official maps, maps drawn on our surveys, and asking neighbors. Overall, attrition between the endline and baseline surveys is kept low at 8.8%.

We collected data on trust in NHIF. Answers are collected on a 4-point scale (1. Distrust completely, 2. Somewhat distrust, 3. Somewhat trust, 4. Trust completely). Column (1) of Table 6 shows that trust increases by 0.10, or 0.12 standard deviations, after a group meeting. In contrast, trust remains at similar levels, if anything decreases, in the subsidy group. Graphical results are shown in Figure 5.

In Column (2) of Table 6, we ask people whether they know about NHIF. We code the answer as 1 if the respondent says yes, and 0 if the respondent say no or somewhat. Being in the "Informal group meeting" intervention increases the probability to know about NHIF by 12 percentage points, but not more than being eligible to receive a subsidy (10 percentage points). Column (3) shows that people have a more accurate information about the true costs of this insurance product after an informal group meeting,[25] not after a subsidy, probably because people in the "Informal group meeting" have to pay for their insurance, while people in the subsidy group do not.

Column (4) shows that usage of the product is low (not significantly different from zero) in the last two years in all treatment groups, which is understandable considering the rare occurrence of hospitalizations. This low usage might explain why the retention is close to zero in the high-subsidy group: people have not had time in a one-year period to use the NHIF and develop positive experiences of their own. Thus, they drop the product when the subsidy is discontinued. The situation is different in the "Informal group meeting" intervention. People may have no positive experiences of their own, but their friends have. Trust and information about NHIF have improved, which may explain the higher retention in that intervention.

Overall, these findings confirm our hypothesis that informal group meetings improve both trust and knowledge in NHIF (despite low usage of the product). To understand why this could be the case, we videotaped and transcribed all conversations within the group meetings. We found that presenting the NHIF product to groups triggered discussions, led by early adopters of NHIF. For example, in one group, an early adopter said: "My child was hospitalized in three hospitals. [...] In all these hospitals, NHIF covered the entire medical bills. In total, NHIF paid more than 100,000 Ksh." In only one group, we witnessed a negative story by a friend of a group member.[26]

Early adopters also talked about the NHIF after the meetings were over. To capture these interactions after the meetings in a

[24] In those cases, the probit model drops that treatment group from the analysis since there is no variation in the outcome, and the treatment group perfectly predicts failure. The coefficient is not estimable. This explains the drop in the sample size in Column (2), since that entire group is dropped.

[25] We ask "How much do you think NHIF costs per year?". We define $Very\_Low\_Info_i$ as a dichotomous variable equal to 1 if the respondent says NHIF costs less than half or more than double its true costs i.e., less than 1,000 Ksh, or more than 4,000 Ksh, considering the true cost is 1,920 Ksh, 0 otherwise.

[26] "I have a relative who underwent a theatre operation in a public hospital. She said that they were made to pay for it after being told that theatre charges are different from other hospital bill and they are not covered by NHIF. The NHIF card was also taken to the District Commissioner's office for reasons that were not clear to her before she could be released from the hospital." In this case, the hospital should not have charged for this "theater operation". The card should not have been taken to the District Commissioner's office. This story may add considerable uncertainty about NHIF repayment of claims.

Table 5
Impact of group presentations versus subsidies on take-up and retention

Model	(1) Probit	(2) Probit	(3) OLS	(4) First stage	(5) IV	(6)	(7)	(8) Probit	(9)	(10)
Dependent variable	Take-up	1 year after	Take-up	Attended	Take-up			Take-up		
Individual Interventions	−0.00	.	−0.00	−0.06**	0.01	−0.00	−0.00	−0.00	−0.00	−0.00
	(0.008)		(0.012)	(0.023)	(0.012)	(0.007)	(0.008)	(0.007)	(0.008)	(0.008)
Subsidy: 90 or 100%	0.36***	0.01	0.36***	0.02	0.36***	0.35***	0.36***	0.35***	0.35***	0.35***
	(0.038)	(0.008)	(0.038)	(0.035)	(0.038)	(0.040)	(0.041)	(0.041)	(0.041)	(0.041)
Informal Group Meeting	0.09***	0.07***	0.09***	0.54***		0.10***	0.10***	0.10***	0.10***	0.10***
	(0.023)	(0.020)	(0.023)	(0.036)		(0.024)	(0.026)	(0.025)	(0.025)	(0.026)
Control Group Map 2	0.04***	0.01*	0.04**	0.31***	−0.01	0.04**	0.04**	0.04**	0.04**	0.04**
	(0.015)	(0.008)	(0.016)	(0.033)	(0.019)	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)
Attended					0.17***					
					(0.042)					
Constant			0.02***	0.16***	−0.00					
			(0.008)	(0.018)	(0.011)					
Controls as in Table 1:										
Socio-economic characteristics						x	x	x	x	x
Health							x	x	x	x
Formal insurance								x	x	x
Informal insurance									x	x
Risk-aversion										x
Observations	1,482	1,009	1,482	1,482	1,482	1,345	1,238	1,232	1,214	1,201
Pseudo *R*-squared	0.20	0.12	0.16	0.22	0.19	0.22	0.23	0.24	0.24	0.24

