The Effects of Community Health Worker Visits and Primary Care Subsidies on Health Behavior and Health Outcomes for Children in Urban Mali

Mark Dean Anja Sautmann*

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Abstract

Subsidized primary care and community health worker (CHW) visits are important demand side policies in the effort to achieve universal health care for children under five. Causal evidence on the interaction between these policies is still sparse. This paper reports the effects on diarrhea prevention, curative care, and incidence as well as anthropometrics for 1649 children from a randomized control trial in Bamako that cross-randomized CHW visits and access to free health care. CHW visits improve prevention and subsidies increase the use of curative care for acute illness, with some indication of positive interaction effects. There is no evidence of moral hazard, such as reduced preventive care among families receiving the subsidy. Although there are no significant improvements in malnutrition, diarrhea incidence is reduced by over 70% in the group that receives both subsidies and CHWs. Positive effects are concentrated among children ages 0 to 2.

JEL codes: I11, I12, O15

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1 Introduction

Despite impressive improvements in child and maternal health over the last decade, child mortality continues to be unacceptably high in many parts of the world. In Mali, and West Africa as a whole, under five mortality remained above 90 per 1000 in 2020, with even higher rates for the poorest households.[1] Many of these deaths are preventable. For example, 12.2% of under-five deaths in Mali in 2019 were due to diarrhea. A majority of these infections are caused by unsafe drinking water and poor sanitation, and only a small share receive the recommended treatment [Unicef, 2021].

In the effort to improve health outcomes for children and mothers and achieve universal health care (UHC), the global health community has focused on two key strategies: free or heavily subsidized basic health care, and home visits by community health workers (CHW) who help bridge access barriers. While user fees for basic health services were considered a tool to maintain sustainability and quality of care in the 1990s [e.g. Akin et al., 1987], there is now broad consensus that African countries should work towards eliminating user fees, at a minimum for mothers and young children [e.g. McPake et al., 2008, UK Secretary of State for International Development, 2009, Jamison et al., 2013]. At the same time, international aid organizations and advocacy groups, like UNAIDS and the "One Million Community Health Workers" campaign, are pushing for various measures to strengthen the role of CHWs in the last-mile delivery of health care [Singh and Sachs, 2013].

These policies are central to ongoing or proposed health reforms both in Mali and across Africa. In 2019, Mali's Ministry of Health announced the intent to provide free children's and mothers' health care within three years, although there were still gaps in covering the estimated cost of $120 million [Adepoju, 2019].[2] By 2016, 33 out of 47 African countries had committed to a financing strategy for universal health coverage [Barroy et al., 2016, Cotlear

[1] Under five mortality in 2020 in West and Central Africa was 91.4 and in Mali 91.0; for the lowest wealth quintile in Mali it was 117.1 (2019 data); Sub-Saharan Africa as a whole had an under five mortality of 73.3 out of 1,000 live births. Source: IGME [2021].

[2] The reforms have been delayed due to the Covid-19 pandemic and political disruptions.

and Rosemberg, 2018]. Meanwhile, the One Million Community Health Workers Campaign estimates over 300,000 CHWs in Sub-Saharan Africa alone.

Given that CHW visits to households combined with subsidized primary care are cornerstones of current global health policy for children under 5, it is crucial to learn how the individual effects of these interventions compare, and how they interact with each other. Here, we study the individual and combined effects of CHW visits and subsidies on measures of preventive and curative care for diarrhea and related health outcomes in peri-urban areas of Bamako, Mali.[3] We analyze data from a randomized control trial of the Action for Health program by the NGO Mali Health. Action for Health combines biweekly CHW visits with a subsidy that covers consultation fees and standard treatment for the most common illnesses among children under five at two local clinics in Sikoro.

The two program components were cross-randomized at the compound level and provided to eligible households starting in winter 2012-13. The main follow-up survey at the end of 2013 collected a detailed nine-week panel of complete health diaries to analyze demand for acute health care [Sautmann et al., 2020]. Here, we use data from a second follow-up in 2014 that collected data on diarrhea-related behaviors and outcomes: preventive measures and knowledge indicators, incidence of diarrhea symptoms and acute care from an abridged 1-week health calendar, and measures of malnutrition. We are interested in the effects on both preventive and acute care and their individual and joint impact on health outcomes. Diarrhea is one of the most important causes of death for children in the region; moreover, it provides a good case study because it is affected by the full range of behaviors that the two interventions aim to change. Preventing the intake of contaminated water or food is one of the most effective ways of avoiding diarrhea, and mild diarrhea cases can be treated at home, but serious cases (e.g., dysentery) require clinical care. In other words, there is an important role for all three: prevention, home care, and formal care.[4]

[3]While CHW programs were originally intended for rural areas, many CHWs work in urban or peri-urban areas. For example, 6% of Malian CHWs are estimated to work in Bamako [Saint-Firmin et al., 2018].

[4]By contrast, prevention is usually the only protection from viral disease, e.g. through vaccination. Other health issues are primarily addressed through curative care, such as bacterial infections.

There are multiple reasons to think that CHWs and subsidies (free care) interact with each other in determining health outcomes. First, CHW activities focus more on preventive care, while subsidies improve access to curative care. The two types of care could be substitutes in the health production function, that is, access to one reduces the need for the other; or complements, that is, adequate prevention and acute care combined lead to greater health improvements than the sum of the individual effects. In addition, there is the possibility of "spillovers" on behavior: since both preventive and curative care of the child depend on their caretaker's actions, a prevention-focused intervention might affect choices about curative care and the reverse. An important concern in this respect is moral hazard; in particular, access to free curative care may lead parents to reduce prevention efforts. Conversely, the interventions could reinforce each other's effect on parents' behavior.[5] For example, Sautmann et al. [2020] show that CHW visits could improve utilization of formal care in the presence of a subsidy: essentially, CHWs advise parents when to seek care, and the subsidy makes it possible for parents to actually follow this recommendation. On the prevention side, receiving CHW visits as part of a larger program that also provides free access to care may increase the credibility of the CHW – or it may even act as motivation for the CHW themselves.

Our empirical analysis estimates the treatment effects in the three intervention groups – CHW visits only, subsidy only, and full Action for Health program – compared to the control group. We also test whether the effect of the two interventions combined is different from the CHW-only and subsidy-only effects. We find promising effects of the CHWs on measures of knowledge and prevention. Both groups that receive CHW visits have better knowledge of the recipe for oral rehydration solution and higher self-reported use of water disinfection, although they are only weakly more likely to know the correct ages for exclusive breastfeeding, and an objective measure of water chlorine contents shows no effects. However, another objective measure, whether a mosquito bednet was hung correctly, is 14pp higher with CHW visits. Most knowledge and prevention measures essentially did not change in

[5]We use substitutes and complements here in the game-theoretic sense: x and y are substitutes in f if the marginal return to x (y) is decreasing in y (x), i.e., the cross-derivative is negative.

the subsidy-only group, as one might expect, and most also showed no significant difference between the CHW-only and the full-program groups.

At the same time, we find positive effects of the subsidy on curative care for children with diarrhea symptoms. The groups receiving the subsidy only and the full program receive oral rehydration treatment (ORT) significantly more often, by 17 and 27 percentage points, respectively. The group receiving only CHW visits saw a 13pp increase in ORT usage but the effect is not significant. There are also large (though statistically not significant) increases in formal care in the full-program group. No such increases are seen in the CHW-only or the subsidy-only group. When examining the incidence of these effects by age, we see that the increase in formal care (by 60pp) accrues primarily among children age 0-2 and the increase in ORT use among age 2-4 children (both in the full-program group). Overall, the full-program group receives better care for acute bouts of diarrhea than the other groups.

We see mixed effects on anthropometric danger signs of malnutrition, with most effect sizes close to zero and only marginally significant. However, a striking finding is that the full program group experiences a large and significant reduction in the number of days with diarrhea symptoms (out of the past 7 days), equivalent to over 70% of the control group average. While the effects on diarrhea incidence in the other two treatment groups are not significant, they are negative as well.[6] We do not reject that the full-program effect equals the sum of the CHW-only and subsidy-only effects. Effects on the mother/caretaker's concern about the child's health are noisily estimated and not significant.

Our results are overall encouraging for the combination of CHW and subsidy interventions. There is no evidence for moral hazard, and if anything, preventive behavior is slightly higher in the full-program group. Children in the full program group also get diarrhea significantly less often and receive better care when they do fall sick.

The findings in this paper complement the analysis of the 2013 data in Sautmann et al.

[6]This pattern is true when looking at either any diarrhea symptoms, or for cases in which there are more than three loose stools per day. The baseline incidence of the danger sign "blood in the stool" is low at 0.045 days, and while all three treatment groups show negative point estimates that are large in relative terms (-0.022 to -0.027) none are statistically significant.

[2020]. The 2013 paper does not analyze health outcomes or prevention, but instead quantifies the impact of subsidies and CHW visits on underuse and overuse of acute care, benchmarking demand against WHO-IMCI careseeking recommendations. Subsidies increased care seeking by 250%, with most of the increase in care classified as necessary by WHO guidelines. There were no CHW effects on average, but exploratory analysis indicated a complementarity between CHWs and subsidies for the youngest children, similar to the effects on care for diarrhea in the 2014 follow-up reported here. Again, these findings are encouraging for layering CHW interventions with the expansion of UHC. In both surveys, we found the strongest effects of the CHWs for the very youngest age groups, suggesting that CHW interventions could potentially focus on children under 2 rather than under 5.

The existing empirical literature provides only a partial picture of the relative health effects of subsidies and CHW visits, particularly in combination. Rigorous evidence on the health outcome effects of removing user fees for primary care is fairly scarce [Ridde and Morestin, 2012, Dzakpasu et al., 2013, Lagarde and Palmer, 2011]. Two exceptions are a randomized control trial in Ghana that found positive health effects on children who were anemic at baseline, and a difference-in-difference study using variation in access due to apartheid policies in South Africa that found positive impacts on children's nutritional status [Powell-Jackson et al., 2014, Tanaka, 2014]. There is also a literature on the effects of price and non-price screening on the take-up and targeting of specific (often preventive) health products [e.g. Cohen et al., 2011, Dupas et al., 2016, Lopez et al., 2022].

By comparison, there is a large literature on the effectiveness of CHW programs [see Lewin et al., 2010, Gilmore and McAuliffe, 2013, Scott et al., 2018, for systematic reviews]. However, to our knowledge, no paper studies the interaction between CHWs and the removal of user fees – a key contribution of our paper.[7] Indeed, some reviews note the lack of evidence

[7]For example, Scott et al. [2018] classifies studies into various determinants of the success of CHWs: the health system function of the CHW; the type of health issue dealt with; training; supervision; characteristics of the CHW; logistical support and supplies; remuneration and incentives; deployment; community embeddedness; and integration with the health system. None of these categories address the cost to the household for acute care seeking.

on referral practices of health workers, and the barriers that households face in following the referral recommendations of CHWs [Kamal-Yanni et al., 2012, Paintain et al., 2014].

