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Can health-information campaigns improve CCT outcomes? Experimental evidence from sms-nudges in Indonesia*

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Employing a clustered RCT this paper examines the short-term impact of a 12-month text messaging campaign on health knowledge and practices among CCT beneficiaries in Indonesia.

Our analysis reveals that a mHealth information campaign can be an inexpensive and effective tool to (further) improve a diverse range of health indicators. Overall, CCT beneficiaries experienced substantial knowledge gains and also showed improved behavior as a result of the intervention. In particular beneficiaries with larger social networks and with low initial levels of health knowledge and practices benefited from the campaign. In contrast, we neither find evidence for an impact on health outcomes, nor for the role of an individual's education, cognitive abilities, personality, and bargaining power in mediating the impact of the intervention.

Key words: CCT, mHealth, information, Indonesia.

JEL codes: D80, I10, I38, J13.

1. Introduction

Conditional cash transfer programs (CCTs) aim to reduce poverty and increase human capital by requiring beneficiaries to comply with conditions such as school attendance and health check-ups. Pioneered in Brazil and Mexico in the late 1990s, CCTs have increasingly been adopted by many countries around the globe. Nowadays CCTs have become the antipoverty program of choice in more than 60 countries with the number of countries and beneficiaries rising steadily (WB, 2018).

Despite the success of many CCTs in improving the lives of the poor, meta-studies and systematic reviews have repeatedly pointed out that there is large heterogeneity across and within CCTs in terms of which education and health indicators improved and which not.[1] Often CCTs fail to meet all policy and program objectives (Ladhani and Sitter, 2020).

In order to strengthen the impact of CCTs, many countries have adjusted the original design by increasing benefit payments, extending the maximum duration of eligibility, and adding additional features such as business trainings, and special education and health sessions (Ibarraran et al., 2017). While possibly beneficial, several of these add-on features have led to increased operational costs to an already expensive implementation process (Benhassine et al., 2015).

Given limited government budgets for social protection and the substantial cost of CCTs (WB, 2018), research has increasingly focused on studying specific implementation features in order to assess the cost-effectiveness of alternative CCT designs (e.g. Alatas et al. (2012); Baird et al. (2011); Barrera-Osoria et al. (2011, 2019)).

Our study links to this strand of CCT implementation research. More specifically, we test whether a low-cost health information campaign (sms-nudges) can result in improved health knowledge and behavior among CCT beneficiaries.

The context of our study is the Program Keluarga Harapan (PKH) in Indonesia which currently covers about 10 million households and constitutes the world's 2nd largest CCT. PKH was launched in 2007 and has since become a flagship of the country's national social protection strategy. Impact evaluations of PKH demonstrated that the program helped to reduce poverty and led to increases in school enrollment among beneficiary households (Cahyadi et al., 2020; WB, 2012). PKH impacts concerning health indicators have been mixed (Cahyadi et al., 2020; Christian et al., 2019; Kusuma et al., 2016; Triyana, 2016) and not met all expectations of policy makers.

As a result of PKH's limited impact on various health indicators – in particular health care knowledge and behavior – we worked together with the government of Indonesia (GoI) in order to assess whether a low-cost mHealth component (sms-nudges) shall become a standard feature in the program's implementation. In collaboration with the GoI we subsequently developed a sms-nudge intervention focusing on 5 core health domains: anaemia, breastfeeding, hygiene, postnatal care, and vaccinations. The intervention involved sending

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[1]Please see Fiszbein et al. (2009) and Bastagli et al. (2016) for reviews and Baird et al. (2014); Garcia and Saavedra (2017); Lagarde et al. (2009); Millan et al. (2019) and Owusu-Addo and Cross (2014) for meta-studies.

out three health-related sms per week over a period of twelve months. To evaluate the short-term impact of the intervention, we implemented a clustered-RCT in which 1,821 beneficiaries in 127 villages were randomly assigned to either a control group (PKH) or a treatment group (PKH + nudges).

Our experiment aims to answer the following questions: Do sms-nudges increase health knowledge and behavior among CCT beneficiaries? Which type of health indicators are responsive to sms-nudges? What individual and village level factors facilitate the success or failure of the sms-nudge campaign?

Overall, our results suggest that text messages can be extremely effective in improving health knowledge and behavior. Knowledge about anemia improved by 6 ppt (40%), about postnatal care by 7 ppt (36%), and about hygiene by 3 ppt (12%). In addition, we find that mothers are more likely to follow hygiene recommendations, while children are more likely to be vaccinated (about one additional vaccination).

Examining various mechanisms that may help explain our findings, we show that the results are partially driven by two factors. First, mothers with lower initial levels of health knowledge and practices benefit relatively more from the intervention. Therefore, the intervention contributed to narrowing health knowledge and practice gaps among CCT beneficiaries. In contrast, we do not find that mothers who are better educated and possess stronger cognitive skills benefit relatively more from the intervention. Second, we observe that in particular women with a larger social network improve health knowledge and practices. While many characteristics are possibly correlated with a person's network, we believe that the results provide some evidence on the need to verify and re-confirm novel health information with peers before adopting new knowledge and behavior.