Robust standard errors in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. "Individual interventions" is a dichotomous variable equal to 1 for all interventions in Study 1 except high subsidies, 0 otherwise. "Subsidy 90 100%" is a dichotomous variable equal to 1 if the individual received a subsidy o 90 or 100% in Study 1. "Informal Group Meeting" is a dichotomous variable equal to 1 if the individual was invited to an informal group meeting, 0 otherwise. "Control group Map 2" is the control group in Map 2. Column (1) is a probit regression with take-up as a dependent variable. The dependent variable in Column (2) is take-up after one year. Column (3) is an OLS regression of Take-up. Columns (4) and (5) are the two stages of an instrumental variable analysis. In Column (4), the dependent variable is "Attended", a dichotomous variable equal to 1 if an individual attended a real group presentation, 0 otherwise. In Column (5), "Attended" is instrumented with "Informal Group Meeting", the invitation to an informal group meeting. Columns (6), (7), (8), (9), and (10) include the exact same controls as in Table 1.

Table 6
Trust and knowledge of NHIF

	(1) Trust in NHIF	(2) Know NHIF? (1 = Yes 0 = No or somewhat)	(3) Low information on price of NHIF	(4) Hospital in last 2 years for you spouse or children?
Individual Interventions	0.06	−0.02	0.01	0.03
	(0.04)	(0.04)	(0.03)	(0.04)
Subsidy: 90 or 100%	−0.10	0.10***	−0.04	0.00
	(0.07)	(0.02)	(0.04)	(0.02)
Informal Group Meeting	0.10**	0.12*	−0.11**	0.04
	(0.05)	(0.06)	(0.05)	(0.04)
Control Group Map 2	0.01	0.07	−0.06*	0.03
	(0.08)	(0.04)	(0.03)	(0.03)
Lagged dependent variable	Yes	Yes	Yes	Yes
Control variables	Yes	Yes	Yes	Yes
Observations	1,190	1,204	1,204	1,204
R-squared	0.066	0.062	0.038	0.052
P-value of *T*-test of Informal group vs High Subsidy	0.02	0.75	0.24	0.45
Mean dep. var. in control group	3.41	0.41	0.33	0.16
SD dep. var. in control group	0.81	0.49	0.47	0.42

OLS regressions, robust standard errors in parentheses, * significant at 10%; ** significant at 5%; *** significant at 1%. In column (1), the dependent variable is the answer to the question "How much do you trust NHIF?", on a 4 point scale (1. Distrust completely, 2. Somewhat distrust, 3. Somewhat trust, 4. Trust completely). In column (2), the dependent variable is the answer to the question "Do you know about NHIF?" (1 = Yes, 0 = No or somewhat). In column (3), the dependent variable is a dichotomous variable equal to 1 if the respondent has very low information about the cost of NHIF (i.e., if the answer to the question "How much do you think NHIF costs per year?" is less than half or more than double the actual cost), 0 otherwise. In column (4), the dependent variable is "Have you, your spouse, or your children been to a hospital in last 2 years?" (1 = Yes, 0 = No). Following McKenzie (2012), we condition on the baseline level of the outcome variable to improve statistical power. The control variables are age, education, gender of the household head, household size, risk aversion, time preferences).

systematic way, approximately two weeks after the meetings, we tracked 40 chairpersons and asked (1) whether some group members were registered with the NHIF prior to the presentation, (2) whether these NHIF members required hospitalization in the last year, (3) got reimbursed by the NHIF, (4) talked about their experienced to the group, and (5) helped convinced other members to register. The chairpersons answered yes to these five questions in 24% of the groups. Column (1) of Table Appendix 10 shows that take-up is higher in these groups, although this evidence should be considered carefully, considering these interventions by early adopters were not experimentally manipulated and are thus potentially endogenous.

