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Health Insurance, a Friend in Need?

Evidence from Financial and Health Diaries in Kenya

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INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

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ABSTRACT

Health insurance can protect consumption from health shocks, but it can also crowd out informal transfers. This paper examines whether health insurance improves consumption smoothing in the face of health shocks, and to what extent results depend on households' access to informal transfers as a risk coping strategy. Using high-frequency panel data on health and finances collected in rural Kenya, we show that mobile money users have stronger access to informal transfers than nonusers. We further find that health shocks induce nonusers of mobile money to lower their nonhealth expenditures by approximately 25 percent in weeks when they are uninsured. These same households are able to smooth consumption in weeks with insurance coverage, due to lower out-of-pocket health expenditures. In contrast, mobile money users are able to smooth consumption when experiencing health shocks even in the absence of health insurance, due to an inflow of informal transfers. For this group, health insurance improves healthcare utilization and does not crowd out the inflow informal transfers during weeks with health shocks. These findings have implications for the design of health insurance and mobile health financing products.

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Health Insurance, a Friend in Need?
Evidence from Financial and Health Diaries in Kenya

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July 26, 2017

Abstract

Health insurance can protect consumption from health shocks, but it can also crowd out informal transfers. This paper examines whether health insurance improves consumption smoothing in the face of health shocks, and to what extent results depend on households' access to informal transfers as a risk coping strategy. Using high-frequency panel data on health and finances collected in rural Kenya, we show that mobile money users have stronger access to informal transfers than nonusers. We further find that health shocks induce nonusers of mobile money to lower their nonhealth expenditures by approximately 25 percent in weeks when they are uninsured. These same households are able to smooth consumption in weeks with insurance coverage, due to lower out-of-pocket health expenditures. In contrast, mobile money users are able to smooth consumption when experiencing health shocks even in the absence of health insurance, due to an inflow of informal transfers. For this group, health insurance improves health- care utilization and does not crowd out the inflow informal transfers during weeks with health shocks. These findings have implications for the design of health insurance and mobile health financing products.

Keywords: mobile money; remittances; health insurance; informal risk-sharing; Africa; Kenya

JEL codes: D14, I13, O15

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1 Introduction

In low- and middle-income countries, households pay a large share of health expenditures out of pocket. To cope with these expenditures, they rely on self-insurance through precautionary savings (Rosenzweig and Wolpin, 1993), adjustments in labor supply (Kochar, 1995), informal credit (Udry, 1994), and informal transfers in the form of gifts and remittances (for example, Lucas and Stark, 1985; Rosenzweig and Stark, 1989; Fafchamps, 1992; Fafchamps and Lund, 2003; De Weerdt and Dercon, 2006). However, these coping strategies provide incomplete insurance; several studies have found that households are unable to fully smooth consumption when household members fall ill (Morduch, 1999; Gertler and Gruber, 2002; Gertler et al., 2006; Wagstaff, 2007; Heltberg and Lund, 2009), and that they underutilize both preventive and curative healthcare (Dupas, 2011).

To reach universal health coverage and ensure access to quality healthcare without harsh financial consequences for households in need of healthcare, policy makers have started introducing health insurance for the poor. Health insurance allows households to prepay for healthcare, thereby reducing the share of catastrophic health expenditures that households need to pay out of pocket. As such, health insurance potentially improves both consumption smoothing and health-seeking behavior. However, if informal transfers and formal health insurance play similar roles in the presence of health shocks, health insurance may replace informal transfers without generating additional impacts, or even result in increased medical spending (Wagstaff, 2007). The anticipation of such subsitution effects could explain why several health insurance pilots have found relatively low demand (Acharya et al., 2012).

This paper therefore tests whether health insurance improves consumption smoothing and health-seeking behavior for households coping with health shocks, and analyzes to what extent these impacts depend on households' access to informal transfers. To do so, it uses detailed, high-frequency panel data from the Health and Financial Diaries project (Janssens et al., 2013). The project provides weekly measures of illnesses, healthcare utilization, and total out-of-pocket health expenditures, as well as informal transfers and nonhealth expenditures on food and other items. These data were collected over the period of a full year among a sample of rural households in western Kenya. Half of the households were enrolled in a health insurance scheme at baseline, and many of them dropped out of the scheme at least temporarily during the course of the year. Further, some of the noninsured households enrolled during the study year. Hence, for nearly half of all households, enrollment status varied over time. We will use this within-household variation in insurance status in the identification of health insurance impacts.

We also test whether these impacts depend on households' access to informal transfers. To that end, the analyses distinguish between nonusers and users of mobile money. During the study period, approximately half of all study households were using mobile money. We show that these households had better access to informal transfers than nonusers. This difference could arise for two reasons: an impact of mobile money itself and selection into using mobile money. First, mobile money technologies substantially reduce the transaction costs of sending and receiving remittances. By making it easier to receive informal transfers, the expansion of mobile money has been shown to protect consumption from weather-related shocks, illnesses, and injuries (Jack and Suri, 2014). Second, households using mobile money accounts will have signed up because they expected to use it. They will have larger social networks, including friends and family who send transfers via mobile money. Mobile money usage can hence be an indicator for the size of one's social network.[1]

We analyze the effects of health insurance on households' ability to smooth consumption, health-seeking behavior, health expenditures, and informal transfers when experiencing an illness or injury, using a household fixed-effects model and controlling for seasonality through week fixed effects. Building on time variation in insurance status within households, the fixed-effects model adjusts for unobserved heterogeneity between insured and uninsured households, for instance due to selection into insurance on the basis of household wealth or household members' health needs. The model tests whether the same household copes differently with illness or injury depending on whether the household has insurance coverage. Under the assumption that the decision to enroll or drop out is not driven by time-varying characteristics that affect our outcome variables, which we show is a plausible assumption in our context, we can attribute differences in behavior to variation in a household's health insurance status.

We find two distinct effects of health insurance. First, among nonusers of mobile money, who have weaker access to informal transfers, health shocks decrease nonhealth expenditures in subsequent weeks.

[1] We do not aim to disentangle these two mechanisms here, given that the nature of our data does not allow us to estimate the impacts of mobile money. Rather, we are interested in whether health insurance can have different impacts for nonusers versus users of mobile money, because the latter group may already have alternative ways to cope with health shocks.

Health insurance eliminates this effect. Insurance coverage also reduces out-of-pocket health expenditures significantly, providing an explanation for why insured households are better able to smooth consumption. Second, among mobile money users, who have stronger access to informal transfers, health shocks do not affect nonhealth expenditures. When uninsured, these households receive more informal transfers in weeks with health shocks, suggesting that they are protected financially by their social networks. In this way, health insurance and informal transfers could be substitutes. However, health insurance does not crowd out informal transfers, and it increases the utilization of clinics while also lowering out-of-pocket expenditures in these clinics. Thus, by shifting patients from the informal health sector to formal clinics, insurance complements the informal transfers that help mobile money users cope with health shocks.

This paper contributes to the existing literature in several ways. First, it adds to the literature on health insurance impacts in low- and middle-income countries. Past research shows that health insurance can improve health-seeking behavior; reduce catastrophic health expenditures, thereby providing financial protection from health shocks; and in some cases improve nonmedical consumption (Wagstaff and Pradhan, 2005; Hamid et al., 2011; Fink et al., 2013; Miller et al., 2013), although studies that find no impacts do exist (Acharya et al., 2012). These studies mainly rely on low-frequency data, collected over a period of at least one to two years. High-frequency data can, however, help improve the power to detect impacts, especially for dependent variables with low autocorrelation (McKenzie, 2012). Further, given that longer recall periods are associated with underreporting of morbidity, doctor visits, and sickness absenteeism (Das et al., 2012), shorter recall periods (of, in our case, only a week) can improve impact estimates. We find impacts independent of whether health shocks allowed patients to carry out their daily activities, including health shocks that patients could have easily overlooked in a survey six months later. These findings highlight the advantages of using high-frequency measurement in evaluating the impacts of health insurance.

Second, the paper relates to the literature on linkages between formal insurance and informal transfers. So far, this literature has mainly focused on how informal transfers crowd out the demand for formal insurance. Using observational data, Mobarak and Rosenzweig (2012) showed that informal risk sharing in caste groups reduces demand for formal weather insurance. Informal transfers may discourage individuals from purchasing optimal levels of formal health insurance coverage (Jowett, 2003), in part because they can rely on contributions from insured peers when they fall ill (Janssens and Kramer, 2016). Studies on whether health insurance crowds out informal transfers are rare. However, social security, pensions, and food aid have been shown to crowd out private transfers, reducing program impacts (Cox and Jimenez, 1992; Dercon and Krishnan, 2003; Jensen, 2004), and similar results may hold for health insurance.

Third, the paper relates to the literature on mobile money. Mobile money can improve health financing by reducing the cost of sending and receiving transfers (Jack and Suri, 2014), and by allowing recipients to spend transfers differently compared with those who receive transfers manually (Aker et al., 2016). In this way, mobile money provides access to informal transfers for recipients who incur health expenditures, enabling them to finance their own healthcare. Health insurance could crowd out these inflows of mobile money. At the same time, when uninsured households spend gifts and remittances on self-medication and other forms of informal care, health insurance—which covers healthcare only in clinics and hospitals—could improve healthcare utilization without crowding out informal transfers. We indeed find evidence of this mechanism, indicating that prepaid healthcare in clinics and hospitals has positive impacts even for mobile money users, despite their ability to finance their own healthcare when going to less formal providers.

The remainder of this paper is structured as follows. The next section describes the study context, sampling methodology, and data collection instruments. Section 3 presents the empirical methodology and the main variables of interest. The econometric results are presented in Section 4. The final section interprets our findings and concludes with a discussion on what implications these findings have for the design of health insurance and mobile health financing products.

2 Context and Data

2.1 Intervention

The study uses data collected among a sample of dairy farmers from Nandi County, a predominantly rural area in western Kenya characterized by poor access to affordable quality healthcare.[2] At the time of the study,

[2] Nandi County had a population of 752,965 in the 2009 National Population and Housing Census, and the area is typical of rural Kenya, with a poverty rate of 47.4 percent, primary school attainment of approximately 67.3 percent, and secondary school attainment of only 10.7 percent according to the Kenya Integrated Household Budget Survey (KIHBs) 2016/2017. With only 13.6 percent of this population living in urban areas, agriculture—including dairy farming—is the main economic activity in the area.

Kenya's national health insurance scheme, the National Hospital Insurance Fund (NHIF), covered inpatient care in public hospitals but not health expenditures in private facilities or expenditures for outpatient care. Hence, despite the existence of the NHIF, households still pay 38.7 percent of total health expenditures out of pocket (Kenya National Health Accounts 2012/2013). In addition, illnesses and injuries may pose financial hardship due to the high costs of transportation to better but often more distant health facilities, and due to forgone income when household members cannot work.