Despite the substantial impact of the intervention on health knowledge and behavior, we do not observe any short-term effect on health outcomes (child anthropometrics and anemia prevalence among mothers). To what extent health outcomes might have improved over the medium to long-term cannot be answered by our study.

Our experiment advances the relevant literature in three ways. First, we add to the literature that attempts to quantify the impact of particular CCT and UCT (unconditional cash transfer) implementation features on health indicators. The studies that exist in this field have focused on examining the role of benefit amounts (Filmer and Schady, 2009; Haushofer and Shapiro, 2016), conditionality criteria (Baird et al., 2011; Benhassine et al., 2015; Brollo et al., 2017), gender of the beneficiary (Benhassine et al., 2015; Haushofer and Shapiro, 2016), targeting mechanism (Alatas et al., 2012, 2016, 2019), timing of transfers (Barrera-Osoria et al., 2011, 2019; Haushofer and Shapiro, 2016), and provision of extra-mentoring (Sedlmayr et al., 2020). In contrast, to these studies we examine the case in which a low-cost mHealth component is integrated into a CCTs standard operational procedure.[2]

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[2]In two sub-treatment arms Grepin et al. (2019) investigate the role of sms reminders on maternal health (safe deliveries) in Kenya where recipients receive health vouchers or conditional cash transfers. The conditional cash transfers studied in Grepin et al. (2019), however, are very different from government run CCT programs. For instance, the CCT

Second, we contribute to the literature in economics that studies whether providing information affects health knowledge, behavior and outcomes. While much of the existing literature has provided mixed evidence on whether information provided via counsellors (Fitzsimons et al., 2016), doctors (Oster, 2018), enumerators (Chinkhumba et al., 2014; Dupas, 2009), facilitators (Banerjee et al., 2019), letters (Armour, 2018), media (Madajewicz et al., 2007), teachers (Dupas, 2011a), religious leaders (Keskin et al., 2017), and human resource departments (Lieber, 2017) can improve health knowledge and behavior, little rigorous evidence in economics regarding information provision via mHealth solutions yet exists.

In contrast to the sms-nudge interventions we are aware of (Dammert et al., 2014; Grepin et al., 2019; Pop-Eleches et al., 2011; Raifman et al., 2014)[3], we examine the impact of an mHealth information intervention on very different health indicators and on CCT beneficiaries. Deriving estimates directly from CCT beneficiaries is important since extrapolations from other study populations is risky given that CCT beneficiaries are likely to differ, among other, in terms of family composition, cognitive ability, wealth status, mobile phone usage, trust into the sender of sms, and incentives to comply with health recommendations (Dupas, 2011b).

Third, we provide more general insights into factors influencing the effectiveness of health sms-nudges. While there is a substantial amount of medical and public health literature that examines the impact of sms-nudges on various health indicators[4], most of these studies are subject to small sample sizes and biases stemming from selection effects into the intervention - persons self-enrolled into sms-nudges. Furthermore, as described in Armanasco et al. (2017) there is a lack of mHealth studies that rigorously examine the role of local and individual characteristics that may determine the relative impact of sms-nudges.

As has been pointed out in the related literature on health information campaigns many factors, such as the recipient's bargaining power (Ashraf et al., 2014), cognitive ability (Dupas, 2011b), personality (Vollrath, 2006), phone signal strength and phone use behavior (Agravat, 2013), prior knowledge and behavior (Dupas, 2011b), and social network position and structure (Banerjee et al., 2019), can influence the success of health information interventions. Relying on our rich dataset, we examine the role of a wide range of individual, household, and village characteristics in explaining our main results.

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was implemented by the researchers themselves and did not correspond to any sort of established local, national or international program. Second, the CCT did not involve any poverty targeting. Third, payments occurred once conditionality criteria were met while typical CCTs involve payments with verification of conditionality criteria at a later stage.

[3]Dammert et al. (2014) find that sms notifications reduce transmission risk of dengue by 0.1SD in Peru while Raifman et al. (2014) observe that malaria patients in Ghana are more likely to adhere to treatment when receiving text message reminders. Similarly, Pop-Eleches et al. (2011) find that HIV patients in Kenya are more likely to adhere to treatment as a result of a text messaging campaign. In contrast, Grepin et al. (2019) find a very limited effect of sms nudges on pregnant women's likelihood to deliver in health facilities in Kenya.

[4]Please see Agravat (2013); Blaya et al. (2010) and Fjelsoe et al. (2009) for reviews and Armanasco et al. (2017); Cole-Lewis and Kershaw (2010); Hall et al. (2015); Orr and King (2015) and Sondaal et al. (2016) for meta-studies.

This paper proceeds in seven sections. Section II provides background on PKH. Section III outlines our intervention and randomization strategy. Section IV describes our data. Section V presents the main results and explores robustness checks. Section VI examines the mechanisms responsible for our results. Section VII discusses extensions to the main findings. Section VIII offers concluding thoughts.

2. The conditional cash transfer program: PKH

2.1. Program implementation

Program Keluarga Harapan (PKH) was introduced in 2007 for 600,000 households and subsequently expanded to cover 10 million households in 2019 (MoSA, 2020). At the end of 2013 - the time of our baseline survey – PKH served about 2.8 million households across Indonesia.