Early adopters also gave advice on the NHIF following the meetings. When we debriefed 167 households that attended a group meeting on average six months after the meetings, we asked "Have you discussed registration with group members who already had NHIF insurance?". We also asked what type of advice they obtained. Twenty percent of them received a positive advice (e.g.,

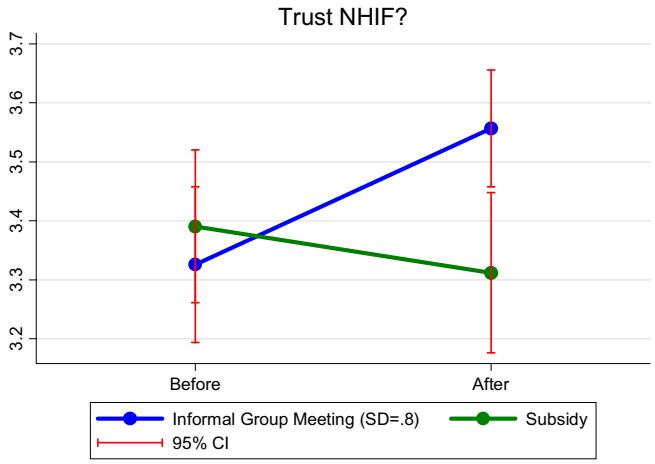

Figure 5. Trust in NHIF.

"I was told by my friend that when she was admitted in the hospital, the bill was covered by the insurance company"[27]). Twenty-four percent of them received a positive advice from a non-adopter. Only 3% of them received a negative advice.[28] Column (2) of Table Appendix 10 shows that take-up is higher after a positive advice by an early adopter.

Our main result could also be explained by imitation. In fact, we find that the chairpersons were registered with NHIF in 61% of the groups. People could simply be imitating what their group leader does. We find support for this hypothesis in Column (3) of Table Appendix 10 where we regress take-up on the take-up of the chairperson and find a positive (although not significant) effect, over and above discussions by early adopters.

Another explanation for our results may be peer pressure. As emphasized in the conceptual framework, peer pressure to register sicker individuals should be stronger in groups already providing informal health insurance. Eighty-six percent of the informal groups in Study 2 already provide informal health insurance, called "hospitality" in Kenya, as evidenced by the variable "Any group with hospitality in household?" in Table 1. We thus interact this variable with "Informal Group Meeting", to measure the differential take-up in groups with or without hospitality. Column (1) of Table 7 repeats the baseline estimates of Table 5, and Column (2) of Table 7 shows the result. There is not more take-up in groups with or without hospitality.

Even though they are not peer pressured to register, the sickest households might nonetheless register with NHIF (adverse selection). This may have consequences for insurance companies. To investigate this, we interact baseline health measures with the variable "Informal Group Meeting". Column (3) of Table 7 shows the results, using a dichotomous variable equal to 1 if any member of the household was admitted in a hospital in the last two years, 0 otherwise, as a health measure. Within the real group intervention, there is no evidence that those households that visited hospitals in the last two years are more likely to register. This result is confirmed in columns (4) and (5), when using our two other health measures from Table 1 ("Weeks missed from work/school/daily duties", and "Probability that you, spouse, or child hospital next year (Beads: 0 = Least likely, 10 = Most likely)". Overall, there is no evidence of adverse selection after informal group meetings.

Overall, this discussion suggests that social learning, in particular from early adopters of NHIF, could explain the main result of the paper. This may explain the failure of the local community leaders intervention in study 1. For this intervention, we purchased NHIF for these community leaders who did not have NHIF before. In the short time frame of the intervention, these community leaders did not have time to experience the system, and were thus unable to speak about the promise of NHIF. In contrast, some of the early adopters in the informal groups have experienced NHIF before, and were able to share their stories.

7. Cost-benefit of group presentations vs subsidies

To show the desirability of group presentations versus subsidies, we undertake a cost-benefit analysis of this group presentation intervention, compared to other interventions. Each presentation had an average of 38 members in attendance. Each meeting costs about 3410 Ksh (42 USD).[29] A 12% take-up rate in groups would see five people registering in this 38-member group.