To improve the quality and affordability of healthcare in Nandi County, the PharmAccess Foundation—a nongovernmental organization with the mission to strengthen health markets in Africa—developed the Tanykina Community Health Plan (TCHP). This insurance scheme was implemented in partnership with the Kenyan insurance company AAR and the Tanykina Dairy Plant Ltd., a farmer-owned dairy organization in Nandi County. Financially supported by the Health Insurance Fund, the TCHP was launched in 2011 for all Tanykina members, and later for members of other dairy organizations as well as the general public residing in program locations. At the onset of the study, the TCHP was available only to farmers supplying their milk to Tanykina. The program intended to improve access to primary and secondary healthcare, in both public and private health facilities, by crowding in private health financing through nonsubsidized insurance premiums.[3]

The TCHP includes interventions targeting both supply and demand in healthcare markets. On the one hand, the scheme aims at improving the quality of healthcare by implementing quality standards, financing for initial facility upgrades, and regularly monitoring visits to facilitate quality improvement. On the other hand, the TCHP introduces health insurance, allowing households to prepay for quality healthcare. Families enrolling in the TCHP are able to use covered healthcare services free of charge in facilities that are part of the insurance network. In the absence of such quality-enhancing interventions, health insurance schemes may have lower impacts (Thornton et al., 2010), and without quality monitoring, adverse provider incentives can even lead to negative health impacts (Fink et al., 2013).

Our analyses use two sources of variation in a household's monthly insurance status. First, although the payment of the monthly insurance premium was automated, Tanykina deducted the premium from enrolled

[3] The program subsidized only marketing and administration costs, making the insurance premium actuarially fair for enrollees who were expecting to incur the average level of health expenditures in the region in the absence of health insurance.

families' monthly milk payments, which are based on the quantity of milk delivered to the dairy. If milk payments were insufficient to pay the insurance premium, for instance because the household did not deliver enough milk throughout the month, the household needed to pay the premium in another way, for instance in cash.[4] If a payment did not occur in time, the household was suspended from receiving free TCHP healthcare services for one month. If a household did not pay for two months in a row, it was dropped from the insurance scheme. This design created variation in insurance status within households over time.

Second, several households dropped out following a redesign of the insurance program. At the onset of the study, the benefit package included both outpatient and inpatient coverage (the "comprehensive package"), and the premium depended on the size of the household. In April 2013, halfway through the study, the TCHP introduced an additional, cheaper package, which consisted of outpatient care only (the "basic package"), and all premiums became fixed, irrespective of household size. The basic and comprehensive packages were priced at KSh 300 and 1,100 KSh per month per family, respectively.[5] After this redesign, all households were approached to select one of the two packages, and those who did not actively select a package were dropped from the plan.[6] In our sample, 31.7 percent of insured households decided not to renew their insurance policy. Among renewing households, approximately 24.2 percent opted for the basic package and the remaining 75.8 percent kept the comprehensive package.

In assessing whether a health insurance scheme has positive impacts, it is important to consider households' alternative risk-coping strategies, including informal transfers. Urban-rural remittances appear to play an important role in health financing in eastern Africa. De Weerdt and Hirvonen (2016), for instance, found a reduction in Tanzanian migrants' consumption in years after their extended family (still at home) experienced negative shocks such as a serious illness, suggesting that these migrants were sending money home to help their family pay the medical bills. When households receive informal transfers to cope with health shocks, there is less scope for health insurance to provide financial protection from catastrophic health expenditures

[4] The premium was deducted from the monthly milk payment before deductions for other services from Tanykina, including veterinary services, agricultural inputs, or cash advances. Hence, only milk production, milk prices, and the quantity of milk sold could influence farmers' ability to pay the premium through their milk accounts.

[5] KSh: Kenya shilling. The value of KSh 1,000 was approximately US$11.50 at the time of data collection.

[6] At this time, the TCHP also opened up to the general population, including households that were not members of Tanykina. Because the TCHP was available only to members of Tanykina at the study design phase, data collection was limited to Tanykina members and their households.

and to improve health-seeking behavior.

Informal transfers to cope with health shocks have been facilitated by the rapid expansion of mobile money. Kenya is one of the first countries in the world with a successful expansion of mobile money, which was introduced there through a product known as M-Pesa. This relatively cheap and convenient technology provides financial inclusion to households without access to formal banking services. In 2014, 58 percent of adults in Kenya had a mobile money account, and by the end of 2015, the service had more than 20 million registered customers and a network of about 85,756 agents. Mobile money is also expanding in other countries in sub-Saharan Africa, with roughly 12 percent of adults having a mobile money account in 2014 (Demirgüç-Kunt et al., 2015). In Kenya, the expansion of mobile money has provided households with consumption insurance for health- and weather-related shocks (Jack and Suri, 2014).

In this environment, health insurance will not add value if it merely substitutes for remittances. However, evidence of extensive monitoring by remitting household members suggests that there is scope for health insurance to have positive impacts. De Laat (2014) finds that migrants do not remit unconditionally. Rather, before remitting, they invest considerable resources into information acquisition, for instance to validate whether indeed there is a health shock in the household back home. Health insurance may help recipients avoid such extensive monitoring from remitting household members and thereby reduce costs for remitting household members, in addition to having positive impacts on health-seeking behavior and consumption smoothing for recipient households.

2.2 Data

To test whether health insurance provides consumption insurance from health shocks and improves health-seeking behavior, we use high-frequency data collected as part of the Financial and Health Diaries project (Janssens et al., 2013) (henceforth referred to as "the diaries"). Data collection took place between October 2012 and October 2013, before mobile money usage in Kenya was near-universal. The aim of the diaries was to enhance understanding of the health-seeking behavior and financial lives of households targeted by the TCHP, and data collection was funded by the PharmAccess Foundation.

Table 1 provides information regarding sample size, attrition, and nonresponse. Three Tanykina dairy collection areas were selected to implement the diaries. These collection areas were close enough to a clinic that distance would not be a major barrier to using healthcare or enrolling in the TCHP. From these three collection areas, we randomly selected seven villages with a minimum of 25 Tanykina member households each, and from these seven villages, we sampled in total 120 households with 184 respondents and 564 household members. Sampling was proportional to the total number of Tanykina members in the seven study villages and stratified by insurance status, in order to create a baseline with around 50 percent of households being insured.[7]

[Table 1 about here]

The diaries included weekly interviews with 120 households for the duration of a full year. All economically active adults in a household, male and female, or 68.9 percent of adults, were interviewed separately and in private.[8] They provided detailed information on all financial flows within a household in the seven days preceding each interview, including all cash in- and outflows (for instance income, expenditures, gifts, and savings) from their financial tools (such as cash, bank accounts, M-Pesa, and saving groups). Thus, in some households, the diaries included two or more respondents.

Each week, at least one respondent in the household also provided information on agricultural production and consumption of self-produced foods, for instance milk, as well as shocks to household wealth, including illnesses, injuries, and health-seeking behavior. The health module covered not only adult respondents but also other household members, including children and financially inactive adults. The module probed for all health events, including major and minor illnesses and injuries (including symptoms and the number of days that the ill or injured household member was unable to work) as well as any healthcare utilization (including provider choice, out-of-pocket expenditures, and types of services received). If other respondents described health shocks not yet listed by the first respondent, these were added.

Before the onset of the weekly interviews, all households included in the diaries study completed a baseline survey. Further, during the period in which the diaries were collected, data collection also included monthly market surveys; quarterly inventories of respondents' assests and liabilities; and experimental games

[7] Sampling of insured (uninsured) households within each village was proportional to the number of insured (uninsured) households in a village relative to the total number of insured (uninsured) households in the seven sampled villages.

[8] The remaining 31.1 percent of adults included students dependent on their parents, disabled people, and the elderly.

to elicit risk aversion, time preferences, and social preferences. After the diaries concluded, participants took an endline survey. A separate TCHP dataset provides information on monthly enrollment, renewal, and suspension of insurance coverage for the individuals in the sample.

2.3 Attrition and Nonresponse

Panel B of Table 1 summarizes attrition at the household and respondent levels. Only two complete households (1.7 percent) dropped out of the sample during the course of the study. The three respondents in these households are included in the analysis up to the week in which their households dropped out. The number of individual respondents dropping out was also small: only eight respondents dropped out while their households continued their participation in the study.[9] In one household, this was because the head deceased. The remaining seven drop-outs were due to individuals leaving the household for reasons not related to health.

Panel C of Table 1 describes nonresponse among the 118 households who did not drop out.[10] If a respondent could not be interviewed in a given week, this person's financial transactions are missing for that week. Health data are missing for a given week only if none of the respondents in the household were available that week. The potential number of complete household interview weeks is 6,136, which is the number of weeks times the number of households that did not drop out. In 77.3 percent of the potential interview weeks, all respondents were present and interviewed. In 15.4 percent of the weeks, one or more respondents were absent, but at least one household member was interviewed; thus, health data are available for 92.2 percent of all weeks. In the remaining 7.3 percent of the weeks, none of the respondents were interviewed.

The financial data can be aggregated at the household level in a particular week only if all respondents were present, which was the case in 77.3 percent of potential weeks. To avoid dropping the 15.4 percent of interview weeks in which financial data are available for some but not all respondents, we replace missing values in the financial data by the respondent's yearly average when health data are available for that week. We then aggregate the financial data at the household level by calculating for every week the deviation

[9] This excludes 23 respondents who were interviewed fewer than ten times, mostly because they were working (for example, in town) at the time of the interviews. We drop these individuals from our analyses and attrition calculations.

[10] Thus, this panel excludes respondents from the two households that dropped out, but they are included in the analyses until they drop out.

from the household average. This methodology applies to all continuous-outcome variables, including total out-of-pocket health expenditures, other expenditures, and remittances. The total deviation from household members' average levels in a household serves as the outcome variable for the financial data, and household members who were not interviewed do not contribute to the deviation.

2.4 Household Characteristics

Columns (1) and (2) in Panel A of Table 2 describe the demographic and socioeconomic characteristics of the sample. The average household head is 51.7 years old and 65.8 percent of heads are male. The average household has 4.9 household members, half of whom are children. The vast majority of households identify themselves with the Protestant church. Of all household heads, 78.1 percent have completed primary education and 44.8 percent have also completed secondary education. Most household heads are engaged in both farming and livestock, and 22.4 percent (also) run a business. On average, households own 1.9 mobile phones. A little more than half of adult respondents used mobile money at least once during the year of data collection.

[Table 2 about here]

Panel B of Table 2 summarizes our main explanatory variables: the incidence of health shocks and insurance coverage. For health shocks, we use two definitions: a broad definition, according to which a household experiences a health shock if at least one family member reports having health symptoms; and a more narrow definition that focuses only on health symptoms due to which the family member is unable to do his or her daily activities (such as going to school, working, or doing domestic chores) for at least one day. Thus, the narrow definition focuses on more serious health shocks, which likely require healthcare and are more likely to be reported in surveys with longer recall, as opposed to minor symptoms such as a mild headache or cold. Households experience several health shocks during the year: on average, they report a health shock in 13.1 interview weeks (27.4 percent) and a severe health shock in 8.0 interview weeks (17.1 percent).