To be eligible for PKH, a household has to be poor[5] and in addition to fulfill at least one of the following demographic criteria: at least one child in the household is below the age of 16 and/or at least one woman in the household is pregnant/lactating.

PKH provides sizeable cash transfers. Households receive between 83 and 290 US dollars per year depending on a household's demographic structure.[6] On average the transfer constitutes about 15 percent of annual household expenditures of a poor household.[7]

PKH comprises five conditionality criteria related to health.[8] Three criteria refer to maternal health and consist of the following: 1.) complete four antenatal care visits and take iron pills during pregnancy, 2.) be assisted by a trained professional during birth, and 3.) lactating mothers must complete two post-natal care visits. Two conditionality criteria apply to young children (< 6 years): 4.) ensure that children have complete childhood immunization and take vitamin A capsules twice a year, and 5.) take children to regular growth monitoring check-ups.[9] All five conditionality criteria are expected to be served by local level health staff and infrastructure.

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[5]The poverty status is determined by proxy-means tests which are linked to the country's national targeting database. During our study period a household was considered eligible for PKH if it belonged to the poorest 8 percent of all Indonesian households. Compared to other social assistance programs in the country PKH is considered to be well targeted (Alatas et al., 2019).

[6]The average payment was 187 US dollars at 2013 prices (Nazara and Rahayu, 2013; WB, 2017b). PKH payment structures in 2014 provided a base payment to every eligible household of about 30 US Dollars (300,000 Indonesian Rupiah), with different top-ups depending on the number and age of children and whether the mother was pregnant or lactating.

[7]According to Indonesia's socio-economic survey (SUSENAS), the poorest 10 percent of households spent in 2014 on average about 14 million Rupiah (1,400 US dollars) per year.

[8]In practice, however, the monitoring, verification, and enforcement of the health conditionality criteria has been a constant implementation challenge and was occasionally abandoned. Albeit there exist large regional and facilitator-specific variations in whether and how strict conditionality criteria are enforced, in most cases violations of conditionality criteria are not punished. Furthermore, only a fraction of PKH beneficiaries were found to strictly follow PKH health conditionality criteria (MSC, 2019; WB, 2012).

[9]Check-ups are supposed to be monthly for infants and quarterly for children 1-5 years old.

At the local level PKH implementation is supported by a facilitator who – depending on the location – is responsible for 50-80 PKH households. The principal tasks of facilitators are administrative and involve the provision of PKH-related information (including health topics), monitoring of conditionalities, and organization of so called PKH groups (kelompok PKH). PKH groups consist of 10-25 beneficiaries (mothers) and are led by the so called PKH group mother (ibu kelompok PKH), who is a PKH benefiaciary herself.[10] According to program guidelines, PKH groups convene every month in order to discuss PKH related topics such as benefit payments as well as education and health topics.

Overall, all four components (cash transfers, conditionality criteria, faciliators, PKH groups) are meant to enable and incentivize PKH households to improve health knowledge, behavior and outcomes. (Gaarder et al., 2010).

2.2. Impact on health: A review

Almost all empirical evidence on the health impact of PKH is based on one dataset - a clustered RCT conducted by the World Bank and TNP2K[11], which involved data collection in the years 2007 (baseline), 2009 (midline), and 2013 (endline).

In general, PKH was found to be moderately successful in improving health outcomes (Cahyadi et al., 2020; Kusuma et al., 2016; Triyana, 2016; WB, 2011). In the short-run (2007-2009), PKH led to some improvements in pre- and post-natal health seeking practices. Improvements were reported for the share of (pregnant) women: with at least four antenatal visits (9 ppt from a baseline of 68 percent), giving birth assisted by trained health professionals (5 ppt from a baseline of 60 percent), having at least two post-natal check-ups (10 ppt from a baseline of 46 percent), bringing child to monthly growth monitoring (22 ppt from a baseline of 12 percent), and completing immunization coverage (3 ppt from a baseline of 2 percent). In the long-run (2007-2013), PKH showed the additional effect of being able to reduce stunting rates by about 9-10 ppt (from a baseline of 42 percent).

Despite its success on some health indicators, PKH has not led to substantial improvements in some core domains of maternal and child health. Vaccination rates remained low as did practices of breastfeeding and health-seeking behaviors related to illness. Likewise, in the long-run (2007-2013) the initial positive effects on ante- and post-natal behavior disappeared, while almost all health knowledge indicators did not improve – neither in the short- nor long-run.

In response to the empirical findings, the GoI launched in 2013 several initiatives to explore how the health impact of PKH could be strenghtened.[12] In

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[10]PKH groups are formed at the village level. If a village has more than 25 beneficiaries multiple PKH groups are formed in the location.

[11]TNP2K refers to Indonesia's National Team for the Acceleration of Poverty Reduction which is part of the country's vice presidential office.

[12]In collaboration with UNICEF 'PKH-Prestasi' was tested by GoI in one district which aimed at improving coordination among local health care providers and enhancing the skills of facilitators in providing health messages (Unicef, 2015). Another approach which was subsequently developed by GoI in collaboration with the World Bank involved the

this context, the GoI explored whether a low-cost mHealth solution could be a viable option. In the next section, we elaborate on the adopted mHealth intervention.