Using a full subsidy to register five people would necessitate meeting 11 people, since according to our estimates, only 45% would take up. Even if the costs of meeting these 11 people were zero, paying a full subsidy to five individuals over the course of one year would cost $5 * 1,920 = 9,600$ Ksh (120 USD), significantly more than organizing one group presentation.

Moreover, retention after one year of full subsidies is zero. This is in sharp contrast with a take-up of 7% one year after the group presentations, and significant word of mouth in the community because of these group presentations. Out of the 2,029 attendees, 174 households not in our sample were registered a year later, and 99 individuals not in these groups came to our office to register because they heard about the group presentations. Group presentations, more than subsidies, created a process of registration to formal health insurance in this community. Group presentations are thus more cost-effective than subsidies at raising take-up.

8. External validity

How generalizable are these findings to other communities? As evidenced in Table Appendix 8, this community shares common features with other rural communities in the Central province of Kenya in particular, and Kenya in general, in terms of basic socioeconomic characteristics.

Respondents were initially selected in 2007 for their potential interest in a community-based rural micro-hydro electrification project, that has not materialized yet. One might worry that people interested in getting electricity may be more entrepreneurial, open minded, or wealthier. These characteristics may also be associated with high interest in health insurance, and high take-up. Even though interventions are randomized, their effects would be overestimated, and findings could not be generalizable to other communities.

In fact, the failure of all interventions in Study 1 speaks against this hypothesis. Take-up is significantly lower than in other existing studies. Delivering information, offering assistance to register, or small subsidies did not increase take-up. Full subsidies temporarily increased take-up to 45%. Take-up went back to zero after

[27] Other quotes are: "she told me that the insurance is good because she has benefited from it, and it covers the bill that one cannot afford to pay", "the person whom she consulted had been hospitalized for 3 months and the NHIF paid all her bill", "she learnt that NHIF is good and keeps its promise", "she told her there was a time she was admitted at hospital and her bill was covered", "someone said NHIF is very important because they already benefited from it", "it has covered some of them who had huge hospital bills", "they told her about the good service offered by NHIF if one is hospitalized". In only one case, an individual received a negative advice: "they told me that NHIF card was delayed a lot. They regret registering".

[28] "She was told that whenever she delays the fee she will be penalized".

[29] For each group presentation, we distributed sodas and biscuits to each member. Sodas cost approximately 20 Ksh each, for a total of 760 Ksh on average per presentation. A box of biscuits cost 250 Ksh. The average cost of a taxi to transport two fieldworkers to each meeting was about 1000 Ksh. The daily salary of a fieldworker was 700 Ksh. The total for all of these costs was 3410 Ksh (42 USD).

Table 7
Heterogeneous effects

Interacting variable: X	(1)	(2) Group with hospitality?	(3) Hospital in past?	(4) Weeks lost	(5) Expect hospital?
Individual Interventions	−0.00	−0.00	−0.00	−0.00	0.00
	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)
Subsidy: 90 or 100%	0.36***	0.30***	0.38***	0.36***	0.39***
	(0.038)	(0.077)	(0.043)	(0.045)	(0.062)
Informal Group Meeting	0.09***	0.12**	0.10***	0.09***	0.08**
	(0.023)	(0.060)	(0.027)	(0.028)	(0.035)
Control Group Map 2	0.04**	0.04**	0.04***	0.04**	0.04**
	(0.016)	(0.016)	(0.016)	(0.016)	(0.017)
X		0.02**	0.03**	0.00	−0.00
		(0.011)	(0.015)	(0.002)	(0.003)
X∗Subsidy: 90 or 100%		0.08	−0.07	0.00	−0.01
		(0.088)	(0.081)	(0.012)	(0.017)
X∗Informal Group Meeting		−0.03	−0.02	0.00	0.01
		(0.065)	(0.055)	(0.010)	(0.011)
Constant	0.02***	0.00	0.02*	0.02**	0.02**
	(0.008)	(0.011)	(0.008)	(0.008)	(0.010)
Observations	1,489	1,457	1,489	1,457	1,336
R-squared	0.163	0.170	0.166	0.168	0.174

OLS regressions, robust standard errors in parentheses, * significant at 10%; ** significant at 5%; *** significant at 1%. In column (2), we interact X with "Subsidy: 90 or 100%", and with "Informal Group Meeting". We include level terms (X), and interacting terms. X is "Any group with hospitality in HH? (1 = Yes, 0 = No)" in column (2), "Hospital in last 2 years for you, spouse, or children? (1 = Yes, 0 = No)" in column (3), "Weeks missed from work/school/daily duties" in column (4), and "Prob you, spouse, or child hospital next year (Beads: 0 = Least likely, 10 = Most likely)" in column (5).

the subsidies were discontinued. This community thus represents a particularly challenging community for the purpose of health insurance take-up.