One related set of papers demonstrate the important role of pro-social motivations and non-monetary incentives for CHW effort [Ashraf et al., 2014, Deserranno, 2019, Wagner et al., 2020]. Wagner et al. [2020] show that CHW who provide ORS solution for free carry out *more* household visits than CHW who are allowed to charge the household and keep the revenue, and argue that this is based on CHW preferences for delivering free goods over conducting "sales visits". This suggests there could be interaction effects of CHW and subsidy policies through CHW motivation. As we argue in section 3.2, in our setting it is a priori ambiguous whether CHW are more or less motivated to visit households that also receive the subsidy. None of these papers test the interaction of price changes for households (for acute care) with CHW vists.

Most closely related to our work is perhaps Shapira et al. [2018], who cross-randomize demand-side incentives (in-kind rewards to households) with a supply-side expansion of CHW services (pay-for-performance incentives at the community level for volunteer CHW) and study the effect on mothers' utilization of pre- and post-natal care. The paper does not find an effect of the pay-for-performance intervention on care use. It does not study the effects of providing free access to acute care and does not measure child health outcomes.

The next section describes health care and home environments in poor areas of urban Mali as well as the Action for Health program. Section 3 describes the experimental design and lays out a framework for thinking about the effects of CHWs and subsidies, individually and in combination. Section 4 describes the empirical results and section 5 provides a discussion and concludes.

2 Health Care in Mali and the Action for Health Program

Public health care in Mali is built around a network of community health clinics or *centres de santé communautaires* (CSComs). A typical clinic in Bamako is staffed with on average

about 1.5 physicians, 4 medical trainees, 5 nurses and midwives, a lab technician, as well as technical and administrative staff [Lopez et al., 2022]. Most clinics have an attached pharmacy. At the time of the study, CSComs operated under the community-funding model of public health care, advocated by the Bamako Initiative from 1987 and endorsed by governments across West Africa, meaning that the revenues from sales of medications and other user fees fund the operation of the clinic. The public health care system is flanked by a private formal sector with higher prices, and informal sources such as market stalls that only rarely sell prescription medications.

The study was conducted in a peri-urban area of the capital Bamako in the catchment area of two local clinics partnering with the NGO Mali Health. The compounds in our sample typically lie along unpaved roads without access to sanitation (compounds are multi-family dwellings sharing a courtyard and common facilities). In the months during and after the wet season, August-November, the incidence of diarrhea and malaria is highest. Mali has high rates of maternal and child mortality, especially in rural areas, and while poor urban populations have better health facility access and lower rates of mortality, families still often lack basic health care. Mali's rapidly growing urban areas resemble those elsewhere in West and Sub-Saharan Africa, although literacy rates in Mali tend to be lower. In addition, fertility and child mortality rates are higher, which makes child health interventions particularly important [Sautmann et al., 2020].

Mali Health started their Action for Health (AfH) program in 2010. Action for Health combines subsidized health care and community healthworker visits. Children are enrolled at birth (or at roll-out) and receive the program until age 5. The subsidy is administered via a personalized card that entitles the child to unlimited free consultations at a partner clinic, and free treatment and medication for any illness due to diarrhea/malnutrition, malaria, vaccine-preventable diseases, and respiratory infection (together causing the vast majority of child deaths outside of neonatal conditions, e.g. WHO [2020]). Families have to cover the remaining expenses, for example for services that are not part of the standard treatment

course for a given diagnosis, and any visits to non-participating providers. The subsidy reduced the average cost to the family of visiting a formal provider by 71% (CFA 933 vs. CFA 2850, approximately USD 1.89 vs. USD 5.76 at 2014 exchange rates) and 70-77% of households who received the subsidy reported their visit as "free" compared with 12%-14% for households not receiving the subsidy [Sautmann et al., 2020]. The value of care received, using prescription records and medications taken, was similar in both groups.

The activities of the CHWs build on the 13 Essential Family Practices as defined by the Malian government. They track simple health indicators including various symptoms and danger signs, height and weight, and mid-upper arm circumference (MUAC), and advise families when to visit a doctor. They teach families how to prepare and use oral rehydration solution (ORS) in mild cases of diarrhea. They also monitor and teach preventive behaviors, such as vaccinations and bed net use, good breastfeeding practices to protect young children from ingesting contaminated water, and hand washing. They deliver water disinfection tablets to households with unsafe water access and teach water purification.

CHWs are recruited locally and their training builds on the C-IMCI [Rosales and Weinhauer, 2003], a set of guidelines for community health workers that incorporates the WHO's and UNICEF's "Integrated Management of Childhood Illness" recommendations [WHO, 2005]. For the expansion covered in this study, Mali Health hired and trained two additional teams of 10 CHW each, one covering the CHW only, one covering the full program group.

All subsidized clinical care was provided by medical professionals and staff trained in country. The clinics in this study were financially supported by Mali Health. For cost control purposes, Mali Health conducted spot checks on diagnosis and prescriptions using bills submitted to Mali Health and the clinic's treatment records and accounting. As a result, per-visit value of care was unaffected by the interventions (see above). These quality control measures mean there may be differences in the level of care received relative to an unmonitored CSCom. However, the qualifications of care providers and the facilities and materials they can access are typical for peri-urban Mali.

3 Experiment and Data Collection

The experiment took advantage of a planned roll-out wave for the Action for Health program in early 2013. Mali Health conducted a household census in 2012 within their targeted expansion area in the catchment areas of their two partner clinics at the time and selected twice as many households as could have been enrolled in the absence of the experiment, using a proxy-means test for identifying the poorest third of families. The study households are located on average approximately 700 meters from the closest clinic.

All compounds with one or more eligible households were randomly assigned to either a subsidy-only, CHW-only, full-program, or control group.[8] The randomization was stratified by average household assets in the compound, number of eligible children at baseline, and compound location. The original teams of 10 CHWs each in the CHW-only and the full-program group were formed by creating pairs of CHWs of comparable quality and experience and assigning one of each pair to each treatment arm. The CHWs were assigned to location strata in an overlapping pattern designed to balance the quality of CHW services between the CHW-only and full-program groups within stratum (see also Sautmann et al. [2020] for more detail). The teams were trained and managed separately to reduce any potential influence of one treatment arm on CHW behavior or motivation in the other.

Randomization at the compound level helps account for potential spillover effects of the CHW treatment due to information sharing among households who also share their living space. However, given the proximity of study compounds we cannot rule out more diffuse information spillovers through contacts outside of the compound. To the extent that CHW visits improve health behaviors of control or subsidy-only households, the effect estimates we report represent therefore a lower bound of the impacts of CHWs. Since the program only included a small fraction of the population,[9] we deem it unlikely that the program had

[8] The per-household cost of the CHW and subsidy components is approximately the same, so Mali Health was able to provide just one arm of the program to twice as many households.

[9] Approximately 30% of local households in the Action for Health expansion areas, a subsection of Sikoro, were eligible for the study; about 75% of these households received one of the treatments; and children under five years make up about 20% of people living in the study households.

significant "epidemiological" spillover effects e.g. through reduced infection rates.

The baseline data was collected in Fall 2012, and the first follow-up took place in 2013. The 2013 data contains detailed health calendars covering 9 weeks, including all health care visits, treatments received, and symptoms observed. This data was used in Sautmann et al. [2020] to study the effect of the interventions on the targeting of primary care for children (utilization conditional on a classification of the child's symptoms as either "care required" or "care not (yet) required" according to IMCI symptom charts).

Our analysis here uses the baseline data along with data collected in the second follow-up survey conducted October 30 - November 4, 2014. This data contains an abridged health calendar that focuses on diarrhea symptoms along with care received over the 7 days preceding the survey visit. In addition, we collected anthropometrics, preventive knowledge and behavior, self-reported receipt of treatment, and other indicators, with a focus on information relevant to malnutrition and diarrhea. Enumerators were unaware of the experiment or treatment arms.

The original treatment groups had been kept intact for a second year, and children in enrolled families in one of the treatment arms continued to receive the subsidy, CHW visits, or both, regardless of age. Moreover, any children born into these families were also enrolled into the same arm. However, it is worth noting that Mali Health was aware of the findings from the 2013 data collection that the CHW program had relatively low impacts on acute care seeking (Sautmann et al. [2020]). While the interventions were ongoing, Mali Health continued to provide additional training to CHWs. This might affect comparability of the CHW effects in 2013 and 2014.

Between the two follow-up surveys Mali Health had received a gift that allowed them to supply all beneficiary households in need with treated mosquito nets (both in the three treatment groups and in other Action for Health households not part of the sample). For ethical reasons, it was decided not to withhold this benefit from any households in the treatment groups that did not currently own treated nets. This may affect the incidence of

health concerns in the three treatment groups.

3.1 Balance and Attrition

The primary unit of analysis is the child or the caretaker (typically the mother). We describe the evolution of the sample here in terms of the number of children in the different waves. At baseline, we enrolled 1,732 children in the data collection. In both follow-up survey rounds, some children could not be found. In both years, 5 children died; additionally, families had moved or were traveling and in one case a family refused to further take part in the study. Newborn children in the treatment households were enrolled in Action for Health either by the CHWs or by a program officer who visited study households at least every three months. This follows the standard protocol for Action for Health, and since the caretakers' treatment choices and resulting health improvements are our outcome of interest, we consider these children part of the sample. It is possible that the treatment allocation affected fertility, but we consider the risk to representativeness greater if we were to exclude these children.

Figure 3 in Appendix A includes a CONSORT diagram detailing both attrition and addition of new children throughout the study. After the first follow-up in 2013, which included 1,768 children, 217 children left the survey for various reasons, 12% of the sample. An ANOVA test fails to reject the hypothesis that attrition is equal across treatment groups. At the same time, 98 children were added to the sample. Again, ANOVA fails to reject the hypothesis that additions were equal across treatments. Table 1 tests for balance for a set of covariates at the child, household, and compound level. Each column is a regression on three treatment arm dummies with stratum fixed effects and clustered standard errors, using the same specification as in the regressions below. Only one coefficient in the table is significantly different from zero. We control for these covariates in the main regressions.

3.2 Framework and Hypotheses

Figure 1 shows in schematic form what effects we might expect from the two treatment components, subsidies and CHW visits. Subsidies that reduce the cost of care at the CSCom

Table 1: Balance: Covariates by treatment group.

	Child	Household Head					Household				Compound
	Is male	Age (years)	Head is literate	Majority ethnicity	Head is male	Head has salaried job	Head is over 50	No. of members	Own home	Log assets	Distance to clinic
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
CHW visits	−0.015	0.075	−0.024	−0.065	−0.041	0.010	0.001	−0.133	0.024	−0.227	−0.015
	(0.037)	(0.106)	(0.048)	(0.053)	(0.032)	(0.032)	(0.046)	(0.306)	(0.046)	(0.268)	(0.060)
Subsidy	0.022	0.031	0.031	−0.049	−0.014	−0.001	−0.019	0.152	0.024	0.233	−0.034
	(0.034)	(0.101)	(0.047)	(0.052)	(0.031)	(0.032)	(0.046)	(0.299)	(0.046)	(0.229)	(0.061)
Full program	0.014	−0.001	0.107**	−0.080	−0.003	−0.022	0.052	0.359	0.045	0.265	−0.055
	(0.035)	(0.102)	(0.047)	(0.052)	(0.032)	(0.031)	(0.047)	(0.285)	(0.046)	(0.224)	(0.060)
Mean	0.515	4.148	0.464	0.648	0.852	0.117	0.424	6.050	0.421	6.205	6.024
N	1649	1649	900	900	900	900	900	900	900	900	583

Notes: Each column is a regression of the variable in the top row onto the three treatment group dummies. All regressions include stratum fixed effects and cluster the standard errors at the compound level. There are between 1 and 6 households and up to 12 children in a compound. The number of observations reflects the total number of children ((1)-(2)), households ((3)-(10)) and compounds (11), not including missing observations.