3. Experimental design

3.1. Rational

The GoI continuously aims at strengthening PKH in order to boost health knowledge, practices, and outcomes among PKH beneficiaries. The country's context with almost universal cell phone penetration (with respect to signal and ownership) in combination with minimal sms delivery costs made mHealth and in particular sms-nudge interventions a very attractive option to be tested.

Furthermore, PKH routinely stores cell phone numbers from each beneficiary. Prior to our intervention, phone numbers of PKH households were used by PKH administrators to communicate the timing of benefit payments. Likewise, PKH faciliators occasionally used the phone numbers to collect information about and coordinate visits of PKH households. Therefore, PKH households were already familiar with receiving PKH-related information via mobile phone including sms. Additionally, given almost universal cellphone possession among the poor, the selection of sms provided the advantage to allow for a possible nationwide roll-out of the sms-nudge campaign.

The objective of our information campaign was to improve in the short-run health knowledge and behavior of PKH households with the hope to improve health outcomes in the long-run. The evaluation framework of the intervention (as discussed below) was designed to provide rigorous empirical evidence on short-term effects.

The selection of topics for the information campaign was guided by PKH's objective to boost maternal and child health. Eventually, five main topics were chosen. Anemia was selected since Indonesia exhibits comparatively high rates of anemia in combination with high rates of miscarriages and maternal mortality (DHS, 2018). The remaining four topics concerned breastfeeding, child immunization, hygiene (hand washing), and post-natal behavior.

3.2. Intervention set-up

The sms-nudge intervention was implemented for twelve months (March 2014 to February 2015) in order to boost mothers' health knowledge and behavior. Targeted PKH households received three sms per week.[13] In total, households

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introduction of so-called family development sessions (FDS) in which faciliators were intensively trained on education, health, and financial management topics. Subsequently trained facilitators had to provide knowledge sharing sessions with PKH groups at least once per year. Starting from 2017 onward FDS sessions have been integrated into PKH operations in some areas of the country (WB, 2017a).

[13]Evidence from meta-studies on sms-nudges in health has shown that the optimal intervention period is six to twelve months (Armanasco et al., 2017) with the optimal number of sms per week being three (Cortes et al., 2020).

received 156 sms over the course of the intervention.[14]

For the implementation of the intervention several additional steps were taken to increase the chance that PKH households paid attention to the sms-nudges. First of all, all messages started with a personalized greeting. Second, by partnering with Indonesia's major telecommunication companies and GoI, the sms sender was always shown as 'PKH information'. Third, the sms delivery time was adjusted to when mothers would be most likely to have time to read the sms.[15] Fourth, the language used in the sms was adjusted to be non-technical, universal, and easy to understand.[16]

Furthermore, following recommendations from the literature on information nudges (Thaler, 2018), a sms would typically follow one of the three following formats: a.) information only, b.) information & call for action, and c.) information & advise. A typical sms would look like the three examples below:

Example immunization:

> Ms. Anindyah, don't wait until the child is sick. Take the child to the Puskesmas for immunization. Children who are immunized are healthier and stronger in facing disease attacks.

Example anemia:

> Ms. Anindyah, anemia or lack of blood is dangerous for mother and baby. When pregnant, check with the health center and drink blood-added tablets once a day for 90 days.

Example hand washing:

> Ms. Anindyah, washing hands with water alone is not enough because the germs that cause disease will not die. Wash hands with soap, rinse with clean running water.

The phone numbers were provided by PKH households during the baseline survey (see below). In case multiple cell phones existed in a household, all phone numbers were contacted during the intervention. Monitoring data provided by Indonesia's telecommunication companies suggested that about 99.4 percent of all sms were successfully delivered over the course of the intervention.

3.3. Sampling and randomization

The initial sampling frame was based on administrative data from PK's monitoring and information system and comprised 2,400 PKH households in 140

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[14]The number of sms varied slightly by topic: anemia (33), breastfeeding (27), child immunization (33), hand washing (21), and post-natal visits and child growth monitoring (60).

[15]Based on research from pre-tests, each week one sms was sent out on Tuesday, Thursday, and Saturday at 7pm — a time when mothers are usually at home, less busy with child care obligations, and tended to access their cell phones.

[16]For ease of implementation the information campaign was one-directional. This means that while targeted PKH households received the sms, households could not reply to the sms and could not contact any specific hotline or website.

villages in proximity to two urban centres on the islands of Sumatra (city of Pekanbaru) and Sulawesi (city of Makassar). Villages eligible for the study needed to possess a minimum of ten PKH recipients. Otherwise, the 140 villages were drawn randomly from a sampling frame of about 340 villages that were in a radius of two hours of travel time from the respective urban center.

The sample of 2,400 PKH households was restricted to households with a relevant demographic composition for the intervention. Therefore, households had to have at least one child below the age of five. Hence, PKH households who only comprised older children (age > 5 years) were not included in the study.[17]

In a given village, each pre-selected household was surveyed (total of 2,400 households). Analysis of the baseline data revealed that the administrative data had not been updated in some cases. More specifically, about 580 out of the 2,400 households were dropped from the sample since they did not fulfill the inclusion criteria (no child below the age of six). As a result, the sampling frame for the intervention was reduced to 1,821 households in 127 villages.[18]

Among the 1,821 households randomization was conducted at the village level (cluster) with 63 villages (898 households) becoming part of the control group (PKH) and 64 villages (923 households) being part of the treatment group (PKH + sms nudges).