In light of this, the significant and large results of Study 2 are all the more striking. Thanks to a simple group intervention, take-up went up by 12 percentage points, close to the 18% take-up in the lowest income quintile in Ghana. In fact, the group intervention of Study 2 could potentially have even greater effects in slightly less disadvantaged communities (living above the poverty line of 1$ per day per capita, living closer than 2 h from an NHIF office or hospitals).

Another threat to the external validity of the findings is that the findings of this paper may only be applicable to contexts where informal groups exist already. In fact, informal groups can be readily identified in most developing countries. It is common practice for individuals in developing countries to be members of tight-knit informal groups (e.g., family groups, church groups, clans). For this paper, we use a particularly broad definition of informal groups, including ROSCAs, as well as clan or family groups, and church groups, which are likely to exist in different contexts.

9. Conclusion

In this paper, we present the first randomized experiment mobilizing informal groups to extend formal health insurance to the poor. We find that 12% of the group members register (with still a 7% take-up after one year), a remarkably large number compared to 45% take-up with a 100% subsidy (and 0% take-up after one year), and no take-up after offering (1) information, (2) assistance to register, (3) small subsidies of 2, 10, or 30%, (4) information from a respected community leader, (5) the possibility to contribute lower and more frequent payments, (6) the possibility to pay for insurance directly by cellphone, (7) a cover in case of default of payment of insurance premiums.

In an endline survey, we find that informal group meetings improve trust and knowledge of the product. Through a detailed qualitative debriefing, we find that a plausible explanation for this result is that previously registered members shared their positive experience about the NHIF which convinced others to take up. A direction for future research is to experimentally test this proposition.

Organizing meetings in existing informal groups is also a formidable way to reach people by leveraging on the system of fines punishing any absence, lateness, or lack of contributions. By targeting 208 households, we were able to reach 2,029 households. Overall, 169 registered, up to 174 one year after the group presentations.

Yet, the impact of organizing meetings, or any other intervention in this paper, is quite limited relative to the target of universal coverage. One may conclude that at given premiums, even informing households in an effective way may not be enough to increase take-up by necessary proportions. Our paper suggests that trust in the NHIF, or health insurance in general, may be an issue. A direction for future research would be to investigate the reasons for this low trust.

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Appendix A. Study 1

Suppose individuals start with an initial wealth of w. With probability p, they experience an accident, and incur the medical costs c. Individuals have a risk-averse utility function u, with $u' > 0$, and $u'' < 0$. The expected utility W is:

$$W = (1-p)u(w) + pu(w-c)$$

An individual may purchase insurance at a premium π, that reimburses a fraction γ of the medical costs in case of accident. In addition, individuals may experience a psychic cost X of pur-