Significance levels: * 0.1, ** 0.05, *** 0.01.

are likely to primarily increase care seeking with a formal provider in the case of acute illness. Positive effects arise from better access to curative care, provided that the child indeed receives this care when it is needed.[10] The CHW visits are more likely to improve preventive care, through teaching caretakers appropriate health behaviors, such as correct breastfeeding, hand washing, and bed net use, and through providing supplies such as water disinfection. These direct effects are represented by the vertical arrows in Figure 1. Acute care and preventive care combine to generate better health outcomes by reducing the incidence and severity of illness.

Our experimental design allows us to analyze the effects of each program component

[10]We are able to analyze in detail how the subsidy changes the utilization of (formal) curative care conditional on the child's health status, and in particular how it affects the risk of health care overuse (vertical arrow on left in Figure 1). This risk arises more frequently in curative care than in preventive care, because formal care only benefits a child with an illness that actually requires care and responds to treatment, whereas non-indicated treatment may have no, or even negative, effects on health outcomes, not to mention that it wastes resources. The 2013 data collection and analysis in Sautmann et al. [2020] pursue these questions in detail.

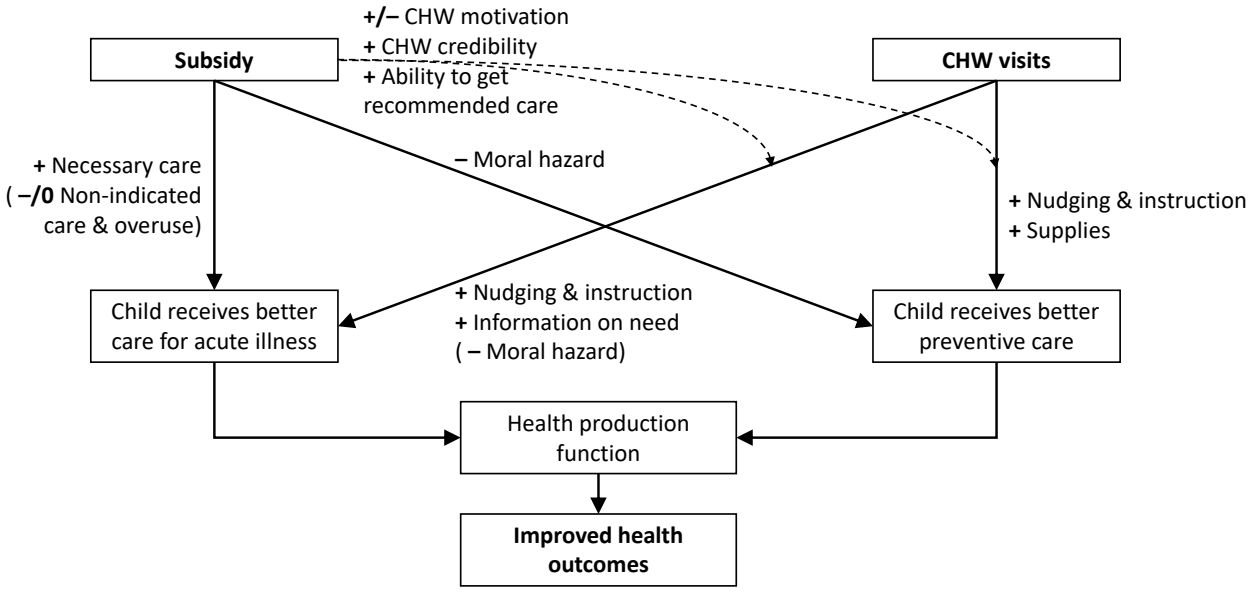

Figure 1: Schematic pathways for treatment effects. The vertical arrows denote the direct effects of the subsidy treatment on acute care, and the CHWs on preventive care, both provided by the child's caretaker. The diagonal solid and dotted arrows show potential "cross-effects" as well as interaction effects in the full program arm through the behavior of caretakers and CHWs, respectively. Acute and preventive care combine in an (unobserved) health production function to determine overall health outcomes.

separately as well as in combination. The full program may have different impacts on health outcomes than the sum of each component alone. The first pathway for such an interaction is through the health production function (bottom of Figure 1). In principle, acute and preventive care may be substitutes in the health production function: acute care may affect overall health less when prevention is strong, or conversely, prevention may be less needed when the child always receives prompt acute care in the case of illness. Alternatively, both inputs affect health in different ways and work together: prevention reduces the incidence of illness and acute care reduces the severity of any remaining illness spells. This means that their health effects are additive and may even be complements, i.e., each type of care becomes more effective in the presence of the other.[11]

In addition, there may be interaction effects of the two interventions on the levels of each

[11]We use complements and substitutes to mean that one input increases or decreases the marginal productivity of the other, see footnote 5.

type care the child receives. These are represented by the diagonal arrows in Figure 1. For prevention, for example, the CHWs provide advice and instruction on sanitation and deliver water disinfectant, but it is up to the parents to actually implement the measures promoted by the CHWs, including using the disinfection tablets regularly. Caregivers may or may not increase their preventive behavior, and moreover, there response may differ depending on whether they also receive the subsidy treatment. An immediate concern is that parents take less care to use prevention knowing their child can see a doctor for free: a form of moral hazard where the beneficiaries reduce effort in response to program benefits. On the other hand, parents may be more willing to follow the advice of the CHW if they also receive the subsidy, for example because the link with the CSCom strengthens the CHW's credibility.

On the acute care side, there is a similar possibility of an interaction effect with the CHWs through the behavior of parents. First, in mild cases of diarrhea, the caretaker should monitor hydration and may provide ORT as necessary. Rehydration solution can be prepared at home using salt, sugar, and water, and the recipe is taught by the CHWs. Positive effects on curative care may therefore arise because the CHWs can nudge the parents to be proactive and provide knowledge to deal with mild cases of illness.

One of the main activities of the CHWs in the realm of acute care, however, is that they directly monitor the child's health during the biweekly visits and in the process teach parents to spot symptoms. The IMCI algorithms are designed to discern signs of serious illness and ensure that a child in need of evaluation sees a formal care provider. We may think of this as the CHWs providing information about the child's health status that is aimed at improving the targeting of formal care. For a child with diarrhea, a visit to a formal health care provider is recommended in more serious cases, such as symptoms for five days or more, dehydration, or blood in the stool.

As argued in Sautmann et al. [2020], the effect of information provision can be ambiguous, because the child's caretakers will in general use new information to align care seeking with their own preferences, rather than those of the policy maker (here represented by the CHW

care-seeking recommendations). Information on its own can improve targeting – e.g., by alerting parents who are not aware how ill their child is – but it may also have no or even a negative effect: simply put, the parent might learn to interpret symptoms but use their new knowledge to postpone a doctor visit as long as possible if they feel the illness is not serious enough. This friction is akin to moral hazard and may arise in particular due to high (private) costs of formal care to the parents, vs. the (social) benefits to the child or to others. This provides a strong case for CHWs and subsidies acting as complements: the subsidy helps align the preferences of parents and policy maker by reducing private cost, while the CHWs provide the necessary information to act on these preferences.[12]

Lastly, while we focused here on the behavior of parents as a potential factor that introduces interaction effects, note that another channel is the behavior of the CHWs themselves (dotted arrows in Figure 1). Specifically, it is possible that the CHWs exert different levels of effort in the CHW-only vs. the full-program group. The direction of the effect could go either way. The CHW may feel more motivated when families are able to act upon advice to seek care due to the subsidy, in particular when it comes to tracking the child's symptoms week to week. Conversely, the CHW may perceive their work as more important when the family does not have access to the subsidy, and this may in particular affect their preventive work.

4 Results

All our regressions estimate intent-to-treat effects and include three treatment group dummies – CHW visits, subsidy, and full program – along with the covariates from table 1 (dummying out missing variables) and stratum fixed effects. Each column is a regression with the variable in the top row as the outcome. In different specifications we also report p-values for various tests: (i) "CHW = full" and "subsidy = full" test whether the full pro-

[12] A direct negative effect of the CHW visits on acute care is also possible; for example, parents may not visit a doctor even when the child appears ill, perhaps in the belief that the illness could not be serious given all the preventive measures taken. This is again a form of moral hazard. We consider this less plausible as the available evidence shows that parents are very aware when their child is not well.

gram has the same effect as one of the program arms separately, and (ii) "CHW+subsidy = full" tests if the arms are complements or substitutes, that is, whether the full program effect is larger or smaller than the sum of effects of the individual program components.

All regressions cluster the standard errors at the compound level. The number of observations varies depending on whether the unit of analysis is the child, their caregiver (the respondent), the household, or the compound. For age-standardized danger signs of malnutrition, we report results only for children under 5. We first report the main results on prevention, acute care, and illness incidence and anthropometric outcomes, and then discuss the findings further in section 5.

The analysis focuses on health care and health outcomes related to diarrhea and malnutrition.[13] Diarrhea is most frequent - and particularly dangerous - among the youngest children, and Sautmann et al. [2020] showed that there may be heterogeneity in the utilization of curative care by age. We therefore also analyze age-specific effects of subsidies and CHWs for acute care and illness incidence.

4.1 Prevention Behaviors and the Effects of CHWs

Table 2 shows effects on indicators that measure knowledge and prevention behavior of the caregiver and should be primarily affected by the activities of the CHWs. In areas with poor sanitation, exclusive breastfeeding helps prevent gastrointestinal (GI) disease before month 6. Afterwards, safe water is an important factor in prevention. If diarrhea does occur, a simple and effective home remedy is oral rehydration treatment. Columns (1) and (2) in Table 2 show indicators for whether the respondent could report the recipe for homemade ORS and whether they knew the age until which children are ideally exclusively breastfed (6 months). Column (3) is an indicator whether the caretaker (mother) reports that she received water tablets as part of a health NGO program last year. Columns (4)-(5) show self-reported use of water disinfectant, and (6) shows water chlorine content measured with detection strips.

[13]The program's effect on malaria care and incidence would have been of interest as well, but the distribution of insecticide-treated malaria nets to all households in the three treatment groups invalidates comparisons between them.

Column (7) shows a dummy for whether the mother could show the enumerator a correctly hung mosquito bed net under which the child sleeps.