As shown in Tables A.2, A.3 and A.4 in the appendix A.1, the randomization resulted in a balance of baseline covariates and pre-intervention outcomes.

4. Data and descriptive statistics

4.1. Data collection

The baseline survey was conducted in December 2013 with all 2,400 households of the initial sampling frame. In April 2015, about two months after the intervention finished, the endline data was gathered. The endline data collection focused exclusively only on those households that were part of the clustered-RCT (1,821 PKH households).[19] Out of the 1,821 relevant baseline households, 95 could not be interviewed at endline (5%), leaving us with an endline sample of 1,726 households.[20]

The survey targeted as main respondent women and in particular the mother of the children. Besides a standard household roster, the questionnaire comprised modules on the socio-economic background of the household, a comprehensive health module, as well as sections capturing the cognitive ability, personality traits, phone usage behavior, social network, and household decision making process of the respondent.

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[17]An exceptions concerns women who were pregnant at baseline and who did not have children yet. These women are already eligible for PKH and were included in our study.

[18]Please see Figures C.1 to C.5 in the online appendix for maps concerning sample locations.

[19]The data was collected by PUSKA-UI - the mother and child health department at the University of Indonesia.

[20]Attrition was slightly higher in the control compared to the treatment group, albeit the difference is not statistically significant at conventional levels.

In addition to the interviews, each respondent was asked to provide a blood-sample in order to measure anemia. Furthermore, the weight and height of the youngest child of the respondent were measured.

4.2. Descriptive results

4.2.1. Respondent and village characteristics

Table A.1 in appendix A.1 depicts baseline characteristics of villages and respondents included as part of the clustered RCT.[21]

About 40 percent of villages are located in rural areas with the remaining ones being located in semi-urban areas. On average a village comprises about 4,000 households and for half of all villages agriculture constitutes the main source of employment. All villages have a cell phone signal and local health clinic (posyandu).[22] Midwives are living in about 65 percent of villages.

On average, villages possess about 5 PKH groups; one PKH group has on average 14 members.

Almost all respondents are female (99%). Consequently, we refer to respondents as 'mothers' throughout the paper.[23] Mothers are between 15 and 42 years old, possess about 7 years of education, and nearly all mothers are married. At baseline, mothers had on average three children. About 4% of sampled women were pregnant at baseline.

In line with the high anemia and stunting rates commonly found in Indonesia, the blood samples and child measuring exercises conducted at baseline reveal that about half of all mothers suffer from a mild or severe form of anemia while a third of all children was stunted.

4.2.2. Outcome variables

The information campaign covered five main topics: anemia, breastfeeding, postnatal care, vaccination, and hygiene. In line with the intervention's objectives, outcome variables focus on health knowledge and behavior.[24]

Health knowledge variables are indices that capture the share of correct responses by the respondent in a given domain. To gauge knowledge mothers

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[21]Please see Table C.1 and C.2 in the online appendix C.1 for the description and coding of village and household variables.

[22]Posyandus are monthly clinics for children and pregnant women, providing vaccinations and nutritional supplements.

[23]15 (14) respondents are baseline (endline) were male due to the circumstance that the mother had passed away. All our results hold when excluding male respondents.

[24]Please see Table C.3 in appendix C.1 for a detailed description and coding of all outcome variables. Knowledge related variables were derived from open questions. In the questionnaire mothers were asked the following questions per topic: anemia: 8 questions with 37 correct responses, breastfeeding: 4 questions with 4 correct responses, postnatal care: 3 questions with 11 correct responses, vaccinations: 2 questions with 19 correct responses, and hygiene: 2 questions with 18 correct responses. With the exception of the 'hygiene' topic, all indices are based on similar questions throughout baseline and endline survey. With respect to 'hygiene', questions were asked in the endline survey only.

had to respond numerous open questions per topic such as: What are the consequences of anemia?; What type of basic immunization should be given to babies? When are you supposed to wash your hands? In addition to the five topic-specific knowledge indices, we constructed an aggregate knowledge index which measures the proportion of correct responses across all topics.

In contrast, information on health behavior was captured in the questionnaires only for 3 out of 5 topics (postnatal care, vaccination, hygiene).[25] All indicators of health behavior were verified by the enumerator. Postnatal care practice refers to whether mothers kept and used maternal and child health books.[26] Vaccination practice indicates the number of vaccinations a child received as recorded in the child vaccination booklet, while hygiene practice is based on stated and observed handwashing practices.

The survey was designed to limit potential biases in the outcome variables. As respondents in the control and treatment group were not aware of a link between the surveys and the sms campaign, responses are unlikely driven by a Hawthorne effect. Furthermore, the wording of the survey questions on health knowledge differed from the text used in the sms campaign; consequently, respondents could not simply repeat the sms text to the knowledge questions, but needed to transfer the knowledge gained during the sms campaign to answer a question correctly. Finally, indicators related to health behavior cannot be subject to desirability biases, as responses were verified by the enumerators.