Table 8
Comparison 2007 sample with 2009 Kenya population and housing census. The values displayed next to each outcome are Cohen-d values adjusted for uneven group size. The values in parentheses are *p*-values.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
	2007 sample	Census 2009											
		Central/Rural		Central		National/Rural		National		Western/Rural		Western	
			(1)–(2)		(1)–(4)		(1)–(6)		(1)–(8)		(1)–(10)		(1)–(12)
Household Head Age (Years)	47.57	47.32	0.01	44.16	0.21	44.65	0.18	42.00	0.35	44.91	0.16	44.29	0.20
			(0.42)		(0.00)		(0.00)		(0.00)		(0.00)		(0.00)
Spouse Age (Years)	40.28	39.52	0.05	37.50	0.20	36.03	0.31	34.72	0.43	35.81	0.33	35.56	0.35
			(0.01)		(0.00)		(0.00)		(0.00)		(0.00)		(0.00)
Marital Status: Single	0.05	0.03	0.12	0.04	0.02	0.01	0.29	0.03	0.12	0.01	0.46	0.01	0.37
			(0.00)		(0.00)		(0.00)		(0.00)		(0.00)		(0.00)
Marital Status: Married	0.82	0.93	0.43	0.92	0.36	0.96	0.70	0.95	0.56	0.96	0.74	0.96	0.70
			(0.00)		(0.00)		(0.00)		(0.00)		(0.00)		(0.00)
Marital Status: Divorced	0.01	0.02	0.03	0.02	0.03	0.01	0.00	0.02	0.01	0.01	0.01	0.01	0.01
			(0.01)		(0.01)		(0.10)		(0.04)		(0.23)		(0.18)
Has Car	0.056	0.035	0.11	0.052	0.02	0.021	0.24	0.043	0.06	0.015	0.32	0.021	0.24
			(0.00)		(0.33)		(0.00)		(0.00)		(0.00)		(0.00)
Has Television	0.39	0.31	0.18	0.40	0.03	0.16	0.63	0.28	0.24	0.16	0.62	0.18	0.53
			(0.00)		(0.14)		(0.00)		(0.00)		(0.00)		(0.00)
Walls: Stone	0.12	0.20	0.19	0.33	0.43	0.06	0.30	0.17	0.11	0.01	1.04	0.01	0.94
			(0.00)		(0.00)		(0.00)		(0.00)		(0.00)		(0.00)
Water Source: River/Pond/Stream	0.37	0.37	0.01	0.26	0.25	0.33	0.09	0.24	0.33	0.18	0.51	0.17	0.53
			(0.60)		(0.00)		(0.00)		(0.00)		(0.00)		(0.00)

Comparison 2007 sample with Kenya Integrated Household Budget Survey (KIHBS) 2005

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
	2007 sample	KIHBS 2005											
		Central/Rural		Central		National/Rural		National		Western/Rural		Western	
			(1)–(2)		(1)–(4)		(1)–(6)		(1)–(8)		(1)–(10)		(1)–(12)
Income	5050	4548	0.08	5959	0.12	3822	0.18	6458	0.06	3107	0.36	4132	0.15
			(0.02)		(0.00)		(0.00)		(0.007)		(0.00)		(0.00)
Household Head Age (Years)	47.58	49.98	0.16	45.97	0.11	47.35	0.01	44.34	0.21	47.93	0.02	45.39	0.14
			(0.00)		(0.00)		(0.48)		(0.00)		(0.52)		(0.00)
Spouse Age (Years)	40.28	41.92	0.12	39.09	0.09	38.38	0.14	36.72	0.27	39.27	0.08	37.41	0.22
			(0.006)		(0.02)		(0.00)		(0.00)		(0.08)		(0.00)
Religion: Protestant	0.54	0.52	0.05	0.51	0.07	0.43	0.22	0.44	0.21	0.52	0.06	0.52	0.06
			(0.15)		(0.03)		(0.00)		(0.00)		(0.13)		(0.07)
Walls: Stone	0.14	0.17	0.14	0.32	0.52	0.05	0.29	0.12	0.04	0.01	0.39	0.02	0.39
			(0.05)		(0.00)		(0.00)		(0.00)		(0.00)		(0.00)
Floors: Cement	0.58	0.37	0.43	0.52	0.12	0.21	0.86	0.39	0.39	0.13	0.97	0.30	0.59
			(0.00)		(0.00)		(0.00)		(0.00)		(0.00)		(0.00)
Water Source: River/Pond/Stream	0.37	0.29	0.17	0.23	0.31	0.29	0.18	0.21	0.40	0.19	0.39	0.15	0.51
			(0.00)		(0.00)		(0.00)		(0.00)		(0.00)		(0.00)
Distance to Water (min)	11.23	11.42	0.02	10.69	0.04	20.05	0.34	16.65	0.23	13.07	0.14	11.46	0.02
			(0.71)		(0.25)		(0.00)		(0.00)		(0.00)		(0.59)