The CHWs have significant positive impacts on health knowledge (columns (1)-(2)) and self-reported water disinfectant use (columns (4)-(5)) in both the CHW-only and the full program groups. In order to overcome experimenter demand effects in self-reported use, we also measured water chlorine content using test strips. There is no evidence for any *objective* impact of the free chlorine tablet distribution on chlorine in the water (column (6)).[14] Households either over-report disinfectant use or use the tablets incorrectly. It is worth noting that nearly 50% of the control group show some chlorine detected in the drinking water, indicating that many households do have access to chlorinated water sources such as community tabs or undertake disinfection on their own accord.

In contrast, we find strong effects of both the CHW-only and the full program intervention on the correct use of the mosquito net (column (7)). We report this measure here because it is another objective check of an important day-to-day health behavior (over and above the free distribution of the bed nets that benefited all three treatment groups, likely the cause of the weakly significant positive effect in the subsidy group). Note that even in the control group, 66% of children had a correctly hung net. However, the CHWs raise the share of children who sleep with mosquito protection by over 14pp.[15]

For most measures of knowledge and prevention, there is no strong evidence of a subsidy effect, as we would expect: the point estimates are typically close to zero and in some cases negative. The two exceptions are for ORS knowledge and bed net usage, where we find small, but significant positive effects.

In most measures we also do not see a strong interaction effect between the subsidy and

[14]The point estimates of the program impact are in some cases relatively large - 1/3 or the control group mean in the case of the CHW only group - but also estimated with large standard errors.

[15]In Appendix B, Table 5, we show self-reported receipt of a free mosquito net in the last year. The effect sizes in all three treatment groups are almost exactly identical, reflecting the distribution to all of Mali Health's beneficiary households that did not yet own a net, see section 3. Note also that we see these strong CHW effects despite potential information spillovers to households without CHWs that received a net, who may have been particularly motivated to seek out information on how to use it.

CHWs. There is no evidence of moral hazard, but there is also no strong positive interaction. One exception is column (1): mothers are significantly more likely to know the recipe for ORS in the full program group than in the CHW group. Despite the quantitatively large, positive effect of 6.7pp in the subsidy-only group, the test that the effect of CHWs and subsidy combined equals the full program effect is still marginally rejected at the 10% level, due to the strong full-program effect of a nearly 50% increase. We will discuss ORT more below, because it may also be prescribed or recommended by a provider and therefore constitutes a special case.

The second exception is column (3), which is a self-reported measure whether the household has ever received water disinfectant tablets from an NGO. Here, the effect of the full project is significantly larger than that of the CHWs only or of the sum of the CHW and subsidy effects. Interestingly, this holds only for this one water disinfection indicator. Self-reported use of the tablets over the last 7 days is somewhat higher in the full program group, but the difference is not significant, and self-reported use on the same day is almost identical in magnitude. We note that the CHW distribution of water tablets is partially determined by the household's prior access to safe water: some compounds have access to communal taps or protected wells and do not receive the tablets, and this partially explains the overall low rates of receipt. It does not explain the difference between CHW and full program effects in column (3).

Table 2: Prevention: caretaker's knowledge and behavior.

	Caretaker's knowledge		Water disinfection				Malaria protection
			self-reported			measured	
	Knows ORS recipe	Knows age of excl. breastfeeding	Given last year	Used last 7 days	Used today	Water chlorine content (ppm)	Bed net hung correctly
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
CHW visits	0.330***	0.096*	0.230***	0.125***	0.095***	0.056	0.146***
	(0.044)	(0.053)	(0.030)	(0.038)	(0.030)	(0.040)	(0.046)
Subsidy	0.067*	−0.057	0.023	−0.013	0.006	0.020	0.082*
	(0.037)	(0.054)	(0.022)	(0.035)	(0.027)	(0.043)	(0.045)
Full program	0.498***	0.046	0.357***	0.169***	0.083***	0.027	0.141***
	(0.040)	(0.052)	(0.037)	(0.038)	(0.028)	(0.048)	(0.044)
Control group mean	0.167	0.554	0.008	0.120	0.058	0.170	0.662
N	1016	1016	1015	1015	1015	1016	1649
p-value: CHW = full	0.00	0.33	0.00	0.26	0.69	0.51	0.91
p-value: C+S = full	0.10	0.93	0.03	0.27	0.65	0.43	0.17

Notes: The unit of observation is the mother/caretaker in columns (1)-(6) and the child in column (7). All regressions include stratum fixed effects, control for covariates, and cluster standard errors at the compound level. "Knows ORT recipe": mother can explain how to make oral rehydration treatment for diarrhea. "Knows age of exclusive breastfeeding": mother answers "6 months" when asked how long a baby should be exclusively breastfed. "Given last year": reports receiving water disinfectant tabs in the last year. "Used last 7 days": self-reported use of water disinfectant. "Water chlorine content" measured chlorine in parts per million. "Any chlorine detected": dummy for nonzero chlorine content. "Bed net hung correctly": the enumerator asked to see the bed net under which the child sleeps (if any) and noted whether it was hung correctly or could be hung easily, vs. stored or not available.

Significance levels: * 0.1, ** 0.05, *** 0.01.

As discussed earlier, it is possible that the subsidy program increases the effectiveness or motivation of CHWs, and this could be a potential source for the interaction effect in columns (1) and (3). Ideally, we would have administrative data or other objective measures of CHW effort, but these records were not available to us. We therefore analyzed other measures of self-reported intervention receipt, shown in detail in Appendix B, Table 5. There is no clear evidence for a complementarity driven by higher CHW effort or credibility in the full-program group. The overall low number of reported visits suggest that many parents do not see the CHW visits as significant, do not recall them, or do not receive them, for whatever reason (this could include the respondent being absent during the day due to work). While the share of reported visits is 11%-13% higher in the full program arm than in the CHW-only arm, a non-negligible share of families also report CHW visits in the subsidy-only arm, significantly more than in the control. Mirroring this pattern, many families report receiving free care in the CHW-only arms, and the share that report the subsidy in the full-program group is higher than in the subsidy-only group. Overall, the most likely explanation for these patterns seems to be that parents under-report the individual program components more often when they do not receive both program parts, perhaps because the full program is more valuable and salient, rather than differences in CHW behavior.

4.2 Acute Illness: Care Received

Table 3 combines information on health care utilization conditional on the child being ill (columns (1)-(3)) with data on the incidence of symptoms (columns (4)-(7)), obtained from a 7-day health calendar over the week preceding the survey. For diarrhea, we first asked respondents to report all days on which the child had diarrhea in the last week. If diarrhea was reported, we asked about days with more than three loose stools, and days with blood in the stool (a danger sign that may indicate dysentery). We also asked whether the respondent was concerned about the child's health on any day. For care received, we recorded any visits to CSComs or associated reference hospitals (CSRef), any other formal provider visits (private or non-profit clinics and hospitals) and whether ORT was given.

Table 3: Acute care for diarrhea and incidence of diarrhea (last 7 days).

	Acute care received			Incidence				
				(0/1)	(no. of days out of 7)			
	CSCOM/ CSREF (1)	Any formal care (2)	ORT given (3)	Any diarrhea (4)	Any diarrhea (5)	≥ 3 loose stools/day (6)	Blood in the stool (7)	Mother concerned (8)
CHW visits	0.041	−0.014	0.127	−0.020	−0.047	−0.046	−0.026	0.114
	(0.089)	(0.139)	(0.108)	(0.019)	(0.057)	(0.049)	(0.027)	(0.112)
Subsidy	−0.060	−0.088	0.174**	−0.024	−0.061	−0.051	−0.027	−0.037
	(0.076)	(0.119)	(0.079)	(0.019)	(0.057)	(0.050)	(0.023)	(0.101)
Full program	0.170	0.088	0.266**	−0.049***	−0.149***	−0.131***	−0.022	−0.118
	(0.105)	(0.184)	(0.121)	(0.018)	(0.051)	(0.043)	(0.026)	(0.100)
Control group mean	0.083	0.222	0.000	0.085	0.210	0.161	0.045	0.492
N	102	102	102	1649	1649	1649	1649	1649
p-value: CHW = full	0.28	0.59	0.39	0.06	0.02	0.01	0.87	0.03
p-value: subsidy = full	0.04	0.31	0.45	0.14	0.04	0.02	0.79	0.40
p-value: C+S = full	0.21	0.38	0.85	0.84	0.56	0.57	0.33	0.18

Notes: The unit of observation is the child. In columns (1)-(3), the sample is restricted to children for whom the caretaker reported any diarrhea in the observation period. All regressions include stratum fixed effects, control for covariates, and cluster standard errors at the compound level. Columns (1)-(3) report measures of acute care received and include only children with any diarrhea symptoms in the last 7 days. Column (2) includes private, faith-based, and NGO providers in addition to public clinics. (4)-(8) report diarrhea symptom incidence and caretaker's concern for the child's health. Column (4) shows the proportion of children with any diarrhea. Columns (5-8) report incidence as the number of days with occurrence, out of 7. Significance levels: * 0.1, ** 0.05, *** 0.01.

We begin by analyzing curative care, and specifically acute care received for diarrhea. Accordingly, the sample in columns (1)-(3) includes only children with diarrhea symptoms. As discussed in detail in Sautmann et al. [2020], this reflects our interest in whether care is received *conditional* on the child experiencing a diarrhea episode. We discuss incidence in more detail below, but note that column (4) shows the share of children with any diarrhea symptoms in the last week and therefore gives an idea of how the sample for acute care use is selected. The share of children with any diarrhea lies between approximately 3 and 9

percent across treatment groups.

Unconditional use of care is not informative about changes in caregivers' health care behavior, precisely because of the variation in illness incidence between treatment groups (see also below) – a parent is unlikely to give ORT to a child who does not have diarrhea.[16] A downside of reporting conditional use of care is the differential selection of the sample of sick children. This means that the results in Table 3 provide unbiased estimates of the healthcare utilization rate among the subset of children who are expected to fall sick under the different program variants, but they cannot be used to directly compare care seeking probabilities for all children (or all households).

Columns (1) and (2) show no significant effect of CHW visits on care received. More surprisingly, there is no measurable effect of the subsidy on the use of formal care, either on its own (where the point estimates are negative, making a large positive effect unlikely) or as part of the full program (where the point estimate is large and positive, but not significantly different from zero). While this may seem surprising in the light of the results of Sautmann et al. [2020], the same paper also provides a potential explanation for this finding. Using the more detailed data from the 2013 survey, Sautmann et al. [2020] find that the increase in health care utilization following the subsidy largely occurs on days in which formal care is required according to the WHO guidelines. Diarrhea on its own does not fall into this category, unless it has lasted for more than 5 days or is accompanied by other symptoms. Thus the number of diarrhea spells in the sample for which formal care is the appropriate response is likely to be even smaller than our already small set of observations, making our point estimates very noisy.[17]

[16]The overall use of care in the full sample is very low and the differences between treatment arms are not significant, but relative average formal care use echoes the estimates of unconditional treatment effects with the larger 2013 sample, where formal care use in the subsidy groups more than doubled, see Sautmann et al. [2020].

[17]The 2014 data reported here constitutes a small sample of spells and does not cover a long enough period to identify spells in which care was required per WHO guidelines in an unbiased manner.