Table 2 also presents more information regarding health insurance status. In total, 57 households (47.5 percent) had insurance coverage for at least one month during the data collection period. Of them, 45 households (78.9 percent) had insurance coverage for only part of the year. Using this variation in insurance status during the year, we identify the impacts of health insurance by comparing behavior in weeks without and with health insurance coverage. Insurance status varies within the year for three reasons: eight households were not enrolled at baseline but enrolled later in the year; others were temporarily suspended for one or more months due to failure to pay the monthly premium; and several households dropped out after being suspended as well as after the redesign of the TCHP.

Panel C of Table 2 describes the dependent variables. Our first set of outcome analyses will test whether nonhealth expenditures are protected from health shocks in weeks without and with health insurance coverage. Total nonhealth expenditures are disaggregated into food expenditures and nonfood expenditures, because food expenditures are closely associated with food consumption and households may prefer to smooth food consumption rather than nonfood expenditures. On average, households spend KSh 487 per week on food, whereas they spend on average KSh 1,839 per week on other items.[11]

A second group of outcome variables focuses on health-seeking behavior. Households seek healthcare in 10.0 percent of all interview weeks, and the 110 households that ever report health symptoms seek healthcare in 78.2 percent of all weeks with a health shock. Patients can forgo care, buy drugs at an unqualified drug vendor or shopkeeper and self-medicate, go to traditional healers, visit a qualified pharmacy for drugs, or consult a healthcare professional at a clinic or hospital. They opt for the latter ("facilities") in 6.0 percent of all interview weeks, and in 45.2 percent of all weeks in which they report a health shock. Average health expenditures, which include costs of consultation, drugs, laboratory tests, registration, and other items/procedures, but not the amount paid by the insurance company or transportation costs to the health provider, are KSh 19.9 per interview week and KSh 211 per health visit.

A final group of outcome variables relates to informal transfers received from family, friends, neighbors, or other people in the household's social network. This includes any gifts and remittances that individual respondents report having received in the week between interview. Households receive transfers in 11.3 percent of all weeks. On average, they receive KSh 142 per week, or KSh 1,247 in weeks that they receive a transfer.

[11] Food expenditures as a proportion of total expenditures might be smaller than in standard consumption surveys because our nonfood expenditure estimates include expenditures for agriculture and business.

2.5 Users versus Nonusers of Mobile Money

Columns (3)–(6) in Table 2 describe these characteristics separately for users and nonusers of mobile money, and test for differences in means between the two household types. We define mobile money users as households that ever use mobile money to send or receive money during the study year. The study period was well before mobile money coverage became near-universal in Kenya. As a result, only 55.0 percent of study households used mobile money at some point during the diaries year, with 544 mobile money transactions recorded in total. This is 0.4 percent of all financial transactions, suggesting that households use mobile money only when necessary and for relatively large transaction amounts.

In Panel A, we find that users and nonusers are fairly similar in terms of demographic characteristics, and we find no evidence of differences in most socioeconomic characteristics either. However, users are significantly less likely to be engaged in business, and not surprisingly, they have significantly more mobile phones compared with nonusers. Panel B focuses on health shocks and insurance. Although mobile money users and nonusers are equally likely to have insurance coverage in at least one month of the diaries, and although there are no differences in whether their insurance status varies over time, users of mobile money are significantly more likely to report health shocks compared with nonusers. Thus, mobile money users are either less healthy or self-report more health shocks than nonusers of mobile money.

Panel C finds that mobile money users also have significantly higher nonhealth expenditures, both on food and nonfood items. Further, they are more likely to seek healthcare than nonusers, in part because they are more likely to report health shocks, but also because they are more likely to seek healthcare (especially in facilities) when experiencing health shocks. As a result, they spend more on health expenditures per week, although per health visit, they do not pay higher costs. Most importantly, mobile money users are a significant 12.2 percentage points more likely to receive informal transfers, increasing their unearned income on average by KSh 152 per week. This finding validates our strategy to use mobile money usage as a proxy for one's ability to access informal transfers during weeks with health shocks.

Table 3 assesses the purposes of households' use of mobile money. In terms of the number of transactions, households mainly use mobile money for purchasing goods and services (78.7 percent), in particular "telecommunication" or airtime. About 20 percent of M-Pesa transactions concern gifts/remittances, loans, or credit repayments. However, in terms of the value of transactions, purchases of goods and services account for only 9.0 percent of total M-Pesa usage, whereas gifts and loans account for 76.9 percent of total value sent or received via M-Pesa. Consistent with the notion that the technology expanded the market for the transfer of remittances (Jack and Suri, 2011; Mbiti and David Weil, 2014), we find that receiving remittances is the most important type of gift or loan transacted via M-Pesa.

[Table 3 about here]

Nonetheless, the number of transactions involving an inflow of remittances through mobile money is small. Although mobile money users receive informal transfers in 16.8 percent of all weeks, this amounts to only 536 mobile transactions in our analysis sample. This means that only 105 transactions (19.6 percent) involve gifts, remittances, loans, or credit repayments, and of these, only 87 (82.9 percent) involve a remittance received. Thus, very few informal transfers are sent via mobile money, and it is hence unlikely that our results will reflect an effect of the technology; rather, they will indicate to what extent coping differs for households who have selected into the technology, in part because they have more access to informal transfers than other households.

Appendix Table A1 provides descriptive statistics distinguishing between "ever-insured" and "never-insured" households, that is, households that are insured for at least one week during the study period versus households that are never insured during the diaries. These groups differ from each other on several demographic and socioeconomic characteristics, as well as a number of the dependent variables displayed in Panel C. Households that are insured at some point during the diaries have significantly older household heads, fewer household members, and higher nonfood expenditures. Importantly, "ever insured" and "never insured" households report health shocks equally often, indicating that the insured do not get sick more often than the uninsured.

3 Methods

3.1 Econometric Strategy

We will estimate the effects of health shocks and insurance coverage on nonhealth expenditures, healthcare utilization, health expenditures, and informal transfers. Our hypothesis is that households who do not use mobile money have weaker access to informal transfers, reducing their ability to protect nonhealth expenditures from health shocks. For them, health insurance provides financial protection from large out-of-pocket health expenditures, reducing the negative impacts of health shocks on nonhealth expenditures. In addition, to the extent that financial constraints prevent households from seeking healthcare, health insurance can improve health-seeking behavior.

We hypothesize that mobile money users are able to protect their nonhealth expenditures from health shocks even in the absence of insurance coverage because they have informal insurance through their social networks. For them, we would expect informal transfers to increase in weeks with health shocks, and health insurance—which reduces health expenditures—could potentially crowd out these informal transfers. If insurance provided through informal transfers is sufficiently strong, we would not expect health insurance to have an effect on healthcare utilization.

We test these hypotheses using the following equation for household i in week t:

$$Y_{it} = \beta_1 Shock_{it} + \beta_2 Insured_{it} + \beta_3 Shock_{it} * Insured_{it} + \alpha_i + \mu_t + \varepsilon_{it}, \tag{1}$$

where Y_{it} is one of our main outcome variables, $Shock_{it}$ is a dummy variable equal to 1 if the household experiences a health shock in week t, $Insured_{it}$ is a dummy variable indicating whether a household is insured in week t, and $Shock_{it} * Insured_{it}$ is the interaction between these two variables. In addition, we include a household fixed effect, α_i, to control for time-invariant household characteristics, and a week fixed effect, μ_t, to reflect time-varying changes that are common across households. Finally, ε_{it} is a regular (time-varying) error term that we assume is clustered at the household level. We will estimate this equation separately for users and nonusers of mobile money.

Our first outcome variable is $NonHealthExp_{it+1}$, representing nonhealth expenditures in the week following a health shock. We focus on future as opposed to current nonhealth expenditures in order to rule out a bias due to state-contingent utility. For instance, illnesses and injuries will reduce someone's ability or preference to consume food, reducing nonhealth expenditures even among the wealthiest households. Expenditures in the subsequent week are confounded less by such state contingencies and are more likely to capture the extent to which households can smooth consumption, for instance due to having to repay their loans.

Other outcome variables include health-seeking behavior, health expenditures, and informal transfers. We measure these variables in week *t* itself because we aim to test whether health insurance directly affects how health shocks influence these behaviors in the week in which the health shock occurs.

3.2 Identification

The parameter estimate $\hat{\beta}_3$ quantifies the effect of health insurance on how the household copes with health shocks. The estimated effect will be consistent only if, conditional on other covariates, the error, ε_{it} , is uncorrelated with the interaction of $Shock_{it}$ and $Insured_{it}$. There are three possible sources of bias that could violate this condition.

First, health shocks and insurance coverage may be correlated with unobserved household characteristics that have a direct effect on our outcome variables themselves. For instance, it is plausible that wealthier households are more likely to have insurance coverage but also go to better facilities, where they spend more per visit, when someone in the household falls ill. Also, households with worse health, whose condition may force them to spend more per health visit, might be more likely to enroll in health insurance. In both cases, unobserved characteristics (a household's wealth and health) could bias the estimated effect of insurance, $\hat{\beta}_3$. To the extent that these unobserved variables are time invariant, the inclusion of household fixed effects corrects for this bias. Intuitively, by comparing spending on healthcare for the same household in weeks without and with health insurance coverage, we can identify the effect of insurance coverage, controlling for a household's average health expenditures.

Second, the probability of experiencing health shocks or (re-)enrolling in insurance may vary over time due to seasonal characteristics that also have a direct effect on our outcome variables of interest. Consider as an example the rainy season versus the dry season. In the rainy season, households are more likely to contract infectious diseases, and economic activity is also higher in this period.[12] Increased economic activity allows households to make more money and pay their insurance premiums but also to spend more on nonhealth expenditures. In order to control for such seasonality, the model includes week fixed effects. To the extent that seasonality is common to all households, this approach will capture differences between, for instance, the dry and the rainy seasons.

Third, the estimated effect of health insurance at the time of a health shock is potentially confounded by time-varying household characteristics. One concern could be that households enroll in health insurance after experiencing relatively severe health shocks. In that case, the interaction of health insurance and shocks would capture the severity of the shock, as opposed to whether the related health expenditures were covered. This, however, seems unlikely in the present study, given that the TCHP maintained a waiting period of 5 to 35 days between the sign-up date and the policy start date.[13] Thus, we would not expect enrolling due to illness to be a major concern.

It is possible, however, that the decision to drop out of insurance depends on unobserved time-variant characteristics. Table 4 regresses insurance status on the previous month's health insurance status, whether the household experienced any health symptoms that month, and the interaction between the two. The regressions presented in this table use data by household and by month and control for household and month fixed effects. Although past health shocks are correlated positively with subsequent health insurance status, this correlation is driven by households who already have insurance. Column (2) shows that this significant positive effect disappears once we control for past insurance status.

[Table 4 about here]

Another variable potentially correlated with the decision to drop out is milk production. Households pay the insurance premium automatically through their milk accounts, and if they do not deliver enough milk throughout the month, they need to raise the cash and pay the insurance premium out of pocket. We

[12] The study region is, however, at a sufficiently high altitude for malaria not to be endemic to the region. Very few health symptoms reported in the diaries study are indeed related to malaria.