Comparison 2007 sample with Kenya Demographic and Health Survey (DHS) 2008

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
	2007 sample	DHS 2008											
		Central/Rural		Central		National/Rural		National		Western/Rural		Western	
			(1)–(2)		(1)–(4)		(1)–(6)		(1)–(8)		(1)–(10)		(1)–(12)
Has Car	0.056	0.41	0.07	0.47	0.04	0.027	0.16	0.070	0.06	0.017	0.18	0.029	0.12
			(0.06)		(0.23)		(0.00)		(0.00)		(0.00)		(0.00)
Has Television	0.39	0.33	0.12	0.36	0.06	0.16	0.55	0.29	0.22	0.17	0.47	0.21	0.37
			(0.00)		(0.06)		(0.00)		(0.00)		(0.00)		(0.00)
Household Head Age (Years)	47.58	48.42	0.06	46.85	0.05	46.20	0.09	43.80	0.24	48.00	0.03	45.57	0.13
			(0.13)		(0.17)		(0.00)		(0.00)		(0.48)		(0.00)
Spouse Age (Years)	40.28	42.00	0.10	40.61	0.02	38.33	0.14	36.96	0.25	38.52	0.10	37.02	0.19
			(0.007)		(0.58)		(0.00)		(0.00)		(0.00)		(0.00)
Household Head Education (Years)	8.34	7.00	0.29	7.35	0.21	5.59	0.61	7.07	0.23	6.23	0.42	6.74	0.34
			(0.00)		(0.00)		(0.00)		(0.00)		(0.00)		(0.00)
Spouse Education (Years)	7.79	6.99	0.21	7.28	0.13	5.25	0.63	6.53	0.28	6.15	0.43	6.48	0.34
			(0.00)		(0.003)		(0.00)		(0.00)		(0.00)		(0.00)
Number of Children	1.59	1.68	0.06	1.62	0.02	2.32	0.40	1.98	0.22	2.44	0.57	2.24	0.43
			(0.08)		(0.50)		(0.00)		(0.00)		(0.00)		(0.00)
Marital Status: Single	0.05	0.07	0.10	0.08	0.15	0.04	0.01	0.08	0.15	0.02	0.13	0.03	0.07
			(0.00)		(0.00)		(0.57)		(0.00)		(0.00)		(0.05)
Marital Status: Married	0.82	0.69	0.31	0.69	0.32	0.74	0.19	0.72	0.21	0.74	0.19	0.74	0.17
			(0.00)		(0.00)		(0.00)		(0.00)		(0.00)		(0.00)
Marital Status: Divorced	0.01	0.07	0.37	0.08	0.40	0.05	0.20	0.06	0.20	0.04	0.20	0.05	0.22
			(0.00)		(0.00)		(0.00)		(0.00)		(0.00)		(0.00)

Table 9
Statistical power of experimental design of Study 1

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Effect size = 20%				Effect size = 12%			
	Information	Information + Partial Assistance	Information + Full Assistance	Total	Information	Information + Partial Assistance	Information + Full Assistance	Total
Subsidy: 2%	90	98	79	100	55	73	43	92
Subsidy: 10%	98	87	92	100	70	50	56	93
Subsidy: 30%	97	95	95	100	69	62	64	95
Total	100	100	100	100	95	95	90	100
Community leader			100				97	
+ Subsidy: 10%			95				64	
+ Chicken			100				89	
+ Incentive to Community leader: 10%			92				57	
Total commmunity leader			100				100	
160 Ksh per month			99				79	
+ Payment by M-pesa			99				80	
+ Cover in case of non-payment			100				99	
Total 160 Ksh per month			100				100	
Subsidy: 90%			100				98	
Subsidy: 100%			100				98	

Note: statistical power is indicated in percentage terms. 10% significance level, pooled standard deviation of take-up in all control and treatment groups: 0.27, size of control group: 365.

chasing insurance (transaction costs to register, fear of showing lack of solidarity to existing informal group...). The expected utility W_I of an insured individual is:

$$W_I = (1-p)u(w-\pi-X) + pu(w-\pi-X-c+\gamma c)$$

Since u is concave, $\frac{\partial W_I}{\partial \gamma} = pcu'(w-\pi-X-c+\gamma c) > 0, \frac{\partial W_I}{\partial X} < 0$, and $\frac{\partial W_I}{\partial \pi} < 0$. Interventions providing information on the benefits of insurance (to increase γ), providing assistance to register (to decrease X), and providing subsidies (to reduce π) unambiguously increase the demand for insurance.

Appendix B. Study 2: Social learning on claims reimbursement

The key concern raised in Study 2 is that individuals may not know ex-ante what γ, the fraction of medical costs reimbursed, is. The intuition of this Study is that γ may depend positively on the advice a of (1) previously registered NHIF members, (2) in one's circle of respected friends, i.e. the informal risk-sharing group, (3) who got reimbursed by NHIF, (4) and shared his experience in the group.