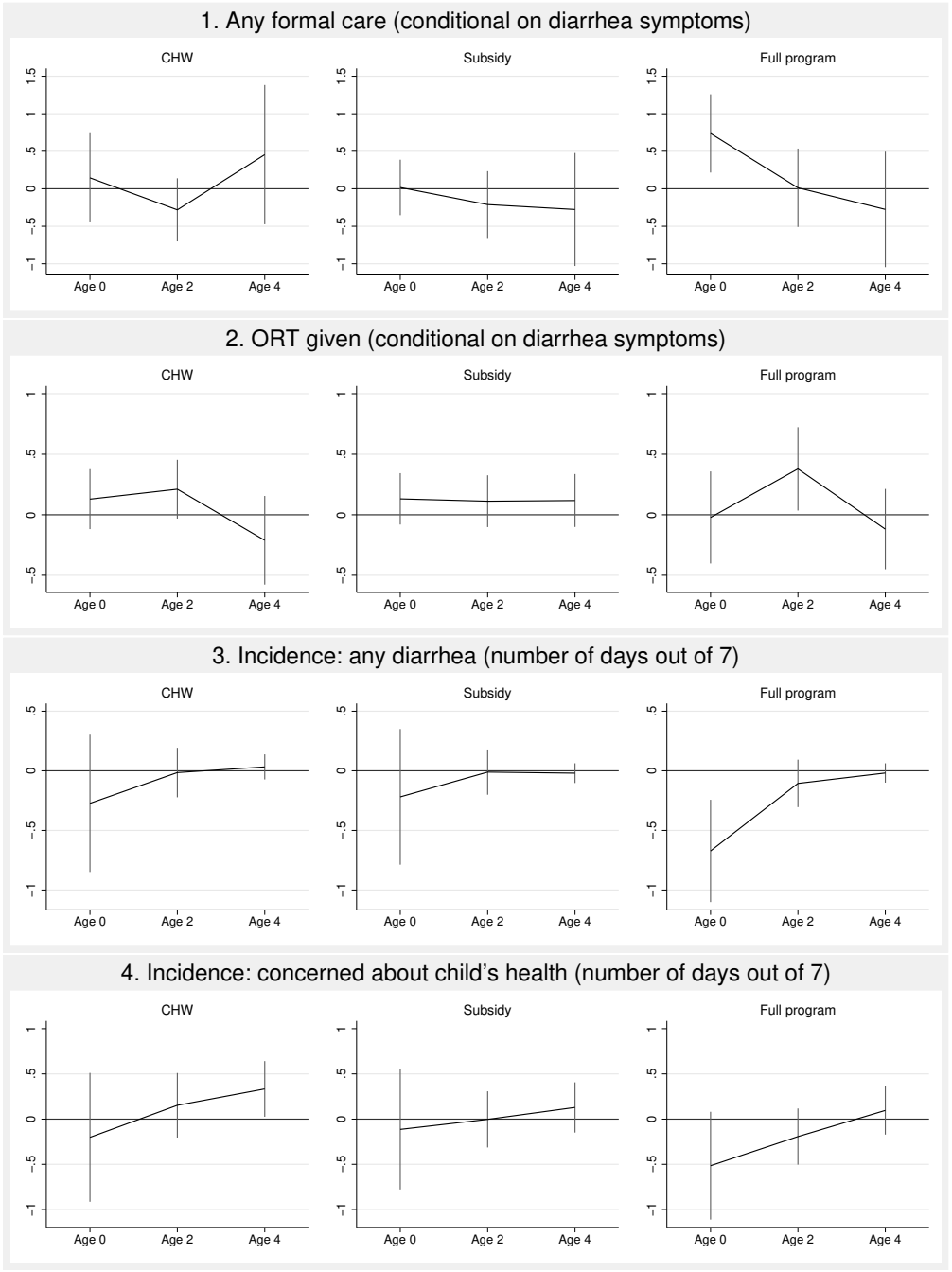

Figure 2: Treatment effects in two-year age groups, relative to control group, with 95% CI. Panels 1 and 2 report care received conditional on exhibiting diarrhea incidence (sample of 102 children); panel 3, number of days with diarrhea; panel 4, number of days caretaker was concerned.

Indeed, mild diarrhea cases can be treated with ORT, which can be prepared at home. Alternatively, pre-mixed ORS packets can be purchased, and providers may also recommend ORT in addition to or in place of prescription medication. Column (3) of Table 3 shows that ORT use is higher than in the control by 12.7 to 26.6pp in all three treatment groups, and significantly so in the groups that receive the subsidy. The difference between the full program group and the other groups is not significant but of large magnitude. Recall that we saw that the CHWs significantly increase knowledge of ORS among caretakers. The effect is stronger in the full-program group, and there is an effect in the subsidy-only group as well. These patterns are consistent with parents learning about ORT from CHWs as well as from CSCom staff, and possibly using the subsidy to purchase more ORS packets.

The results of table 3 mask important differences across age groups. Panels 1 and 2 of figure 2 additionally show the effects on use of any formal care (corresponding to column (2)) and ORT (column (3)) broken out into two-year age groups.[18] Panel 1 shows that the increase in formal care use in the full program group is concentrated among young children. Children age 0-2 who receive the full program have an over 60% higher chance than the control group of seeing a formal care provider, and the effect is statistically significant at the 1% level. Children who receive only the subsidy do not show a corresponding effect, suggesting a positive effect of the CHWs on care seeking propensity. Panel 2 of figure 2 shows that the 2-4 age group who receive the full program see a significant increase in ORT use (whereas the subsidy group shows moderate increases in all age groups that are not individually significant).

Although we need to interpret these findings with caution due to the small sample, the evidence overall suggests that the full program group benefits from significantly better care for acute diarrhea. Parents in the full-program group more often seek formal care for the youngest, most vulnerable children, and use ORT more often for the older children. This is consistent with the CHWs helping steer parents' use of different curative care options. Both

[18]Note that children over 5 would have aged out of the sample under normal conditions.

the CHWs and the subsidy contribute in different ways to better awareness and use of ORS, a low-cost, effective treatment for mild diarrhea cases. The age-specific effects on formal care use complement those found in Sautmann et al. [2020] from the first year of the intervention: the CHWs in the full-program group significantly increased medically recommended curative care for the youngest children, over and above the subsidy-only group. A possible explanation is that information about the child's health status provided by CHWs improves acute care seeking for young children, even when access is free. An alternative, program-specific explanation may be that the CHWs educate parents of newborns on eligibility or support them in claiming the subsidy benefit.

4.3 Acute Illness: Incidence

Columns (4) to (8) of Table 3 report on the incidence of diarrhea symptoms as well as the subjective concern of the mother about the child's health. Children who are being weaned are the most vulnerable to GI problems, since they are exposed to food and water for the first time, and diarrhea incidence for the 0-2 year age group is typically highest. We therefore show age-specific effects on diarrhea and mother concern in panels 3 and 4 in figure 2 as well.

Strikingly, Table 3 columns (4) to (6) show large and significant reductions in diarrhea incidence in the full program group. The effect size in column (5) is equivalent to over 70% of the control group mean of 0.21 days. The effects in the subsidy-only and CHW-only groups are also negative but not significant. Indeed, we can reject that the effect is the same in the full program group as it is in either of the groups that received a single program arm, but do not reject that it is the sum of the two individual effects. From Figure 2, incidence reductions are driven by the age 0-2 group, and the effect is significant at the 1% level in the full-program group. The magnitude is remarkable: the average number of days with diarrhea symptoms in the 0-2 age group is 0.75, and the estimated effect is -0.67 days, or a reduction by 90%. We see negative but not significant effects on days with "blood in the stool," which is a fairly rare danger sign.

The effects in column (8) of Table 3 for mother's concern are not statistically significant,

Table 4: Anthropometrics and malnutrition indicators.

	Weight (kg)	WfA less than -2	MUAC (mm)	MUAC below 125
	(1)	(2)	(3)	(4)
CHW visits	0.023	−0.060*	−0.392	−0.004
	(0.204)	(0.036)	(1.027)	(0.012)
Subsidy	−0.448**	0.012	−0.616	−0.000
	(0.185)	(0.036)	(0.971)	(0.012)
Full program	−0.015	−0.035	−1.206	−0.017*
	(0.172)	(0.033)	(1.020)	(0.010)
Control group mean	14.653	0.196	152.990	0.022
N	1635	1069	1631	1060
p-value: CHW = full	0.85	0.42	0.45	0.20
p-value: subsidy = full	0.01	0.13	0.55	0.07
p-value: C+S = full	0.13	0.78	0.89	0.39

Notes: The unit of observation is the child. Inconsistent repeat measurements for the same child were dropped. All regressions include stratum fixed effects, control for covariates, and cluster standard errors at the compound level (except regression (2) which does not include covariates). "MUAC" is mid upper arm circumference and "WfA" is Weight-for-Age (z-score). Values below 125mm and -2, respectively, indicate moderate acute malnutrition for children under 5. Correspondingly, regressions (2) and (4) only include children under 5.

Significance levels: * 0.1, ** 0.05, *** 0.01.

although the large negative coefficient in the full-program group indicates a similar pattern as the other measures. The effect is again strongest among 0-2 year olds but still not significant at the 5% level (Figure 2, panel 4). The subsidy-only group shows a smaller and also insignificant negative effect. There is an unexplained positive effect in the CHW group, driven by children 4 years and older. If this is a robust effect, it could indicate that the CHWs make caregivers aware of potential health problems, but do not provide them with the resources to seek care. It is worth noting that mothers report on average 0.5 days out of 7 (7%) with a concern about their child's health, highlighting the pressure that the caregivers of the children in our sample experience.

4.4 Malnutrition Indicators: Weight and MUAC

In Table 4, we report results for weight and MUAC, two indicators of malnutrition that may respond to lower incidence and better treatment of diarrhea. Columns (1) and (3) report raw treatment effects on weight in kilograms and MUAC in millimeters. Columns (2) and (4) report indicators for two danger sign indicators for children under 5 years: weight for age below -2 standard deviations, and MUAC below 125 mm. Note that many children at the time of the 2014 follow up are older than 5 and therefore excluded from these indicators. Other reasons for missing data were outliers flagged during the age normalization procedure.[19]

The effects of the full program, while generally of the right sign, are largely insignificant. The exception is a significant negative effect on the number of children exhibiting malnutrition according to the MUAC measure. The CHW-only group also has effects which are largely of the expected sign, with a borderline significant effect on the fraction of children showing weight for age below -2 standard deviations. The negative effect of the subsidy on raw weight is puzzling and may be a random outlier. A lot of precautions were taken to minimize measurement error, partly informed by the challenging measurement conditions (e.g. no flat, hard surfaces to place a scale). Each child was weighed twice, and the two measurements compared. If there was a difference of more than 0.1kg, a third measurement was taken.[20] Weakly, columns (2) and (4) suggest that the CHWs might have some effect on the incidence of malnutrition danger signs. The age specific effects in Figure 4 of Appendix B for weight for age (significant reductions in dangerously low weight for age in the 0-2 age group in the CHW-only and the subsidy-only group) suggest again that program effects occur primarily at the lowest ages, likely due to the incidence profile of diarrhea, but we do not see a corresponding effect in the full program group.