[13] Specifically, households registering between the first and 25th of the month were covered from the first of the *next* month, but those registering after the 25th had to wait one more month for their coverage to start.

therefore also control for milk production in order to capture time-varying characteristics that are potentially correlated with insurance status on the one hand and our key outcome variables on the other hand. Column (3) shows that past milk production does not have a significant effect on insurance status.[14]

Note that our identification exploits the fact that our data include observations of both insured and uninsured health shocks for the same household. If the analysis did not include both types of health shocks, the identified effect could still reflect differences in unobserved characteristics between insured and uninsured households that have an effect on outcome variables only in weeks with health shocks. For instance, suppose that households with larger social networks are more likely to enroll in insurance. If we were to compare the effect of health shocks among households with and without insurance coverage, we could find that insured households are more likely to receive remittances in response to a shock, even though in weeks without health shock, they do not receive more remittances. This finding would not necessarily be due to their insurance coverage. Instead, their larger social network is more likely to send remittances in times of need. Our identification hence exploits the observation of health shocks and behavior for the same household, during weeks with and without health insurance.[15]

At the same time, this strategy implies that health insurance effects are identified using a relatively small number of households observed with a high frequency. Insurance status varies within the year for only 45 of the 120 households. We include households without variation in health insurance status in order to help estimate the week effects and coefficients for other covariates that appear in our model. These households may confound the estimated effect of health shocks, if health shocks have different implications depending on whether a household ever has insurance during the diaries period. As a robustness check, we will therefore also estimate the effect of health shocks separately for three groups of observations: households that are never insured in the study year; households that are insured at some point but not during the observation week; and the same households, but now observed in a week with health insurance coverage. Results are qualitatively similar to those obtained above but estimated with lower precision due to our small sample size. We hence

[14] Milk production does not perfectly predict the quantity of milk delivered to the cooperative because households can also sell their milk in the local market. However, the two are correlated, as they deliver relatively larger quantities to the cooperative in months following a period of higher milk production (Geng et al., 2017). This table shows that side selling in months with relatively lower milk production apparently does not result in a significant risk of losing insurance coverage.

[15] This is why we cannot identify the effects of using mobile money or having a larger social network. For that, we would want to compare the same household before and after its members start using mobile money, and we do not have the data to do so.

estimate Equation (1) as our preferred specification.

4 Results

This section describes the effects of health insurance on nonhealth expenditures in weeks following a health shock. We also present effects of health insurance on health care utilization, health expenditures, and informal transfers in weeks with health shocks in the household. The analyses will distinguish between nonusers and users of mobile money. Due to their weaker access to informal transfers, we hypothesize that health insurance will have positive impacts for the former group. For the latter group, one might worry that health insurance crowds out informal transfers and hence has no impact on our outcome variables.

4.1 Households with Weaker Access to Informal Transfers (Nonusers of Mobile Money)

We first estimate Equation (1) for households that never report using mobile money. Table 5 summarizes how these households cope with health shocks, depending on whether they have insurance coverage. We report coefficients for our health shock variable (the effect of uninsured health shocks), its interaction with health insurance status (the impact of health insurance in weeks with a health shock), and the *p*-value that the sum of these two coefficients differs significantly from 0. We further control for household and week fixed effects and a household's insurance status. Panel A uses a broad definition for health shocks, treating any health symptom reported in the household as a health shock. Panel B uses a narrower definition, considering only symptoms due to which the household member cannot carry out his or her daily activities.

[Table 5 about here]

Columns (1) and (2) estimate the model for total expenditures and food expenditures, respectively, in the following week. Panel A shows that uninsured health shocks reduce total expenditures in the following week by 26.9 percent and food expenditures by 22.0 percent ($p < 0.05$). The coefficient on the interaction term (*Health Shock * Insured*) is, however, positive and large enough for the sum of the two coefficients—the effect of health shocks in insured weeks—to be close to 0 ($p = 0.935$ for total expenditures and $p = 0.706$ for food expenditures). Thus, households without mobile money do not shield consumption from health shocks in uninsured weeks, but they do in weeks with insurance coverage. In Panel B, we find very similar results for health symptoms that prevent the patient from carrying out his or her daily activities.

Health insurance potentially also improves health-seeking behavior. Columns (3) and (4) therefore present estimates of the same equation for variables indicating whether the household consulted any health-care provider and a health facility, respectively. Not surprisingly, household members are significantly more likely to seek healthcare in weeks when they report health symptoms ($p < 0.01$). However, even when experiencing more severe health shocks that prevent household members from carrying out their daily activities (Panel B), only about 32 percent consult any healthcare provider and about 25 percent go to a health facility. Health insurance does not appear to increase the use of healthcare services; the coefficient on the interaction term is relatively small and statistically insignificant. Thus, households forgo consulting with healthcare providers for the majority of health symptoms, regardless of whether the household members have insurance when the symptoms occur.

Columns (5) and (6) explore a potential channel through which health insurance could reduce the negative impacts of health shocks on consumption. These columns estimate Equation (1) for health expenditures spent out of pocket at any healthcare provider and in facilities, respectively. Column (5) reveals that health insurance reduces out-of-pocket health expenditures by 53.9 and 62.7 percent in Panels A and B, respectively, or by about one-third of health expenditures in uninsured weeks with health shocks, but the effect is not significant. Column (6) focuses on expenditures in facilities. Because the TCHP covers only health-care in facilities, we now find a more precisely estimated health insurance effect that is significant at the 10 percent level. Thus, to cope with health shocks, uninsured households shift resources toward healthcare utilization at the expense of nonhealth expenditures, but insured households do not need to do so and can smooth consumption in the aftermath of a health shock.

Finally, Columns (7) and (8) study the impacts of health shocks, interacted with health insurance status, on the receipt of informal transfers. For nonusers of mobile money, health shocks do not increase the probability of receiving a transfer, as shown in Column (7), or the amount of transfers flowing into the household, as shown in Column (8). Thus, in periods without insurance coverage, households who do *not* use mobile money do not use informal transfers to cope with health shocks. Health insurance does not significantly affect reliance on this coping strategy, meaning that formal insurance does not crowd out informal transfers. For households not using mobile money, however, it might be more difficult to attract money for health expenditures on a short basis.

To summarize, nonusers of mobile money reduce their nonhealth expenditures, including food expenditures, following a health shock. This reduction is driven by increased health expenditures, which these households cannot finance using an inflow of informal transfers. For these households, we would not expect a crowd-out effect of health insurance. Indeed, health insurance reduces these households' out-of-pocket expenditures in clinics and hospitals, and protects nonhealth expenditures from unplanned health expenditures. Despite lower health expenditures, however, the TCHP does not increase healthcare utilization for this group.

4.2 Households with Stronger Access to Informal Transfers (Users of Mobile Money)

Next, we estimate Equation (1) for our second sample of households, that is, for those who report using mobile money. Having stronger access to informal transfers, these households may receive gifts and remittances when facing health shocks, improving their ability to protect consumption from health shocks. This smoothing through transfers would reduce the scope for health insurance to have an impact; in fact, health insurance could even crowd out receipt of informal transfers in weeks with health shocks. Table 6 tests to what extent this is the case.[16]

[Table 6 about here]

Columns (1) and (2) analyze the implications of health shocks for nonhealth expenditures. For noninsured households, total expenditures are 11.1 percent ($p < 0.10$) above average in weeks following a health shock (Panel A). More serious health shocks, due to which a household member is unable to carry out his or her daily activities, raise total expenditures to 23.4 percent ($p < 0.05$) above average (Panel B). This increase is mainly driven by nonfood expenditures; health shocks increase food expenditures by a lower 6.2 and 17.7

[16] Appendix Table A2 estimates the differences in coefficients for nonusers versus users of mobile money, testing whether the two samples respond significantly differently to health shocks and insurance coverage.

percent in Panels A and B, respectively.[17]

Uninsured households are able to increase their nonmedical spending in weeks with health shocks despite significant and meaningful increases in healthcare utilization and health expenditures, as shown in Columns (3) and (4) for healthcare utilization and in Columns (5) and (6) for health expenditures. These results are very different compared to those in Table 5, raising the question of how mobile money users finance an increase in both medical and nonmedical spending. Columns (7) and (8) therefore assess to what extent health shocks affect inflows of informal transfers, finding evidence to support the hypothesis that users of mobile money are in a better position than nonusers to finance their healthcare by having more access to informal transfers. For mobile money users, health shocks increase the probability of receiving informal transfers by 5.2 percentage points, as shown in Column (7) ($p < 0.10$), increasing the transfer amount received by 35.8 percent in Column (8) ($p < 0.10$). For more severe health shocks, this effect is even more pronounced, with health shocks increasing the transfer probability and transfer amount by 10.8 percentage points and 71.9 percent, respectively.

The question, then, is whether health insurance could crowd out these informal transfers. Focusing on both total and food expenditures, in Columns (1) and (2), we indeed observe that health shocks offset the increase in nonmedical spending in weeks after a household experiences a health shock. However, we do not observe significant crowding-out effects on other variables, and we even observe positive impacts of health insurance in a number of areas.

In Column (3), we see that health insurance does not significantly affect healthcare utilization, independent of whether we consider all health shocks, as in Panel A, or the more restricted set of more severe health shocks shown in Panel B. By contrast, as shown in Column (4), health insurance increases the utilization of facilities by 8.8 percentage points in Panel A ($p < 0.05$). Health insurance further reduces total out-of-pocket expenditures in Column (5), but significantly so only for the severe health shocks in Panel B. Expenditures on healthcare received in facilities are not reduced significantly by insurance, likely because

[17] Health shocks do not increase nonhealth expenditures in the following week because households postpone their expenses in weeks with health shocks. In fact, when using nonhealth expenditures in the current as opposed to the following week as dependent variable, we find an even larger and more significant coefficient on the health shock variable. The finding that health shocks increase households' nonhealth and nonfood expenditures is consistent with Wagstaff (2007), who argued that they do so because households reallocate consumption away from food toward items considered even more essential to the recovery of the sick member, such as expenses on housing and electricity.

insurance encourages households to obtain more of their healthcare in facilities that are part of the TCHP network, where they will often still pay a small share of expenditures, for instance on prescription drugs, out of pocket.[18]

Finally, Columns (7) and (8) suggest that the TCHP does not have a strong crowding-out effect. Panel A shows that health insurance does not reduce the probability of receiving transfers and has a negative but statistically insignificant effect on the transfer amount received. Panel B shows that the probability of receiving informal transfers is reduced in weeks when households facing health shocks have insurance coverage, but only by 2.6 percentage points, which is again small and statistically insignificant. In sum, insurance does not crowd out informal transfers, and in fact has a positive effect on health-seeking behavior.

4.3 Robustness Checks

Effects of Health Shocks before and after Policy Change

This section presents a number of robustness checks. A first check explores whether our results could be explained by households, selectively dropping out of health insurance; perhaps households drop out of the TCHP in months when they expect to be financially more constrained and also less able to smooth consumption in the presence of a health shock. To explore this question further, we use an alternative definition for health insurance coverage that will not be subject to such a bias.