Since u is concave, $\frac{\partial W_I}{\partial a} = pcu'(w-\pi-X-c+\gamma c)\gamma'(a) > 0$. More advice by early adopters may raise formal health insurance take-up.

Appendix C. Peer pressure in groups

We call h, the hospitality paid by each member when one group member is admitted to a hospital. Suppose now that there are N healthy and 1 sick group members,[30] with respective probabilities p_L (low) and p_H (high) to fall sick. The welfare $W_{G,S}$ for a healthy individual (without any formal health insurance) in a group G with one sick member S:

$$W_{G,S} = (1-p_L)u(w-p_L(N-1)h-p_Hh) + p_Lu(w-p_L(N-1)h - p_Hh + Nh - c)$$

If the sick individual registers with NHIF, and is not part of the group anymore:

$$W_{G,-S} = (1-p_L)u(w-p_L(N-1)h) + p_Lu(w-p_L(N-1)h+(N-1)h-c)$$

As p_L is low, the healthy group member benefits by not having to pay hospitality to the sick member. In case of sickness, the hospitality is reduced to $(N-1)h$ since the sick member is not asked to contribute. For a risk-neutral individual, the gain of selecting out the sick member is:

$$W_{G,-S} - W_{G,S} = (1-p_L)p_Hh - p_L(-p_H+1)h = (p_H-p_L)h > 0$$

The intuition for this result is that the healthy member has to contribute less to the sick member (but also gets some reduced hospitality). A healthy member should thus be willing to compensate, or apply pressure on, sick members up to $(p_H-p_L)h$.

For a sick individual, the utility function of being part of the group is:

$$W_G = (1-p_H)u(w-p_LNh) + p_Hu(w-p_LNh+Nh-c)$$

which for a risk-neutral individual collapses to $W_G = w + (p_H-p_L)Nh - p_Hc$

The utility function of registering with NHIF is:

$$W_I = (1-p_H)u(w-\pi-X) + p_Hu(w-\pi-X-c+\gamma c)$$

which for a risk-neutral individual collapses to $W_I = w-\pi-X-p_H(1-\gamma)c$.

For a sick individual, being in a group is beneficial since they pay low hospitality to others (since others are healthy), but receive high overall hospitality. Sick members should have even less incentive than healthy members to join NHIF. However, if each healthy group member compensate the sick member up to their gain established above $(p_H-p_L)h$, then registering with NHIF becomes more attractive. Adverse selection should thus be exacerbated in groups. Peer pressure will also be higher in groups with low social distance.

[30] One could imagine the opposite situation with 1 healthy and N sick group members. In this case, the healthy member has strong incentive to defect to NHIF to avoid paying high hospitality payments. This would generate advantageous, not adverse, selection. We argue that this is unlikely to happen since an individual would be subject to fines, or exclusion from groups providing social support, credit, savings, and other types of insurance, in case of non-payment of hospitalities.

Table 10
(Dependent variable: Take-up of NHIF)

	(1)	(2)	(3)
Early adopters talked about positive experience?	0.105		0.111
	(0.041)**		(0.043)**
Group leader has NHIF?			0.003
			(0.018)
Positive advice by early adopter		0.192	
		(0.093)**	
Positive advice by non-adopter		−0.085	
		(0.068)	
Negative advice by early adopter		−0.153	
		(0.047)***	
Negative advice by non-adopter		−0.260	
		(0.058)***	
Constant	0.066	0.196	0.072
	(0.010)***	(0.039)***	(0.011)***
Observations	1572	167	1357
R-squared	0.02	0.05	0.03

OLS regressions, robust standard errors in parentheses, * significant at 10%; ** significant at 5%; *** significant at 1%. In column (1), "Early adopters talked about positive experience?" is a dichotomous variable equal to 1 if any of the group members already registered with NHIF required hospitalization in the last year, got reimbursed by NHIF, talked about their experienced to the group, and helped convinced other members to register. The sample includes all individuals in the groups. Our sample consists of only 1572 out of the 2029 total attendees of group meetings, since we debriefed only 40 chairpersons. Standard errors are clustered at the group level. In column (2), "Positive advice by early adopter" is a dichotomous variable equal to 1 if the individual received a positive advice by an early adopter. The sample includes 167 attendees. In column (3), "Group leader has NHIF?" is a dichotomous variable equal to 1 if the group leader has NHIF, 0 otherwise.

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