One possible reason for the limited effect of the program on these measures is that the

[19] We used the standards defined by the Unicef IGROWUP macro for weight for age, see latest version at Unicef [2019].

[20] Children were weighed on their own if over two and with their mother if below two years of age.

population has relatively small numbers of children exhibiting signs of malnutrition. Only 2% had a MUAC measurement below 125mm in the control group, while 20% had a weight for age below -2 standard deviations.

5 Discussion and Conclusion

Overall, our results are encouraging for combined interventions of both removal of user fees and employment of community health workers who visit households in an urban context.

The CHWs have significant effects on indicators of preventive knowledge and behavior, such as breastfeeding practice and knowledge of ORS. Even though we do not find significant impacts on objectively measured water disinfection, self-reported disinfectant use is higher in the CHW treatment arms. There is a possibility that self-reports are inflated due to experimenter demand effects. However, the significant effects of the CHWs on (objective) mosquito net hanging are not consistent with mere over-reporting and suggest that the problem could also be incorrect use of the disinfectant by the household, or of the water tests that our enumerators used. It will be important to understand better why self-reported and measured disinfection diverge, especially in the context of evidence from Kenya that chlorine solution dispensers at water sources increase use and greatly reduce child mortality [Haushofer et al., 2021]. On the curative care side, the subsidy significantly increases the use of oral rehydration treatment for children acutely ill with diarrhea.

The effects on preventive and curative care behaviors by parents are equal or greater in the full program group in almost every aspect of care seeking: In families receiving both interventions, caretakers are more knowledgeable about ORS and self-report higher water disinfectant use. Moreover, formal care is increased significantly in the 0-2 age group, while ORT use is significantly higher among 2-4 year olds. Overall, the findings suggest better targeting and use of care in the group receiving both interventions, although with the caveat that the sample size of 102 children with diarrhea is small. This is consistent with the (exploratory) results on formal care seeking in the 2013 survey, which show that the CHWs

complement the subsidy in increasing medically needed care for the youngest children.

The two interventions seem to work particularly well together for the use of ORT, likely due to the fact that ORT use is promoted by both CHWs and formal health care providers. We saw that the subsidy-only group significantly more often receive ORT than the control. They are also 9.7pp more likely than the control to know the recipe for ORS (Table 3, column (4)). For both receipt of ORT and ORS knowledge, effects are largest for households that received both CHW visits and the subsidy.

Overall, the interventions are successful at changing parents' care-giving behavior, and we do not find any evidence of moral hazard, in the sense that households for example reduce prevention in response to subsidized care. If anything, both preventive knowledge and behaviors and curative care are most improved in the full-program group.

Likely as a result, we find that the full program group has significantly lower diarrhea incidence than the other groups, driven by the youngest children, who are also the most vulnerable group, with the highest incidence in the control. The number of days with diarrhea is reduced by over 70% of the control group incidence for the sample as a whole, and by over 90% in the 0-2 age group. While the reduced incidence implies gains in children's well-being, we do not find clear effects of the two interventions on indicators of malnutrition.

A robust interpretation of the evidence is that the CHWs improve prevention, the subsidy improves curative care, and, when households receive both interventions, the reduction in diarrhea incidence represents the sum of these two effects. There is suggestive evidence of stronger CHW effects on some prevention activities when parents have access to free care as well. We argued earlier for two possible channels by which the subsidy treatment might strengthen CHW effectiveness: one is through motivating CHWs, the other is through increasing their credibility with parents. The former is of interest for any CHW programs, while the latter is particularly relevant for non-profit health program providers designing their own interventions, such as Mali Health. The indirect question format of the data on treatment receipt that we used introduces measurement error (see discussion in Appendix

B.2), and therefore does not provide a conclusive test of these channels. However, the fact that respondents report the Action for Health benefits more often in the group receiving both interventions suggests that each may make the other more salient, possibly contributing to better health care behaviors on the parents' part. These possibilities may be a fruitful area for further research.

Any policy recommendations of course depend on the objectives and cost constraints of the implementing body. However, our results make a case for the application of subsidies and CHWs in tandem. The two policies seem to address different constraints that households face, and for at least one key outcome measure - diarrhea incidence - we find that the two are at worst additive in their effects. Moreover, the impact of the individual arms on health outcomes are similar and, in the case of Action for Health, they also cost about the same, suggesting comparable marginal benefits per dollar spent. Our results also show possible areas in which programs of this type can be improved. For example we find strong suggestive evidence that program benefits are concentrated in children under 2 years old, suggesting that resources could be most usefully directed towards the youngest age group.

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Online Appendix

A Consort Diagram

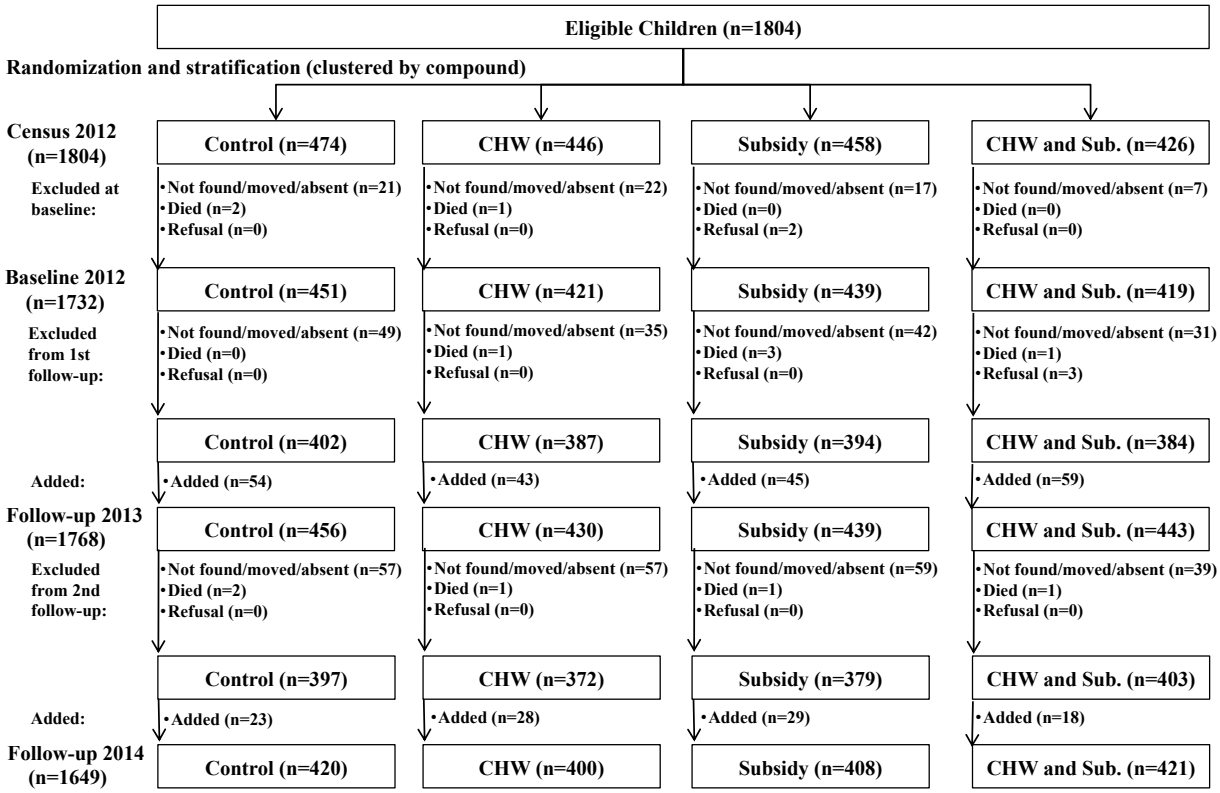

Figure 3: Consort diagram of children in each treatment arm, showing the evolution of the sample throughout the study. The census was conducted by the NGO Mali Health. At baseline, surveyors re-identified the households from the census and listed all children. At each follow-up, households (if found and did not refuse) re-confirmed all children and any households/children not listed in previous rounds were added. This included children newly born into the household as well as children returned from absences etc.

B Additional Results

B.1 Treatment effects on Anthropometrics by Age

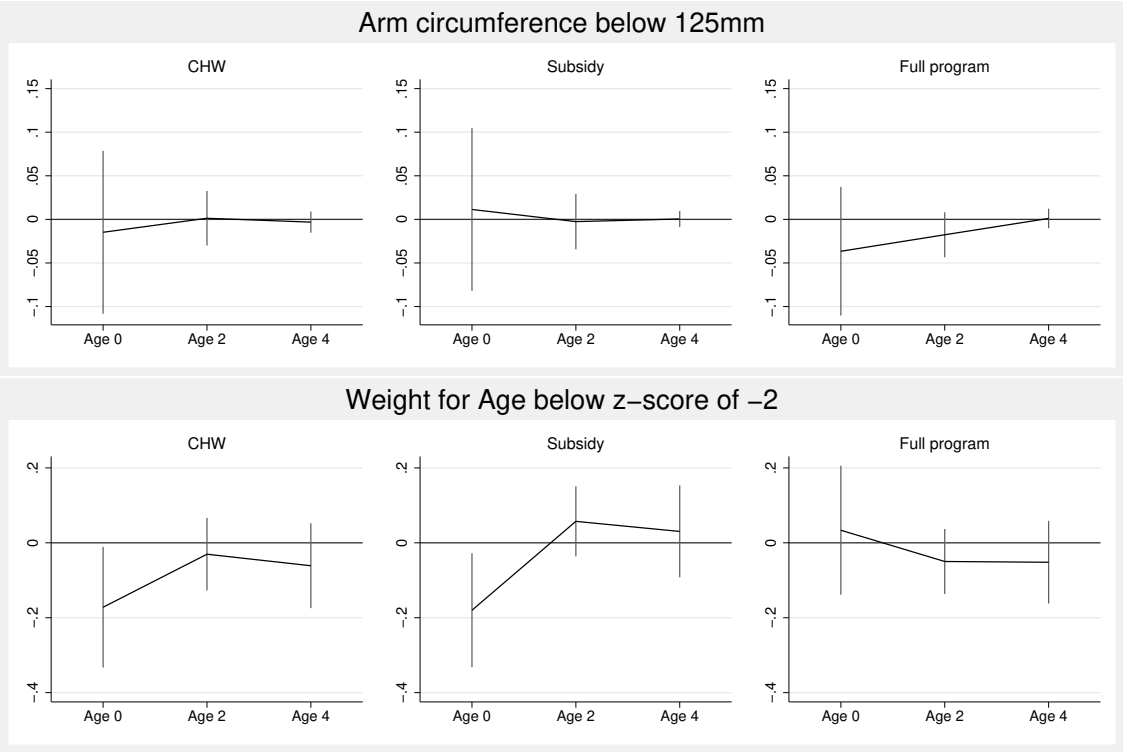

Figure 4: Effect on indicators for malnutrition relative to control group with 95% CI in two-year age groups.