Specifically, we use the redesign of the TCHP as an instrument for dropping out of insurance. In April 2013, households' insurance policies were not renewed automatically. Instead, all households were approached with the question of whether they wanted to renew their insurance policy into one of two packages: one with basic coverage and one with comprehensive coverage. Of the 41 households with insurance coverage around that time, 13 households (31.7 percent) dropped out because of this policy change. We will explain the policy change as an exogenous source of variation in health insurance coverage, bearing in mind that measurement error will be substantial, given that the "treatment" affected only 13 households.

Table 7 estimates Equation (1), replacing the variable $Insured_{it}$ with a variable indicating observations

[18] Appendix Table A3 tests whether increased healthcare utilization is associated with higher transportation costs, which could inflate health expenditures. Clinics covered by the TCHP can be far away. We find an increase in transportation costs for both nonusers and users of mobile money, providing an explanation for why we do not observe larger impacts on healthcare utilization.

after the TCHP redesign (*PostChange$_t$*), when coverage was significantly lower than before the redesign. We restrict the sample to the 58 households that had insurance coverage at some point before the policy change, because for never-insured households, the policy change will have had no impact. We report the effect of health shocks defined in the broad sense that includes all health symptoms reported by family members. We distinguish between the effect of *Health Shock* before the redesign, when insurance coverage was high, and—by adding the coefficient for *Health Shocks* interacted with *PostChange*—its effect after the redesign, when insurance coverage was much lower. In other words, the interaction term captures the intent-to-treat effect of reducing insurance coverage. We would thus expect coefficients on the interaction term to move in the opposite direction compared to the interaction between health shocks and insurance status.

[Table 7 about here]

Panel A presents estimates for nonusers of mobile money. Consistent with our priors, Columns (1) and (2) demonstrate that health shocks do not affect nonhealth expenditures in the period before the policy change, when health insurance coverage is still high, but they reduce nonhealth expenditures after the remodeling of the health insurance scheme (although standard errors are large). The reduction in insurance coverage is also associated with reduced healthcare utilization, hence explaining why health expenditures decline despite the reduction in insurance coverage. Finally, health shocks do not affect informal transfers, independent of whether the shock occurs before or after the TCHP redesign. This latter finding corroborates the evidence that nonusers of mobile money do not use informal transfers to cope with health shocks.

Panel B estimates the same model, but now for the sample of households that use mobile money. In our earlier analyses, they were able to smooth consumption in the face of health shocks due to an increase in informal transfers, and health insurance coverage improved their healthcare utilization without crowding out these informal transfers. In Columns (1) and (2), the coefficient on the interaction term is indeed smaller than it is in Panel A, at least for total expenditures, and in the period with lower insurance coverage, this sample uses significantly less healthcare. Health expenditures react to the TCHP redesign in a very similar way as in Panel A, suggesting that the reduction in utilization has a more dominant effect on health expenditures than the removal of insurance coverage. Finally, we find that households are more likely to receive transfers when experiencing health shocks, consistent with the result that health insurance does not crowd out informal transfers.[19]

Effects of Health Shocks on Gifts versus Remittances

A second robustness check analyzes the effect of health shocks and insurance coverage on transfers from within and outside the community. In theory, because mobile money reduces transaction costs, especially for remittances, nonusers of mobile money may be particularly disadvantaged in terms of their access to informal transfers from outside the community. In that case, we may not observe an effect of health shocks and insurance on informal transfers because our measure combines gifts from within the community and remittances from outside the community. Table 8 therefore estimates Equation (1) separately for these two transfer variables. Columns (1) and (2) report estimates for nonusers of mobile money, Columns (3) and (4) report estimates for users, and Columns (5) and (6) report the differences in estimated coefficients.

[Table 8 about here]

For nonusers of mobile money, we find that health shocks have no effect on transfers from either inside or outside the community. In contrast, for users, health shocks increase the probability of receiving transfers from inside the community by 4.0 percent, and when the health symptoms prevent an individual from carrying out his or her daily activities, the probability of receiving a transfer increases by 7.0 percent. Health insurance coverage has no crowd-out effect, as shown in Column (3). By contrast, in Column (4), Panel B, shows that the more severe health shocks significantly increase the probability of receiving transfers from outside the community in the absence of insurance coverage, whereas insurance coverage eliminates this effect. We may find crowding out here because without health insurance, migrant family members will invest considerable resources into monitoring remittances (cf. De Laat, 2014), and health insurance helps them avoid these costs.

To summarize, we find that even when studying gifts from inside the community, nonusers of mobile money have weaker access to informal transfers than users. At the same time, we find that mobile money users cope with health shocks mainly by using gifts from within the community and rely on remittances

[19] After the policy change, informal transfers become lower. Perhaps norms have changed with the introduction of health insurance, in such a way that solidarity is lower for individuals not purchasing insurance. In that case, health insurance can crowd in informal transfers.

mainly in cases of more severe shocks. Health insurance crowds out these remittances, which could reflect the costs associated with either asking for a transfer or sending it from afar. Both senders and receivers may prefer the independence offered by health insurance coverage in coping with shocks.

Using First Differences Instead of Fixed Effects

We also analyze whether we obtain different results when estimating our model using first differences. The fixed-effects estimator is consistent and efficient when there is no serial correlation, but in the presence of serial correlation, the first-difference estimator would be more efficient. In order to obtain the first-difference estimator, we transform Equation (1) as follows:

$$\Delta Y_{it} = \beta_1 \Delta Shock_{it} + \beta_2 Insured_{it} + \beta_3 \Delta Shock_{it} * Insured_{it} + \Delta \mu_t + \tilde{\varepsilon}_{it}, \quad (2)$$

where we estimate the effect of health shocks separately for uninsured households, $\hat{\beta}_1$, and for insured households, $\hat{\beta}_1 + \hat{\beta}_3$.

Results in Appendix Table A4 are fairly comparable to the initial estimates using fixed effects, but with one key difference: this model does not replicate the effects of health shocks on subsequent nonhealth expenditures. This could be because we are using the second lag of nonhealth expenditures, because the first lag for this variable—nonhealth expenditures in the week with the health shock—is potentially influenced by health shocks as well. When nonhealth expenditures exhibit relatively low autocorrelation, controlling for the second lag introduces noise into the estimates. Other findings remain nonetheless the same. As shown in Columns (3) and (4), health insurance is still associated with an increased probability of consultations in facilities among mobile money users, and it reduces health expenditures, at any health provider and in facilities, among mobile money nonusers, as shown in Columns (5) and (6). Finally, also using first differences, we find an increase in informal transfers received by mobile money users but not by nonusers.

Health Insurance Impacts for Ever-Insured Households

A final robustness check explores whether the effects of health insurance could be due to ever-insured households, being different in weeks with health shocks than never-insured households. The fixed-effect model would not capture such differences. Appendix Tables A5 and A6 therefore estimate Equation (1), but now controlling for a term that interacts health shocks with a dummy variable indicating whether the household was ever insured. We do not use this as our main specification because the interaction term reduces precision, given the small sample size.

Appendix Table A5 presents model estimates for nonusers of mobile money. We replicate the result that ever-insured households reduce their nonhealth expenditures less when they have health insurance than when they do not have health insurance. In fact, we find significantly negative effects of health shocks on consumption only during weeks in which these households do not have health insurance coverage. Effects are statistically insignificant for both never-insured and currently insured households. Further, for ever-insured households facing a health shock, insurance coverage significantly reduces health expenditures, as shown in Columns (5) and (6).

Appendix Table A6 presents estimates of the same model, but now restricting the sample to mobile money users. First, note that health shocks have no effect on either total or food expenditures, independent of whether we focus on never-insured households, ever-insured households currently uninsured, or currently insured households. However, for ever-insured households, insurance coverage increases healthcare utilization in facilities, as shown in Column (4), without decreasing health expenditures or informal transfers significantly.

To summarize, our main findings are robust to a specification in which we control for a variable interacting health shocks with a dummy variable to indicate whether a household has ever been insured. That is, even among only ever-insured households, nonusers of mobile money are unable to smooth consumption unless they have health insurance coverage, whereas mobile money users smooth consumption regardless of their insurance coverage, and for the latter, insurance coverage does not crowd out informal transfers. Further, insurance coverage reduces medical spending out of pocket for nonusers of mobile money, whereas it increases the probability of visiting a health facility for mobile money users. This replicates the main findings from our preferred specification, reinforcing the conclusion that our results are driven by monthly variation in health insurance status instead of differences in how ever-insured and never-insured households cope with health shocks in months when they are uninsured.

5 Discussion and Conclusion

Health shocks can have long-lasting, financially catastrophic consequences for households without access to reliable insurance mechanisms. This paper studies how households cope with health shocks. In particular, our interest is in testing whether households use informal transfers as a health financing strategy, and whether health insurance will crowd out such informal transfers. If that were the case, then the crowding-out effect could weaken the impact of health insurance schemes.

To study these questions, we use diaries with high-frequency, high-detail data on health, health-seeking behavior, and households' cash flows, collected in the context of a community health insurance scheme in Kenya. Variation in households' monthly insurance status allows us to study how the same household copes with health shocks in weeks without and with health insurance coverage. The high-frequency data allow us to investigate not only major health shocks, that prevent household members from carrying out their daily activities, but also less severe health symptoms that can easily be overlooked in a household survey with a longer recall period. Finally, we analyze coping strategies separately for nonusers and users of mobile money, conjecturing that the latter type of household will have more access to informal transfers when coping with shocks.

We find that for nonusers of mobile money, health shocks significantly reduce nonmedical spending, including food expenditures. Consistent with our conjecture, these households do not rely on informal transfers to finance their health expenditures, and for them, health insurance cushions the negative impacts of health shocks on nonmedical consumption by lowering out-of-pocket health expenditures. Despite this reduction in health expenditures, we do not observe an increase in their healthcare utilization during weeks with health insurance coverage.

For users of mobile money, health shocks do not have a negative effect on nonmedical spending. These households appear to finance their health expenditures by attracting more gifts and remittances in weeks with health shocks. Nevertheless, health insurance is not a mere substitute for their informal transfers: it increases the probability that these households will seek high-quality care from a facility. This improved healthcare utilization potentially explains why insurance does not reduce their out-of-pocket health expenditures. Finally, for these households, health insurance does not reduce the probability of receiving informal transfers, suggesting that informal transfers and health insurance are substitutes only in terms of consumption smoothing; in terms of healthcare utilization, they play separate roles.

It is important to stress that mobile money users' improved ability to cope with health shocks (in the absence of health insurance) is not caused by the improved ease of receiving remittances through mobile money. The study was conducted in a period when mobile money coverage was not yet near-universal in Kenya, and most gifts and remittances were received in cash instead of wired via mobile money. Hence, mobile money is unlikely to drive our results. Rather, it seems that mobile money users have a larger social network to help both within and outside their communities, and perhaps their increased social network has driven these households to start using the technology.

A challenging question resulting from these findings is whether health insurance services should be better integrated with mobile money services. Since 2016, the TCHP has been operating within a mobile health wallet ("M-TIBA") developed by PharmAccess and CarePay[20]. Beyond the provision of health insurance coverage, M-TIBA can serve as a platform for donors to directly send their beneficiaries healthcare subsidies, for instance for maternal and child health care, and for friends and family to earmark remittances for health expenditures.