<center>Table 1 about here.</center>

Summary statistics for all outcome variables are shown in Table 1. Panel A depicts outcome variables at baseline for all respondents that were included in the RCT, Panel B restricts the sample to those that were re-interviewed at endline, and Panel C shows outcome variables at endline.

Health knowledge varies greatly across different domains and respondents. Mothers seem to have a rather good knowledge of breastfeeding but know little about anemia. There is similar variation in health related practices. At baseline two out of three mothers do not have any child health record book at home and only 18% own the required two. Likewise, while some children obtained complete immunization (about 14 vaccinations), the majority of children had been only vaccinated once and 20 percent were not vaccinated at all.[27]

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[25]Behavioral changes with respect to breastfeeding and anemia were not collect since the subsample of respondents who were pregnant at a given time was too small.

[26]Postnatal care behavior is affected by the health status of mothers and children. Since we cannot distinguish from the data whether actual postnatal care visits were done because of sickness, precaution, or compliance with PKH, our indicator proxies mothers' diligence towards postnatal care.

[27]Note that this variation can partly be driven by differences in children's age. In the regression analyses we include control variables on children's age.

5. Main results

5.1. Empirical specification

We estimate treatment effects by OLS based on the following regression model:

$$Y_{ivt+1} = \alpha_s + \beta T_{vt} + X'_{ivt}\gamma + Z'_{vt}\theta + \epsilon_{ivt} \tag{1}$$

where Y_{ivt+1} refers to the outcome variable for individual i in village v at time t+1, α_s indicate sub-district fixed effects, X refers to individual and household-level control variables, and Z includes village-level controls. T_{vt} is a dummy variable indicating treatment status. Standard errors are clustered at the village level.

For the main specifications, X includes the age, gender, marital status, level of education, and religion of the respondent. Furthermore, X comprises household size, whether the respondent is pregnant at baseline, the number of children below five, and whether the mother is the household head. Z includes the number of families and early childhood facilities in the village, and dummy variables for whether a midwife resides in the village, rural vs. semi-urban status, agriculture as the main economic sector, and phone signal strength.

5.2. Results

Tables 2 and 3 report the effect of the sms campaign on knowledge and health practices respectively. Column (1) reports estimates of treatment effect without any additional controls, while column (2) includes mother and village controls as well as sub-district fixed effects.

Table 2 about here.

The information intervention significantly improved knowledge in the domains of anemia, postnatal care and hygiene (Table 2). The share of correct responses on anemia increased by 6 ppt (or, 40%), on postnatal care by 7 ppt (36%), and on hygiene by 3 ppt (12%). Combined knowledge across all five domains improved by 4 ppt (15%). These effects remain significant when controlling for individual, household, and village characteristics.

The intervention seems to have on average no impact on breastfeeding knowledge and only marginally on vaccination knowledge (statistically significant at the 10 percent level).[28]

Table 3 about here.

The intervention not only improved knowledge but also changed health related practices (Table 3). Mothers in the treatment group are more likely to have a child health record book (*postnatal care practice*) and their children receive on average one more vaccination than in the control group. Similarly, hygiene practices improve. All effects remain significant once including controls.

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[28]The level of breastfeeding knowledge was already high at baseline which possibly made it more difficult to achieve further improvements.

5.3. Robustness checks

In this subsection we report results from various sensitivity checks. Overall, we find that the main treatment effects are comparatively robust to a number of different specifications and standard error adjustments. All results of our main specification are confirmed with the exception of the effect on *hygiene knowledge*, which loses significance when using Lee's treatment effect bounds or a more lenient coding approach.

Attrition

As previously discussed about 5 percent of households could not be interviewed at the endline survey. While the overall attrition rate is low, attrition might nonetheless be non-random. To assess whether the main results are affected by non-random attrition we provide treatment effect bounds following Lee (2009).

As shown in Tables A.5 and A.6 in appendix A.2 the obtained treatment effects remain statistically and economically significant on the upper an lower bound for 3 out of 4 knowledge outcomes (anemia, postnatal care, combined knowledge index) and all three health practice outcomes. Only for hygiene knowledge the treatment effect turns out insignificant at the lower bound.

Multiple hypothesis testing

Our main results comprise five outcome variables referring to knowledge and three outcome variables relating to behavior. While all outcomes are closely related to the content of the information campaign, potential concerns about multiple hypothesis testing might be raised.

Following the recommended adjustments of Romano and Wolf (Romano and Wolf, 2005, 2016; Clarke et al., 2019) we correct standard errors to account for family-wise error rates. As shown in Table A.7 in Appendix A.2, all statistically significant treatment effects remain significant even after adjusting for multiple hypothesis testing.

Spatial correlation in the error structure

In our main specifications standard errors are clustered at the village level. Given that study villages are located in the same region, standard errors might still be biased if substantial spatial correlations in outcome variables are present.

To address this concern we provide in Tables A.8 and A.9 in appendix A.2 results based on adjusted standard errors following Conley (1999).[29] Again, our results remain valid.