B.2 Self-Reported Receipt of Program Benefits

Table 5 shows what caretakers say about the receipt of various Action for Health components. Mali Health was not directly mentioned and the surveyors were blinded to the experiment. The respondent was first asked if the child received any kind of health program. Columns (1)-(3) report self-described receipt of a health program and active recall of either of the two Action for Health components. Columns (4) and (5) additionally include affirmative responses to two follow-up questions to learn indirectly about program receipt (prompted recall): whether the child has a physical card that entitles them to free visits at the community clinic, and whether an NGO worker visited the household to measure the child's weight

and height. Column (6) asks mothers who directly or indirectly reported CHW visits in (5) whether a visit was received in the last 2 weeks. Lastly, column (7) is included in the table to show that all treatment groups were equally likely to receive treated mosquito bednets (see section 3 on the experimental design).

The numbers suggest that there is overreporting or misreporting of the benefits received: relative to the control group, an additional 6.4% to 8.5% of the CHW-only group report subsidized care (columns (2) and (4)), and an additional 25.9% to 33.6% of the subsidy-only group report CHW visits, on top of the 4.7%-10.7% reported in the control group (columns (3) and (5)).

The full program effects are significantly higher than the individual group effects in all columns (3) to (6). It is possible that the subsidy groups receive home visits from clinic staff or describe clinic consultations or administrative visits from Mali Health in an ambiguous way. It is also possible that the CHW-only group mistake a vaccine card for the Action for Health subsidy card. Lastly, the differences between the full-program and individual-intervention groups may be recall error, reflecting that the program benefits are more salient when children receive the full program.

As discussed above, it is also possible that there are truly more CHW visits in the full program group. The CHWs in the CHW-only group may feel less motivated, for example because they question the purpose of regularly monitoring the child's symptoms, or because parents are less inclined to listen to them. However, we would expect that CHWs in the CHW-only group visit their families at least some of the time: the CHWs are monitored and managed in small groups of around 10, and they record health data for children that their supervisor and CSCom staff have access to. Moreover, CHW motivation does not explain why households in the CHW-only group believe they received access to free care at the clinic. In sum, the significant rates of misreporting mean that the evidence is inconclusive on CHW motivation effects.

Table 5: Health care program receipt.

	Child in any health program (1)	Receives subsidy (2)	Receives CHW visits (3)	Subsidy or card reported (4)	Health worker visits reported (5)	NGO/HW visit last 2 weeks (6)	Received bed net (7)
CHW visits	0.581***	0.064***	0.532***	0.085***	0.551***	0.409***	0.311***
	(0.042)	(0.022)	(0.042)	(0.022)	(0.042)	(0.040)	(0.037)
Subsidy	0.630***	0.532***	0.259***	0.650***	0.336***	0.097***	0.327***
	(0.036)	(0.035)	(0.041)	(0.034)	(0.041)	(0.026)	(0.037)
Full program	0.753***	0.573***	0.645***	0.743***	0.688***	0.530***	0.324***
	(0.031)	(0.040)	(0.038)	(0.032)	(0.035)	(0.037)	(0.037)
Control group mean	0.055	0.017	0.047	0.019	0.107	0.014	
N	1648	1648	1648	1648	1648	1641	899
p-value: CHW = full	0.00	0.00	0.02	0.00	0.00	0.02	0.78
p-value: subsidy = full	0.00	0.41	0.00	0.03	0.00	0.00	0.96
p-value: C+S = full	0.00	0.66	0.02	0.87	0.00	0.67	0.00

Notes: The unit of observation is the child (columns (1)-(6)) or the household (column (7)). All regressions include stratum fixed effects, control for covariates, and cluster the standard errors at the compound level. "Child in any health program": mother was asked whether the child is enrolled in any health program. "Receives subsidy" and "Receives CHW visits": mother describes these two services as part of the program. "Subsidy or card reported" and "Health worker visit reported": includes mothers who respond affirmatively to an indirect question to confirm program receipt; whether the child has the card that entitles them to program benefits at the clinic, and whether an NGO worker visited to measure the child's weight and height. "NGO/HW visit last 2 weeks": mothers reported any NGO/HW visits *and* that a visit occurred in the last 2 weeks. "Received bed net": at household level, whether a free mosquito net was received. Significance levels: * 0.1, ** 0.05, *** 0.01.

B.3 Vaccines

The full survey questionnaire (see Appendix C) includes questions on vaccines that were requested by the partner NGO. For children where a vaccination booklet could be shown, all 17 entries required for children up to age 5 were recorded. For children who did not have a booklet, an abbreviated list was collected that allowed reporting up to 10 vaccines.

During the intervention period, several vaccine drives took place in Bamako (referenced in the survey questionnaire), and as a result, treatment arm differences are not meaningful. As can be seen from Table 6, for children who had a vaccination card, vaccination is near universal with a control group average of 16 vaccines received. For all measures of vaccination, differences between the treatment groups are small and not significant.

Table 6: Vaccines received.

	Vaccine card shown	No. of vaccines (card)	No. of vaccines (no card)
	(1)	(2)	(3)
CHW visits	−0.004	−0.150	0.195
	(0.045)	(0.317)	(0.302)
Subsidy	−0.036	−0.255	0.091
	(0.045)	(0.319)	(0.272)
Full program	0.031	0.206	0.360
	(0.044)	(0.299)	(0.293)
Control group mean	0.548	16.043	4.139
N	1649	906	726
p-value: CHW = full	0.42	0.23	0.58
p-value: C+S = full	0.25	0.14	0.85

Notes: The unit of observation is the child. Column (2) includes only children for whom a vaccine card was reported, column (3) only children without a vaccine card. All regressions include stratum fixed effects, control for covariates, and cluster standard errors at the compound level.

Significance levels: * 0.1, ** 0.05, *** 0.01.

C Survey Questionnaire

Interviewer Name _____ ID Number _____ Date (DD/MM/YY) _____ Time (HH.MM)_____ Supervisor Checked (Y) (N)

START A NEW SHEET FOR EACH MOTHER ON YOUR LIST: COPY COMPOUND ID, HOUSEHOLD ID AND MOTHER ID INTO BOX 1

BOX 1	
Compound ID Number	__ __ __ __
Household ID Number	__ __
Mother ID Number	__ __ __ __

For each child, associated with this mother on your sheet, identify the child's current main caretaker in the household.
This might be the child's mother, or a grandmother, aunt, sister, etc.
The caretaker may be different from last year.
If different children of the mother from your sheet are being looked after by different caretakers, use a new sheet for each caretaker

Read consent form to caretaker.

Did the caretaker give consent?	**1- Yes**	**2 - No**	**If no: end the interview.**

Is the Mother/Caretaker the same as on your list? 1- Yes 2 - No If no, enter the current caretaker/ mother's name into Box 2 below

BOX 2
Current Caretaker's/Mother's First Name _____ Last Name _____

Is this household in the same concession as on your list? 1- Yes 2 - No if no: enter new location GPS _____

Copy HH and Compound ID numbers into all following pages. Confirm names, ID of all children being looked after by this caretaker, and copy them into the top of pages 2-5
Cross out unused colums in sheets 2-5

Comments

Start with first child, ask all questions 1 - 2G, then go to second child, ask all questions 1-2G for that child, etc.

Compound ID | | | | | Household ID | | |

A *Enter each child's first and last name*			
B *Copy child's ID from your list.*	ID	ID	ID
1 Is *{first name}* currently present? *Circle one answer.*	1 yes 4 no, child is dead *> next child* 5 no, child is temporarily absent *> next child* 6 no, child left permanently *> next child*	1 yes 4 no, child is dead *> next child* 5 no, child is temporarily absent *> next child* 6 no, child left permanently *> next child*	1 yes 4 no, child is dead *> next child* 5 no, child is temporarily absent *> next child* 6 no, child left permanently *> next child*
2A Has *{first name}* been enrolled in a health program at any point in the past year?	1 yes > 2B 2 no *> 2D*	1 yes > 2B 2 no *> 2D*	1 yes > 2B 2 no *> 2D*
Only if yes to 2A: 2B What is the name of the program?	1 Sigida Keneyali (Mali Health) 2 Other: _____ 9 Don't know	1 Sigida Keneyali (Mali Health) 2 Other: _____ 9 Don't know	1 Sigida Keneyali (Mali Health) 2 Other: _____ 9 Don't know
Only if yes to 2A: 2C What services did (*first name)* receive?	1 Free/reduced care at local clinic 2 Visits from a health worker *> 2E* 3 Free/reduced care at local clinic *and* visits from a healthworker *> 2E* 4 Did not receive any services 9 Other: _____	1 Free/reduced care at local clinic 2 Visits from a health worker *> 2E* 3 Free/reduced care at local clinic *and* visits from a healthworker *> 2E* 4 Did not receive any services 9 Other: _____	1 Free/reduced care at local clinic 2 Visits from a health worker *> 2E* 3 Free/reduced care at local clinic *and* visits from a healthworker *> 2E* 4 Did not receive any services 9 Other: _____
Only if 2 in 2A or 1, 4 or 9 in 2C: 2D In the last two months, did you receive regular visits from a local health organization who measured {name's} weight and temperature?	1 yes *>2E* 2 no *>2G*	1 yes *>2E* 2 no *>2G*	1 yes *>2E* 2 no *>2G*
Only if 2 or 3 in 2C, or 1 in 2D: 2E Did (the health worker/the organization) check on the health of {first name} in the last 2 weeks?	1 yes 2 no	1 yes 2 no	1 yes 2 no
Only if 2 or 3 in 2C, or 1 in 2D: 2F Did you receive any health products from the health worker/the organization in the last year? *(circle all that apply)*	2 no 3 yes: aquatabs 4 yes: a mosquito net 5 yes: other_____	2 no 3 yes: aquatabs 4 yes: a mosquito net 5 yes: other_____	2 no 3 yes: aquatabs 4 yes: a mosquito net 5 yes: other_____
Only if 2 in 2A or 2, 4 or 9 in 2C 2G Do you have a health card that allows {name} to get free care at the local clinic?	1 yes 2 no	1 yes 2 no	1 yes 2 no

Compound ID | | | | | Household ID | |

A *Enter each child's first and last name*			
B *Copy child's ID from your list.*	ID	ID	ID
3A: Surveyor: enter today's date	Day: Month:	Day: Month:	Day: Month:
3B: Surveyor: Was the child born before today's date in 2012? Use the date of birth from the information sheet or ask mother	1 - Yes - over 2 years old *>4* 2 - No - under 2 years old *>5*	1 - Yes - over 2 years old *>4* 2 - No - under 2 years old *>5*	1 - Yes - over 2 years old *>4* 2 - No - under 2 years old *>5*
4: If 1 in 3B and child can stand by themselves. Ask question for each child separately.			
4A: Measure child's weight	. KG	. KG	. KG
4B: Confirm that you have moved the scale	1 - Yes	1 - Yes	1 - Yes
4C: Measure child's weight	. KG	. KG	. KG
4D: Calculate 4A minus 4C	. KG	. KG	. KG
IF 4D > 0,1kg or <-0,1kg, continue with 4E. Otherwise next child or Q6			
4E: Confirm that you have moved the scale	1 - Yes	1 - Yes	1 - Yes
4F: Measure child's weight	. KG	. KG	. KG
4G: Calculate 4F minus 4A	. KG	. KG	. KG
4H: Calculate 4F minus 4C	. KG	. KG	. KG
If 4G > 0,1kg or <-0,1kg, AND 4H > 0,1kg or <-0,1kg, inform supervisor.			
4I // CROSS OUT QUESTION 5 and go to Q 6.			