In the context of these developments, we show that M-TIBA can provide value to different households in different ways, and that mobile money usage can help distinguish between these different households. Even in areas or periods with higher mobile money penetration and more complex usage patterns compared to what we found in the present study (where only 50 percent of households reported using mobile money at least once during the year), one could use machine learning to predict the ability to cope with health shocks and impacts of health insurance on the basis of mobile money usage patterns. A promising question for future research is whether this approach indeed works; if it does, it would help policymakers identify households with different healthcare needs.

In our case, for example, one group of households—nonusers of mobile money—has a relatively smaller social network to cope with health shocks. Because they do not rely on informal transfers to finance their healthcare, they would strongly benefit from the financial protection that health insurance can

[20] This Kenyan social enterprise is working together with the current insurance provider UAP Old Mutual to expand the number of insured clients through their mobile health wallets. UAP Old Mutual offers the TCHP as an NHIF+ package called "Afya Kamili", bundling coverage for outpatient and inpatient care with funeral and personal accident insurance.

provide.[21] As such, governments and donors would want to target insurance premium subsidies towards this group. Conditional on households having the right technology, mobile health wallets could reduce the costs of providing such subsidies, and the money being earmarked for healthcare could help attract donations from governments, donor organizations or even individuals interested in financing healthcare for the poor.

By contrast, the second group—users of mobile money—is able to cope with health shocks financially due to an increase in informal transfers from friends and family. This group might benefit from mobile health wallets for two reasons. First, mobile health wallets could include health insurance, which we show induces them to seek better-quality healthcare from clinics and hospitals instead of chemists, private doctors or traditional healers. Second, health insurance lowers remittances received from outside the community. This could be owing to the finding that migrant family members who send money home invest considerable resources in monitoring the household's finances (De Laat, 2014). Such monitoring would potentially diminish if remittances were earmarked for a specific purpose, for instance healthcare in formal health clinics. This would give family members residing elsewhere the opportunity to pay the health insurance premium, or deposit money for health care, with the guarantee that the money is indeed spent on (quality) healthcare.

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[21] Transportation costs could be a barrier to insurance impacts on where they seek health care, and it may be worthwhile covering those costs through mobile health wallets as well.

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Tables

Table 1. Sample size, attrition and non-response

	Number (1)	Percentage (2)
Panel A. Baseline sample		
Villages	7	
Households	120	
Adult respondents	184	
Household members	564	
Respondents per household	1.5	68.9†
Panel B. Attrition		
Households dropping out	2	1.67
Respondents leaving the household	8	4.35
Panel C. Non-response		
Interview weeks	52	
Household interview-weeks excl. attrition	6,169	
- No respondents interviewed	449	7.3
- At least one but not all respondents interviewed	952	15.4
- All respondents interviewed	4,768	77.3
- At least one respondent interviewed	5,689	92.2

Note: Data from the Health and Financial Diaries project (Janssens et al., 2013). All financially active adults were interviewed weekly for 55 weeks, except for three weeks in which interviewing was not possible due to major holidays or elections. Regarding Panel B, † = as a percentage of adults. Regarding Panel C, note that the analysis will use household interview-weeks when at least one respondent was interviewed.

Table 2. Household characteristics, health shocks, and informal transfers by M-Pesa usage

	Full sample		Nonuser	User	Comparison	
	Nr. of observations	Sample mean	of mobile money	of mobile money	Diff.	p-value†
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. Household characteristics						
Demographic characteristics						
HH head age	120	51.7	51.2	52.1	-0.9	0.7632
HH head is male (%)	120	65.8	64.8	66.7	-1.9	0.8332
HH size	120	4.9	4.6	5.1	-0.4	0.2650
HH members under 18 years (%)	120	45.9	44.5	47.2	-2.7	0.5630
HH members who are female (%)	120	51.1	51.9	50.5	1.4	0.7057
HH head is protestant	119	85.7	90.7	81.5	9.2	0.1558
Socioeconomic characteristics						
Head has completed primary school (%)	105	78.1	77.8	78.3	-0.6	0.9463
Head has completed secondary school (%)	105	44.8	42.2	46.7	-4.4	0.6541
Head engaged in crop production	107	100	100	100	0.0	n.a.
Head engaged in livestock	107	99.1	100	98.3	1.7	0.3696
Head engaged in business	107	22.4	31.3	15.3	16.0	0.0491
# of mobile phones	120	1.9	1.6	2.0	-0.4	0.0490
Mobile money user (%)	120	55.0	0.0	100	-100	n.a.
Nr. interviews	120	47.9	47.5	48.2	-0.7	0.4097
Panel B. Health shocks and insurance						
Week with health shock (#)	120	13.1	9.15	16.3	-7.1	0.0001
Week with health shock (%)	120	27.4	19.8	33.6	-13.8	0.0003
Week with severe health shock (#)	120	8.03	6.32	9.42	-3.1	0.0101
Week with severe health shock (%)	120	17.1	14.2	19.4	-5.3	0.0418
Insured for at least one month (%)	120	47.5	44.4	50.0	-5.6	0.5482
Variation in insurance coverage (%)	57	78.9	79.2	78.8	0.4	0.9730
Week with insurance coverage (%)	45	64.1	65.1	63.4	1.7	0.8426
Panel C. Dependent variables						
Avg. food expenditures per week (KSh)	120	487	410	551	-141	0.0278
Avg. nonfood expenditures per week (KSh)	120	1,839	1,550	2,076	-526	0.0925
Week with health visit (%)	120	10.0	5.57	13.7	-8.1	0.0000
Week with health visit if health shock (%)	110	78.2	69.4	84.8	-15.4	0.2072
Week with facility visit (%)	120	5.99	3.80	7.78	-4.0	0.0000
Week with facility visit if health shock (%)	110	45.2	37.8	50.7	-12.9	0.0753
Avg. health expenditure per week (KSh)	120	18.9	10.9	25.5	-14.6	0.0001
Avg. health expenditure per visit (KSh)	102	211	215	207	7.6	0.8587
Week with informal transfers (%)	120	11.3	4.59	16.8	-12.2	0.0000
Avg. informal transfer per week (KSh)	120	142	58.6	210	-152	0.0026
Avg. transfer if informal transfer (KSh)	89	1,247	1,690	1,010	680	0.2546

Note: n.a. = not applicable. Users (nonusers) of mobile money reported at least one (no) financial transactions via mobile money during the diaries. † The p-value in Column (6) is calculated based on a t-test for equal means between the sample of mobile money users and nonusers.

Table 3. Mobile money usage

	Transactions (%) (1)	Value (%) (2)
Purchases of goods and services	**78.7%**	**9.0%**
Food	0.2%	1.2%
Productive assets	0.2%	2.0%
Education	0.5%	24.9%
Fuel, energy, utilities	0.2%	2.3%
Telecommunication	98.6%	68.1%
Labour services	0.2%	1.5%
Gifts, loans, credits, advance, harambee	**19.6%**	**76.9%**
Credit repayment received	1.0%	0.3%
Gift/remittance received	82.9%	92.2%
Gift/remittance given	16.2%	7.5%
Savings	**0.9%**	**1.9%**
Business investment	60.0%	53.0%
Daily expenses/nothing specific	40.0%	47.0%
Income / sales of goods and services	**0.7%**	**11.0%**
Food	50.0%	96.3%
Education	50.0%	3.7%
Total number of transactions	**536**	**222,473** (KSh)

Note: This table presents the percentage of transactions and the percentage of total transaction value by transaction type. The transactions are restricted to transactions only in weeks that are included in the analysis.

Table 4. Determinants of health insurance status

	Dependent variable: Household has insurance coverage in month m		
	(1)	(2)	(3)
At least one week with health symptoms in month $m-1$	0.038*	0.015	0.015
	(0.020)	(0.013)	(0.013)
Household had insurance coverage in month $m-1$		0.491***	0.490***
		(0.061)	(0.060)
... × At least one week with health symptoms in $m-1$		0.018	0.017
		(0.038)	(0.038)
Average liters of milk produced per day in month $m-1$			0.003
			(0.003)
Number of observations	1,305	1,305	1,305
Number of households	120	120	120
R-squared within households	0.063	0.307	0.308
Mean dependent variable	0.341	0.341	0.341

Note: This table presents an analysis of data by household and month, because insurance status does not vary within a month and because health insurance coverage rarely varies between members of the same household. Coefficients are estimated using a linear model with household and month fixed effects. The *R*-squared within households gives the proportion of explained variation after controlling for household fixed effects, that is, the explained variation within households. * $p < 0.10$ ** $p < 0.05$ *** $p < 0.01$.

Table 5. Effects of health insurance for nonusers of mobile money

	Nonhealth expenditures (inverse hyperbolic sine)		Health visit (dummy variable)		Health expenditures (inverse hyperbolic sine)		Informal transfers (dummy)	(i.h.s.)
	Total Expenditures	Food Expenditures	Any Provider	Facility	Any Provider	Facility	Receives Transfer	Transfer Amount
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: All health shocks								
Health shock	-0.269**	-0.220**	0.270***	0.203***	1.509***	1.042***	-0.006	-0.052
	(0.132)	(0.094)	(0.048)	(0.037)	(0.288)	(0.234)	(0.012)	(0.084)
Health shock × Insured	0.286	0.287	0.038	0.007	-0.539	-0.549*	-0.026	-0.171
	(0.216)	(0.183)	(0.085)	(0.070)	(0.367)	(0.282)	(0.036)	(0.300)
p-value Insured	0.935	0.706	0.000	0.001	0.000	0.006	0.352	0.445
Panel B: Severe health shocks								
Health shock	-0.290**	-0.248**	0.316***	0.250***	1.582***	1.278***	0.001	-0.015
	(0.138)	(0.104)	(0.055)	(0.045)	(0.342)	(0.287)	(0.014)	(0.097)
Health shock × Insured	0.310	0.260	0.044	0.042	-0.627	-0.620*	-0.023	-0.211
	(0.296)	(0.270)	(0.102)	(0.091)	(0.424)	(0.357)	(0.043)	(0.399)
p-value Insured	0.948	0.964	0.000	0.001	0.002	0.008	0.589	0.557
Mean dependent variable	1.315	0.905	0.054	0.036	0.253	0.147	0.046	0.058
Number of observations	2511	2511	2555	2555	2555	2555	2555	2555
Number of households	54	54	54	54	54	54	54	54

Note: Analyses presented in this table use data by household and week. Coefficients are estimated using a linear model with household and week fixed effects, controlling for whether the household has insurance coverage. In Panel A, "Health shock" is a dummy variable equal to 1 if at least one family member had health symptoms in the 7 days before the interview and 0 otherwise. In Panel B, "Health shock" only includes symptoms that prevented the patient from carrying out his or her daily activities. The last row, "*p*-value Insured" is the *p*-value from the test that the sum of the two coefficients for "Health shock" and its interaction with "Insured" equals zero. Nonusers of mobile money are households who never report financial transactions through mobile money during the diaries. * $p < 0.10$ ** $p < 0.05$ *** $p < 0.01$.