Alternatives to OLS estimation

Since our outcome variables of interest are mostly fractions or count data (vaccinations) we assess in a next step the sensitivity of results to estimating main

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[29]We implement the procedure in Stata using the `acreg` package (Colella et al., 2019).

treatment effects by GLM fractional logit and poisson models. As shown in Tables A.10 and A.11 in appendix A.2 the main results remain robust.

Lagged dependent variable

Our main regression specification does not control for baseline values in the dependent variable. This choice was motivated by the circumstance that we wanted to present results from the same model specification for all outcome variables. Since baseline information was not collected on two outcomes (hygiene knowledge and vaccination practices) we presented results without the inclusion of the lagged dependent variable.

Tables A.12 and A.13 in appendix A.2 depict results for the case that the lagged depended variable is included as control. By and large, all of our main results continue to hold.

Alternative covariate specifications

To assess whether results are affected by the choice of covariates we present in Tables A.14 and A.15 in appendix A.2 estimates from specifications that include additional control variables. More specifically we control for: subjective well-being & welfare, Big 5 personality traits, cognitive ability, and the respondent's bargaining power inside the household.

Overall, our previous results remain.

Alternative definition of outcome variables

In our main specification, all knowledge variables with the exception of *breast-feeding knowledge* are defined on the basis of the number of correct responses for a specific question; in the same vein, *hygiene practice* is defined based on the number of correct steps the respondent followed when washing her hands. Alternatively, these variables could be defined in a more lenient approach, based on whether the respondent knew at least one of the correct answers (or followed at least one of the correct handwashing steps).

Coding the outcome variables in a more lenient approach increases, as could have been expected, the effect size, with the exception of the treatment effect on *hygiene knowledge*, which becomes economically and statistically insignificant (see Table A.2.7 in appendix A.2).

Spillovers

Treatment and control villages are located in the same regions. As shown in the location maps (Figures C.1 to C.5 in online appendix C.2), some villages are in close distance to each other. Given that people might be in contact with persons from other villages, we examine in a last step whether spillovers from treatment to control villages might occur. In the case of such spillovers the previous treatment effects rather represent a lower bound of the actual treatment effect.

For the analysis, we focus on control villages only and compare changes in our outcome variables of interest between villages that are located close to the next treatment village and villages that are located less close. We here define 'closeness' if the distance to the next treatment village is below the median distance in the sample within a province (in both provinces, this is approx. 2.6 km).[30]

Results are reported in Table A.17 in appendix A.2. Overall, there seem to be no spillovers from treatment to control villages on health related knowledge and practices. The only exception we found relates to anemia knowledge: mothers living in villages that are close to a treatment village have higher knowledge about anemia than mothers living further away.

6. Mechanisms

The information campaign was carefully designed to follow best-practice examples from the mHealth literature. Consequently, sms frequency, timing, and content was pre-tested with mothers being addressed in personalized messages. Likewise, the sms sender came from a trusted source that families and mothers were familiar with.

The adopted design contributed to the success of the intervention to improve health knowledge and practice outcomes. While our previous discussion focused on average treatment effects we turn in this section to sub-treatment effects in order to shed light on the mechanisms driving our results. In particular, we follow the literature on information interventions (Dupas, 2011b) to assess the role of attentiveness, information processing, relevance, updating, and social networks.

In the following, we present in this section results for the aggregated knowledge index and the three behavioral outcomes.[31] Findings for the separate five knowledge domains are shown in the online appendix B.1.

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[30]In addition to physical contacts and meetings, spillovers might occur if text messages were forwarded to mothers in control villages. While forwarding text messages involves deliberate intentions and costs, even if messages were forwarded, it would imply that our results are only lower bound estimates of true impact. Evidence from qualitative interviews conducted at endline indicated that respondents in control villages were not aware of the intervention and hadn't received our text messages. Furthermore, spillovers might occur within villages. While the intervention was clustered at the village level, it might be that within treatment villages knowledge and behavior change improved among mothers who were not part of our intervention. Since in treatment villages only mothers were surveyed who were part of the sms campaign, our data does not allow to shed light on possible within village spillovers.

[31]This section presents results based on regression specifications that use the same covariates as before: individual/household/village controls and subdistrict fixed effects. As part of our robustness checks we in addition estimated specifications in which covariates are interacted with the particular mechanisms under consideration. By and large, the results in this section do not change if controls are interacted with the particular mechanism. Results are available from the authors upon request.

6.1. Receiving information and attentiveness

For the intervention to show impacts it is important that mothers read the information and pay attention to it. Mothers should use their phones regularly in order to notice and read text messages. However, mothers who use their phone too often might be distracted or cognitively overloaded to be attentive to our health messages.

While we do not know from the data whether recipients read the text message and how many other (text) messages a mother typically received per week, we know from the baseline survey how often a mother typically uses her phone per week.

Table 4 about here.

Table 4 depicts results from including phone usage behavior and its interaction term with treatment status as additional explanatory variables.[32] We find that the messages seem only to be effective in improving knowledge for mothers who use their phones less frequent (less than once per day). While we observe heterogeneous effects with respect to health knowledge, we do not find that differences in phone usage behavior help explain the impact of the sms campaign on health behavior.