5: If 2 in 3B or child cannot stand by themselves. Ask question for each child separately.			
5A: Measure mother's weight	. KG	. KG	. KG
5B: Measure weight of mother and child	. KG	. KG	. KG
5C: calculate child's weight as 5B minus 5A	. KG	. KG	. KG
5D: Confirm that you have moved the scale	1 - Yes	1 - Yes	1 - Yes
5E: Measure mother's weight	. KG	. KG	. KG
5F: Measure weight of mother and child	. KG	. KG	. KG
5G: calculate child's weight as 5F minus 5E	. KG	. KG	. KG
5H: Calculate 5C minus 5G	. KG	. KG	. KG
IF 5H > 0,1kg or <-0,1kg, continue with 5I. Otherwise next child or Q6			
5I Confirm that you have moved the scale	1 - Yes	1 - Yes	1 - Yes
5J: Measure mother's weight	. KG	. KG	. KG
5K: Measure weight of mother and child	. KG	. KG	. KG
5L: calculate child's weight as 5K minus 5J	. KG	. KG	. KG
5M: Calculate 5L minus 5C	. KG	. KG	. KG
5N: Calculate 5L minus 5G	. KG	. KG	. KG
If 5M > 0,1kg or <-0,1kg, AND 5N > 0,1kg or <-0,1kg, inform supervisor.			
5O// CROSS OUT QUESTION 4 and go to Q 6.			

6: Measure Child's Arm Circumference	MM	MM	MM

Compound ID | | | | | Household ID | |

A *Enter each child's first and last name*			
B *Copy child's ID from your list.*	ID	ID	ID
Ask Q7 and the following in the most suitable order			
7: Do you have a vaccine card for *{first name}* ?	0 - Does not have vaccine card >7B 1 - Yes, is available to show >7A 2 - Yes, is not currently available >7J	0 - Does not have vaccine card >7B 1 - Yes, is available to show >7A 2 - Yes, is not currently available >7J	0 - Does not have vaccine card >7B 1 - Yes, is available to show >7A 2 - Yes, is not currently available >7J
7A: If 1 is selected in Q7: Use the vaccine card to fill in whether the child has had any of the following vaccines then go to Q8 TICK HERE IF THIS IS A RETURN VISI			0
BCG/tuberculosis	1 - yes 2 - no	1 - yes 2 - no	1 - yes 2 - no
Polio 0	1 - yes 2 - no	1 - yes 2 - no	1 - yes 2 - no
Polio 1	1 - yes 2 - no	1 - yes 2 - no	1 - yes 2 - no
Polio 2	1 - yes 2 - no	1 - yes 2 - no	1 - yes 2 - no
Polio 3	1 - yes 2 - no	1 - yes 2 - no	1 - yes 2 - no
DTCoq 1	1 - yes 2 - no	1 - yes 2 - no	1 - yes 2 - no
DTCoq 2	1 - yes 2 - no	1 - yes 2 - no	1 - yes 2 - no
DTCoq 3	1 - yes 2 - no	1 - yes 2 - no	1 - yes 2 - no
Hepatitis B 1	1 - yes 2 - no	1 - yes 2 - no	1 - yes 2 - no
Hepatitis B 2	1 - yes 2 - no	1 - yes 2 - no	1 - yes 2 - no
Hepatitis B 3	1 - yes 2 - no	1 - yes 2 - no	1 - yes 2 - no
H Flu (Hib) 1	1 - yes 2 - no	1 - yes 2 - no	1 - yes 2 - no
H flu (Hib) 2	1 - yes 2 - no	1 - yes 2 - no	1 - yes 2 - no
H flu (Hib) 3	1 - yes 2 - no	1 - yes 2 - no	1 - yes 2 - no
Measles	1 - yes 2 - no	1 - yes 2 - no	1 - yes 2 - no
Yellow Fever	1 - yes 2 - no	1 - yes 2 - no	1 - yes 2 - no
Vitamin A	1 - yes 2 - no	1 - yes 2 - no	1 - yes 2 - no
{If 0 in Q7} 7B: (Name) he / she had any vaccines to prevent it from getting diseases , including vaccinations the day of a national vaccination campaign ?	1 yes >7C 2 no > next child or 8	1 yes >7C 2 no > next child or 8	1 yes >7C 2 no > next child or 8
7C: The BCG vaccine against tuberculosis, that is to say an injection in the arm or shoulder , which usually leaves a scar ?	1 yes 2 no	1 yes 2 no	1 yes 2 no
7D: The polio vaccine , that is to say (the drops in the mouth of the child) he was given in the first 2 weeks after birth or later or later?	1 yes >7E 2 No >7F	1 yes >7E 2 No >7F	1 yes >7E 2 No >7F
[7D yes] 7E: How often does the polio vaccine has he been given	____ Fois (1-4)	____ Fois (1-4)	____ Fois (1-4)
7F: The DPT vaccine , that is to say an injection given in the thigh or buttock, sometimes given along with polio drops ?	1 yes >7G 2 No >7H	1 yes >7G 2 No >7H	1 yes >7G 2 No >7H
[7F yes] 7G: How many times has the DPT vaccine he was given	____ Fois (1-3)	____ Fois (1-3)	____ Fois (1-3)
7H:The vaccine against measles or MMR , that is, an injection in the arm â age 9 months or later , to protect it from measles?	1 yes 2 no	1 yes 2 no	1 yes 2 no
7I:The race the last six months, do you gave NAME a dose of vitamin A as it. [note : show sample]	1 yes 2 no	1 yes 2 no	1 yes 2 no
7J: If 2 in Q7, schedule a return visit for the mother to see the vaccine card. ENTER RETURN VISIT DATE ___DD ___MM: Record results on the above sheet.			

Compound ID | | | | | Household ID | |

A *Enter each child's first and last name*			
B *Copy child's ID from your list.*	ID	ID	ID
8: Has {name} had diarrhea in last 7 days?	1 Yes *>8A* 2 No *> Next child or Q9*	1 Yes *>8A* 2 No *> Next child or Q9*	1 Yes *>8A* 2 No *> Next child or Q9*
8A: *Enter current day of week and backfill last week*			
8B: What days did {name} have diarrhea?			
8C: Were there any days when there was blood in the *stool) (1 if yes 2 if no for each day)*			
8D: Were there any days with more than three loose *stools? (1 if yes 2 if no for each day)*			
8E: Were there any days when you gave {name} ORT? *(1 if yes 2 if no for each day)*			

9: Were you concerned about the health of {name} in the last 7 days?	1 Yes *>9A* 2 No *> Next child or Q10*	1 Yes *>9A* 2 No *> Next child or Q10*	1 Yes *>9A* 2 No *> Next child or Q10*
9A: *Enter current day of week and backfill last week*			
9B: For each day this week, fill in whether the mother was not concerned (4) somewhat concerned (5) or very concerned (6)			

10: In the last week, have you or someone else in th household consulted or visited anyone about this child's health?	1 Yes *>10A* 2 No *> Next child or Q11*	1 Yes *>10A* 2 No *> Next child or Q11*	1 Yes *>10A* 2 No *> Next child or Q11*
10A: Enter current day of week and backfill last week . For each of the health care providers below, put 1 for each day when provider saw the child:			
10B: Médecin/infirmière au CSCOM			
10C: Médecin/infirmière à l'hôpital (CSREF)			
10D: Médecin/infirmière privé			
10E Guérisseur traditionnel			
10F: Pharmacie/pharmacien			
10G: Pharmacie parterre/furatigi/marché/ boutique			
10H: agent de santé /relais communitaire			
10I: Autre			

11: Did {Name} sleep under a mosquito net in the past 7 days?	1 Yes *>11A* 2 No *> Next child or Q12*	1 Yes *>11A* 2 No *> Next child or Q12*	1 Yes *>11A* 2 No *> Next child or Q12*
11A: Ask to see the net, and circle what you saw	0 net was shown and is currently attached 1 Net was shown, but is not attached, could see how it would be attached 2 the net was found but was not attached, could not see how it would be attached 3 Respondent could not show net 4 Other	0 net was shown and is currently attached 1 Net was shown, but is not attached, could see how it would be attached 2 the net was found but was not attached, could not see how it would be attached 3 Respondent could not show net 4 Other	0 net was shown and is currently attached 1 Net was shown, but is not attached, could see how it would be attached 2 the net was found but was not attached, could not see how it would be attached 3 Respondent could not show net 4 Other

Compound ID		Household ID		Mother ID	

12A: What is the main source of drinking water for the members of your household? *[Tick one]*	
Indoor plumbing	1
Protected indoor well	2
Non-protected indoor well	3
Internal drilling	4
Water tank/water service	5
Water seller	6
Bags/bottles of water	7
Public drilling	8
Protected outdoor well	10
Unprotected outdoor well	11
River/stream/lake	12
Rain water/spring water	13
Dam/canal	14
water tower	15
Other	99

12B: Did you change the source of your drinking water in the last two years?	1 *yes > 12C* 2 *no >13*

12C: What was the previous main source of drinking water for the members of your household before you changed? *[Tick one]*	
Indoor plumbing	1
Protected indoor well	2
Non-protected indoor well	3
Internal drilling	4
Water tank/water service	5
Water seller	6
Bags/bottles of water	7
Public drilling	8
Protected outdoor well	10
Unprotected outdoor well	11
River/stream/lake	12
Rain water/spring water	13
Dam/canal	14
water tower	15
Other	99

13: Enter current day of week and backfill last week								
13A: Did you use water disinfectant for your drinking water in the last 7 days?	1 Yes > 13B 2 No > 13C							
13B: On which days did you use disinfectant?	*1 Yes 2 No*							
13C: Have you replaced the household's drinking water in the last 7 days?	1 Yes > 13D 2 No > 14							
13D: On which days did you change water?	*1 Yes 2 No*							

Q14: Surveyor: you are now going to test the family's drinking water.
1) Ask them for a small amount of the water they use for drinking.
2) Put 50cc (2ml) of the water into the testing cup.
3) Move the testing strip (with the testing window in the water) gently back and forth through the water for 20 seconds (about 40 strokes back and forth)
4) Remove the testing strip, shake it once to remove the excess water, and fold the strip in half so that the handle is under the testing window (for a solid white background)
5) Wait 20 seconds then match the color of the testing window to the color chart within 1 minute.

ENTER APPROPRIATE NUMBER FROM COLOR CHART (BETWEEN 0 and 6)		

15: Do you know how to make ORS?	1: Yes >15A 2: No >16			
15A: What are the ingredients? (Circle all that are mentioned)	1: Water	2: Sugar	3: Salt	4: Other
16: For how many months after a child is born should a mother practice exclusive breast feeding?	Months			

END OF SURVEY

Data Availability Statement

A replication package with the data used in this paper, the analysis files, and the survey questionnaire will be made available at publication.