Table 6. Effects of health insurance for users of mobile money

	Nonhealth expenditures (inverse hyperbolic sine)		Health visit (dummy variable)		Health expenditures (inverse hyperbolic sine)		Informal transfers (dummy)	(i.h.s.)
	Total Expenditures	Food Expenditures	Any Provider	Facility	Any Provider	Facility	Receives Transfer	Transfer Amount
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: All health shocks								
Health shock	0.111*	0.062	0.365***	0.185***	1.722***	0.833***	0.052*	0.358*
	(0.066)	(0.073)	(0.029)	(0.019)	(0.173)	(0.125)	(0.027)	(0.185)
Health shock × Insured	-0.155	-0.050	0.036	0.088**	-0.343	-0.067	0.004	-0.048
	(0.122)	(0.152)	(0.043)	(0.034)	(0.278)	(0.209)	(0.035)	(0.273)
p-value Insured	0.684	0.923	0.000	0.000	0.000	0.000	0.009	0.084
Panel B: Severe health shocks								
Health shock	0.234**	0.177**	0.589***	0.340***	2.830***	1.513***	0.108***	0.719***
	(0.099)	(0.084)	(0.052)	(0.036)	(0.304)	(0.241)	(0.035)	(0.232)
Health shock × Insured	-0.277*	-0.137	-0.053	0.070	-1.051**	-0.403	-0.026	-0.163
	(0.154)	(0.150)	(0.074)	(0.053)	(0.412)	(0.350)	(0.045)	(0.321)
p-value Insured	0.747	0.762	0.000	0.000	0.000	0.000	0.004	0.012
Mean dependent variable	1.270	0.889	0.138	0.078	0.717	0.253	0.170	0.152
Number of observations	3103	3103	3165	3165	3165	3165	3165	3165
Number of households	66	66	66	66	66	66	66	66

Note: Analyses presented in this table use data by household and week. Coefficients are estimated using a linear model with household and week fixed effects, controlling for whether the household has insurance coverage. In Panel A, "Health shock" is a dummy variable equal to 1 if at least one family member had health symptoms in the 7 days before the interview and 0 otherwise. In Panel B, "Health shock" only includes symptoms that prevented the patient from carrying out his or her daily activities. The last row, "*p*-value Insured" is the *p*-value from the test that the sum of the two coefficients for "Health shock" and its interaction with "Insured" equals zero. Users of mobile money are households who at least once report financial transactions through mobile money during the diaries. $^{*}\ p < 0.10$ $^{**}\ p < 0.05$ $^{***}\ p < 0.01$.

Table 7. Effect of health shocks before and after the TCHP redesign

	Nonhealth expenditures (inverse hyperbolic sine)		Health visit (dummy variable)		Health expenditures (inverse hyperbolic sine)		Informal transfers (dummy)	(i.h.s.)
	Total Expenditures	Food Expenditures	Any Provider	Facility	Any Provider	Facility	Receives Transfer	Transfer Amount
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Nonusers of mobile money								
Health shock	0.008	0.001	0.317***	0.226***	0.887***	0.349**	-0.009	-0.087
	(0.186)	(0.186)	(0.051)	(0.052)	(0.188)	(0.128)	(0.024)	(0.186)
Health shock × Postchange	-0.435	-0.302	-0.212***	-0.125***	-0.572**	-0.117	-0.047	-0.260
	(0.399)	(0.338)	(0.048)	(0.042)	(0.215)	(0.151)	(0.031)	(0.248)
p-value Postchange	0.223	0.233	0.014	0.007	0.117	0.126	0.127	0.268
Panel B: Users of mobile money								
Health shock	0.042	0.110	0.438***	0.279***	1.550***	0.781***	0.073***	0.451**
	(0.127)	(0.171)	(0.033)	(0.031)	(0.252)	(0.194)	(0.024)	(0.192)
Health shock × Postchange	-0.197	-0.332	-0.217***	-0.133***	-0.659***	-0.234	-0.060	-0.405
	(0.202)	(0.265)	(0.034)	(0.034)	(0.232)	(0.163)	(0.045)	(0.375)
p-value Postchange	0.208	0.182	0.000	0.000	0.000	0.003	0.696	0.857
Number of observations								
Panel A: Nonusers	1248	1248	1140	1140	1140	1140	1140	1140
Panel B: Users	1716	1716	1604	1604	1604	1604	1604	1604

Note: Analyses presented in this table use data by household and week, including only the sample of households with at least one month of insurance coverage before the redesign of the TCHC. Coefficients are estimated using a linear model with household and week fixed effects, controlling for "Postchange", a dummy variable that is equal to 1 for weeks after the TCHC redesign and 0 otherwise. "Health shock" is a dummy variable equal to 1 if at least one family member had health symptoms in the 7 days before the interview and 0 otherwise. In Panel A (Panel B), nonusers (users) of mobile money are households who never (at least once) report financial transactions through mobile money during the diaries. The last row, "*p*-value Postchange", is the *p*-value from the test that the sum of the two coefficients for "Health shock" and its interaction with "Postchange" equals zero. * $p < 0.10$ ** $p < 0.05$ *** $p < 0.01$.

Table 8. Effect of health insurance on gifts from inside the village versus remittances from outside the village

	Mobile money nonusers		Mobile money users		Difference nonusers and users	
	Dependent variable: Dummy equal to 1 if the household receives transfers from anyone:					
	Inside village	Outside village	Inside village	Outside village	Inside village	Outside village
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: All health shocks						
Health shock	-0.002	-0.004	0.040**	0.022	0.039	0.023
	(0.017)	(0.003)	(0.018)	(0.018)	(0.025)	(0.017)
Health shock × Insured	-0.048	0.017	0.011	-0.029	0.067	-0.044**
	(0.051)	(0.011)	(0.027)	(0.020)	(0.057)	(0.022)
p-value Insured	0.306	0.138	0.015	0.372	0.270	0.101
Panel B: Severe health shocks						
Health shock	0.004	-0.002	0.070**	0.046**	0.069**	0.047**
	(0.020)	(0.003)	(0.028)	(0.020)	(0.034)	(0.020)
Health shock × Insured	-0.032	0.009	0.001	-0.049**	0.036	-0.058**
	(0.073)	(0.010)	(0.039)	(0.021)	(0.082)	(0.025)
p-value Insured	0.687	0.388	0.006	0.655	0.626	0.397
Mean dependent variable	0.038	0.004	0.099	0.054	0.072	0.032
Number of observations	2139	2139	2753	2753	4892	4892
Number of households	54	54	66	66	120	120

Note: Analyses presented in this table use data by household and week. Coefficients are estimated using a linear model with household and week fixed effects, controlling for whether the household has insurance coverage. In Panel A, "Health shock" is a dummy variable equal to 1 if at least one family member had health symptoms in the 7 days before the interview and 0 otherwise. In Panel B, "Health shock" only includes symptoms that prevented the patient from carrying out his or her daily activities. The last row, "*p*-value Insured" is the *p*-value from the test that the sum of the two coefficients for "Health shock" and its interaction with "Insured" equals zero. Mobile money nonusers (users) are households who never (at least once) report financial transactions through mobile money during the diaries. * $p < 0.10$ ** $p < 0.05$ *** $p < 0.01$.

Appendix A Additional tables (online supplement)

Table A1. Household characteristics, health shocks, and informal transfers by insurance status

	Full sample		Never	Ever	Comparison	
	Nr. of observations	Sample mean	insured in diaries	insured in diaries	Diff. in means	*p*-value
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. Household characteristics						
Demographic characteristics						
HH head age	120	51.7	48.0	55.8	-7.8	0.0059
HH head is male (%)	120	65.8	65.1	66.7	-1.6	0.8562
HH size	120	4.9	5.4	4.4	1.0	0.0109
HH members under 18 years (%)	120	45.9	53.5	37.6	15.9	0.0005
HH members who are female (%)	120	51.1	49.8	52.6	-2.8	0.4548
HH head is protestant	119	85.7	85.5	86.0	-0.5	0.9409
Socioeconomic characteristics						
Head has completed primary school (%)	105	78.1	71.4	85.7	-14.3	0.0788
Head has completed secondary school (%)	105	44.8	44.6	44.9	-0.3	0.9793
Head engaged in crop production	107	100.0	100.0	100.0	0.0	0.0000
Head engaged in livestock	107	99.1	98.1	100.0	-1.9	0.3242
Head engaged in business	107	22.4	24.1	20.8	3.3	0.6841
# of mobile phones	120	1.9	1.7	2.0	-0.3	0.1762
Mobile money user (%)	120	55.0	52.4	57.9	-5.5	0.5482
Nr. interviews	120	47.9	47.7	48.1	-0.5	0.5994
Panel B. Health shocks and insurance						
Week with health shock (#)	120	13.1	12.5	13.7	-1.2	0.5248
Week with health shock (%)	120	27.4	26.6	28.4	-1.8	0.6449
Week with severe health shock (#)	120	8.0	8.0	8.0	-0.0	0.9874
Week with severe health shock (%)	120	17.1	17.2	17.0	0.2	0.9396
Insured for at least one month (%)	120	47.5	0.0	100.0	-100.0	0.0000
Variation in insurance coverage (%)	57	78.9	n.a.	78.9	n.a.	n.a.
Week with insurance coverage (%)	120	24.0	0.0	50.6	-50.6	0.0000
Panel C. Dependent variables						
Avg. food expenditures per week (KSh)	120	487.4	468.7	508.1	-39.3	0.5408
Avg. non-food expenditures per week (KSh)	120	1,839	1,570	2,137	-566.9	0.0683
Week with health visit (%)	120	10.0	10.2	9.9	0.3	0.8487
Week with health visit if health shock (%)	110	78.2	74.1	82.9	-8.8	0.4683
Week with facility visit (%)	120	6.0	5.7	6.3	-0.6	0.5102
Week with facility visit if health shock (%)	110	45.2	42.8	48.1	-5.3	0.4624
Avg. health expenditure per week (KSh)	120	18.9	21.3	16.3	5.0	0.2053
Avg. health expenditure per visit (KSh)	102	210.9	229.9	189.4	40.5	0.3304
Week with informal transfers (%)	120	11.3	10.8	11.9	-1.1	0.6795
Avg. informal transfer per week (KSh)	120	141.9	115.7	170.9	-55.3	0.2786
Avg. transfer if informal transfer (KSh)	89	1,247	736.9	1,793	-1,056	0.0618

Note: n.a. = not applicable. Never (ever) insured households were not (at least once) insured during the diaries. † The *p*-value in Column (6) is calculated based on a *t*-test for equal means between the sample of ever insured and never insured households.

Table A2. Effects of health insurance for users versus nonusers of mobile money

	Nonhealth expenditures (inverse hyperbolic sine)		Health visit (dummy variable)		Health expenditures (inverse hyperbolic sine)		Informal transfers (dummy)	(i.h.s.)
	Total Expenditures	Food Expenditures	Any Provider	Facility	Any Provider	Facility	Receives Transfer	Transfer Amount
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Insured	-0.068	-0.057	0.000	0.001	0.157	0.180**	0.040*	0.325*
	(0.202)	(0.204)	(0.024)	(0.018)	(0.108)	(0.075)	(0.022)	(0.170)
Health shock	-0.251**	-0.243**	0.272***	0.206***	1.506***	1.040***	-0.002	-0.018
	(0.126)	(0.100)	(0.048)	(0.037)	(0.285)	(0.233)	(0.012)	(0.084)
... × User	0.365**	0.297**	0.095*	-0.020	0.215	-0.204	0.056*	0.387*
	(0.142)	(0.119)	(0.056)	(0.041)	(0.333)	(0.266)	(0.029)	(0.199)
... × Insured	0.268	0.323*	0.037	0.004	-0.508	-0.536*	-0.029	-0.190
	(0.213)	(0.188)	(0.084)	(0.070)	(0.365)	(0.284)	(0.036)	(0.297)
Insured × User	0.168	-0.109	0.031	0.015	0.127	0.001	-0.051	-0.342
	(0.266)	(0.299)	(0.032)	(0.026)	(0.178)	(0.134)	(0.040)	(0.314)
... × Health shock × User	-0.425*	-0.371	0.002	0.086	0.181	0.468	0.033	0.155
	(0.242)	(0.236)	(0.095)	(0.078)	(0.459)	(0.352)	(0.050)	(0.402)
Mean dependent variable	1.290	0.896	0.101	0.060	0.510	0.206	0.115	0.110
Number of observations	5614	5614	5720	5720	5720	5720	5720	5720
Number of households	120	120	120	120	120	120	120	120

Note: Analyses presented in this table use data by household and week. Coefficients are estimated using a linear model with household and week fixed effects, controlling for whether the household has insurance coverage. "Health shock" is a dummy variable equal to 1 if at least one family member had health symptoms in the 7 days before the interview and 0 otherwise. "Users" stands for mobile money users; that is, households who at least once report financial transactions through mobile money during the diaries. * $p < 0.10$ ** $p < 0.05$ *** $p < 0.01$.

Table A3. Effects of health insurance on transportation costs and total health expenditures including transportation costs

	Mobile money nonusers		Mobile money users		Difference	
	Transport cost	Total expenses incl. transport cost	Transport cost	Total expenses incl. transport cost	Transport cost	Total expenses incl. transport cost
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: All health shocks						
Health shock	0.839***	1.606***	1.100***	2.128***	0.245	0.523
	(0.166)	(0.290)	(0.092)	(0.172)	(0.188)	(0.334)
Health shock × Insured	0.371	-0.030	0.505***	0.177	0.153	0.222
	(0.354)	(0.444)	(0.171)	(0.261)	(0.392)	(0.514)
p-value Insured	0.000	0.000	0.000	0.000	0.000	0.000
Panel B: Severe health shocks						
Health shock	1.032***	1.883***	1.878***	3.516***	0.830***	1.633***
	(0.202)	(0.334)	(0.209)	(0.315)	(0.290)	(0.453)
Health shock × Insured	0.437	0.003	0.366	-0.378	-0.042	-0.053
	(0.424)	(0.537)	(0.310)	(0.442)	(0.149)	(0.179)
p-value Insured	0.000	0.000	0.000	0.000	0.000	0.000
Mean dependent variable	0.201	0.302	0.482	0.79	0.356	0.572
Number of observations	2555	2555	3165	3165	5720	5720
Number of households	54	54	66	66	120	120

Note: We have applied an inverse hyperbolic sine transformation to all dependent variables in this table. Analyses use data by household and week. Coefficients are estimated using a linear model with household and week fixed effects, controlling for whether the household has insurance coverage. In Panel A, "Health shock" is a dummy variable equal to 1 if at least one family member had health symptoms in the 7 days before the interview and 0 otherwise. In Panel B, "Health shock" only includes symptoms that prevented the patient from carrying out his or her daily activities. The last row, "*p*-value Insured" is the *p*-value from the test that the sum of the two coefficients for "Health shock" and its interaction with "Insured" equals to zero. Nonusers (users) of mobile money are households who never (at least once) report financial transactions through mobile money during the diaries. * $p < 0.10$ ** $p < 0.05$ *** $p < 0.01$.

Table A4. First difference estimatos for impact of health insurance

	Nonhealth expenditures (inverse hyperbolic sine)		Health visit (dummy variable)		Health expenditures (inverse hyperbolic sine)		Informal transfers (dummy)	(i.h.s.)
	Total Expenditures	Food Expenditures	Any Provider	Facility	Any Provider	Facility	Receives Transfer	Transfer Amount
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Mobile money nonusers								
Health shock	0.045	0.045	0.292***	0.213***	1.713***	1.103***	0.005	0.020
	(0.096)	(0.106)	(0.046)	(0.036)	(0.273)	(0.231)	(0.011)	(0.077)
Health shock × Insured	-0.013	-0.067	0.016	-0.005	-0.701**	-0.645**	-0.031	-0.198
	(0.186)	(0.184)	(0.083)	(0.077)	(0.346)	(0.293)	(0.044)	(0.315)
p-value Insured	0.852	0.895	0.000	0.004	0.000	0.015	0.551	0.555
Panel B: Mobile money users								
Health shock	0.057	0.084	0.362***	0.173***	1.683***	0.765***	0.047*	0.321*
	(0.052)	(0.059)	(0.031)	(0.021)	(0.177)	(0.124)	(0.024)	(0.170)
Health shock × Insured	-0.154*	-0.006	0.052	0.118***	-0.302	0.004	-0.015	-0.240
	(0.082)	(0.114)	(0.051)	(0.039)	(0.323)	(0.235)	(0.033)	(0.286)
p-value Insured	0.193	0.429	0.000	0.000	0.000	0.001	0.145	0.695
Number of observations:								
Panel A: Mobile money nonusers	2300	2300	2334	2334	2334	2334	2334	2334
Panel B: Mobile money users	2887	2887	2940	2940	2940	2940	2940	2940

Note: Analyses presented in this table use data by household and week. Coefficients are estimated using a linear model with first differences, controlling for "Insured", a dummy variable that is equal to 1 if the household has insurance coverage and 0 otherwise. "Health shock" is a dummy variable equal to 1 if at least one family member had health symptoms in the 7 days before the interview and 0 otherwise. In Panel A (Panel B), nonusers (users) of mobile money are households who never (at least once) report financial transactions through mobile money during the diaries. The last row, "*p*-value Insured", is the *p*-value from the test for whether the sum of the two coefficients for "Health shock" and its interaction with "Insured" equals zero. * $p < 0.10$ ** $p < 0.05$ *** $p < 0.01$.

Table A5. Effects of health insurance for ever insured households that are not using mobile money

	Nonhealth expenditures (inverse hyperbolic sine)		Health visit (dummy variable)		Health expenditures (inverse hyperbolic sine)		Informal transfers (dummy)	(i.h.s.)
	Total Expenditures	Food Expenditures	Any Provider	Facility	Any Provider	Facility	Receives Transfer	Transfer Amount
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Health shock	-0.207	-0.151	0.307^{***}	0.219^{***}	1.837^{***}	1.297^{***}	-0.006	-0.054
	(0.161)	(0.115)	(0.061)	(0.047)	(0.358)	(0.285)	(0.015)	(0.107)
... × Ever insured	-0.260	-0.252	-0.169^{**}	-0.072	-1.513^{***}	-1.175^{***}	-0.000	0.011
	(0.260)	(0.238)	(0.082)	(0.066)	(0.415)	(0.316)	(0.017)	(0.127)
... × Insured	0.314	0.284	-0.006	-0.012	-0.935^{**}	-0.857^{**}	-0.027	-0.168
	(0.196)	(0.172)	(0.091)	(0.077)	(0.423)	(0.331)	(0.038)	(0.312)
p-value Ever insured	0.030	0.061	0.011	0.002	0.079	0.267	0.463	0.509
p-value Ever insured + Insured	0.632	0.689	0.207	0.154	0.207	0.051	0.429	0.524
Mean dependent variable	1.415	0.974	0.054	0.036	0.253	0.147	0.046	0.058
Number of observations	2334	2334	2555	2555	2555	2555	2555	2555
Number of households	54	54	54	54	54	54	54	54

Note: Analyses presented in this table use data by household and week. Coefficients are estimated using a linear model with household and week fixed effects, controlling for whether the household has insurance coverage. "Health shock" is a dummy variable equal to 1 if at least one family member had health symptoms in the 7 days before the interview and 0 otherwise. The last rows, "*p*-value Ever insured" and "*p*-value Ever insured + Insured" are the *p*-values from tests for whether the sum of the two coefficients for "Health shock" and its interaction with "Ever insured" — and the three coefficients for "Health shocks", its interaction with "Ever insured" and "Insured" — are equal to zero, respectively. Sample is restricted to nonusers of mobile money (households who never report financial transactions through mobile money during the diaries). * $p < 0.10$ ** $p < 0.05$ *** $p < 0.01$.

Table A6. Effects of health insurance for ever insured households that are using mobile money

	Nonhealth expenditures (inverse hyperbolic sine)		Health visit (dummy variable)		Health expenditures (inverse hyperbolic sine)		Informal transfers (dummy)	(i.h.s.)
	Total Expenditures	Food Expenditures	Any Provider	Facility	Any Provider	Facility	Receives Transfer	Transfer Amount
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Health shock	0.088	0.068	0.393***	0.199***	1.879***	0.923***	0.055	0.374
	(0.071)	(0.073)	(0.033)	(0.021)	(0.208)	(0.149)	(0.033)	(0.225)
... × Ever insured	-0.054	-0.171	-0.122**	-0.063	-0.687**	-0.395	-0.014	-0.069
	(0.107)	(0.199)	(0.055)	(0.042)	(0.320)	(0.246)	(0.049)	(0.352)
... × Insured	-0.100	-0.027	0.006	0.072*	-0.516	-0.166	0.001	-0.065
	(0.124)	(0.155)	(0.048)	(0.037)	(0.311)	(0.241)	(0.039)	(0.284)
p-value Ever insured	0.699	0.590	0.000	0.000	0.000	0.009	0.253	0.270
p-value Ever insured + Insured	0.625	0.560	0.000	0.001	0.128	0.316	0.400	0.476
Mean dependent variable	1.340	0.938	0.138	0.078	0.717	0.253	0.170	0.152
Number of observations	2940	2940	3165	3165	3165	3165	3165	3165
Number of households	66	66	66	66	66	66	66	66

Note: Analyses presented in this table use data by household and week. Coefficients are estimated using a linear model with household and week fixed effects, controlling for whether the household has insurance coverage. “Health shock” is a dummy variable equal to 1 if at least one family member had health symptoms in the 7 days before the interview and 0 otherwise. The last rows, “*p*-value Ever insured” and “*p*-value Ever insured + Insured” are the *p*-values from tests for whether the sum of the two coefficients for “Health shock” and its interaction with “Ever insured” — and the three coefficients for “Health shocks”, its interaction with “Ever insured” and “Insured” — are equal to zero, respectively. Sample is restricted to users of mobile money (households who at least once report financial transactions through mobile money during the diaries). * $p < 0.10$ ** $p < 0.05$ *** $p < 0.01$.

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