6.2. Ability to process information

Even if mothers read the PKH text messages and pay attention to them, they need to be able to mentally process and understand the content. As discussed in more detail in Dupas (2011b), information campaigns often find that women from poor socio-economic backgrounds and low levels of education are more likely to need more time and struggle to process information even if it is easily accessible (Cutler and Lleras-Muney, 2010; Walque, 2007; Rosenzweig and Schultz, 1989).

Bearing in mind that mothers' education levels are low in general in our sample, we analyse whether treatment effects are less pronounced for mothers with less years of schooling. As shown in Table 5 we do not find evidence for smaller treatment effects for less educated mothers. While mothers with less than primary education have on average lower knowledge, they are not less likely to respond to the treatment.

Furthermore, we test in a next step the link between cognitive ability and treatment effects more directly. Leveraging a baseline measure of mothers' mental accounting abilities (Thaler, 2018) we examine in Table A.18 in appendix A.3) differences in treatment effects by cognitive skill levels.[33] Again, we find that cognitive ability is not explaining our main results.

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[32]For the empirical specifications we created a dummy variable indicating *limited phone use* which takes the value 1 if a mother used her phone not more than once a day, which is the median, and 0 otherwise.

[33]At baseline, respondents were asked to solve and memorize a number of simple math tasks. The test was taken from the Indonesian Familiy Life Survey's cognitive skills module and had been validated. We define a respondent to have high cognitive ability if she solves all tasks correctly.

Table 5 about here.

6.3. Relevance and prior knowledge

Although almost all women in the study exhibited non-optimal health knowledge and behavior, some women knew more than others and some women showed better health behavior than others. Since the content of the sms was uniform across treatment mothers, the relative amount of new information should be larger for less knowledgeable mothers.

To assess whether knowledge gains were relatively stronger for mothers with poorer knowledge and health practices at baseline, we re-estimate our main specification including an additional explanatory variable on mothers' level of knowledge or practice in the respective domain at baseline and its interaction term with treatment status.[34] As shown in Tables 6 and 7, we find partial evidence for a catching up process across mothers. Mothers with little knowledge on anemia at baseline improved their knowledge by more. In the case of vaccinations the effects are even more pronounced: only recipients with a low knowledge at baseline improve their knowledge further. This dynamic might help explain why we do not see any average treatment effects on vaccination knowledge. Furthermore, the information campaign is particularly effective in changing postnatal care practices for mothers that had followed a poor practice at baseline.

Table 6 about here.

Table 7 about here.

6.4. Updating beliefs and compliance

To what extent mothers follow the information and recommendations provided in the text messages depends on mothers' willingness and agency to update their beliefs and change their behavior.

To investigate whether our main results are driven by mothers' personal willingness to adopt new recommendations, we re-estimate our previous specification by including the personality measure of 'openness' and its interaction term with treatment status.[35] As shown in Table 8 we do not find that the intervention is more effective for recipients who, ceteris paribus, are more open-minded.

Table 8 about here.

Furthermore, even if mothers are willing to change their behavior they might not do so if they do not have relevant decision power in the household. As

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[34]Note that we can analyze this only for outcome variables that have been elicited at baseline.

[35]We collected information on Big 5 personality traits which allows us to obtain measures on mothers' degree of extraversion, agreeableness, conscientiousness, neuroticism, and openness. The related survey module was borrowed from the Indonesian Family Life Surveys for which its validity had been tested. 'Openness' indicates whether a person is open to new experiences, curious and willing to try new things. We define a respondent to be 'open' if she is above the median degree of openness in the sample.

depicted in Table 9 we do not find evidence of treatment effect heterogeneity by the strength of a mother's bargaining power.[36]

Table 9 about here.

6.5. Social (health) network

Presumably, information is not very effective in isolation. Mothers receiving text messages might need to exchange and validate the information with peers before considering adopting new knowledge and changing behavior. As previous studies have shown the quality of a person's social network in terms of size, composition, and structure affects 'social learning' and changes in behavior (Centola, 2011; Charness et al., 2014; Beaman et al., 2018).

In order to study the importance of social networks, we included in the baseline survey a comprehensive social network module in which mothers' listed with which other PKH mothers they are regularly in contact with (visiting) and whom they would ask for advice in general and for health-related issues more specifically.

Deriving each respondent's personal PKH network we focus in the following on the 'visit' network exclusively.[37]. Mothers named at least two and on average eight other PKH mothers they visited or were visited by (see Table A.19 in appendix A.4). We construct a mother-specific network centrality measure that captures out-degree centrality – i.e., the number of other mothers a mother visits or is visited by on a regular basis.[38]

As shown in Table 10 the personal social networks seem to play a crucial role during the intervention. The larger a mother's social network at baseline the more her health knowledge improved during the intervention and the more likely she is to vaccinate her child and follow recommended hygiene practices.[39]

Table 10 about here.

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[36]At baseline, respondents were asked a number of questions on their intra-household bargaining power related to various household and child related decisions. For our analysis we define a mother to have high bargaining power if she has an above median score in a bargaining index regarding household related decisions and in a bargaining index regarding child related decisions which are based on principal component analysis from questions on maternal and child health.

[37]The 'visit' network in our data overlaps considerably with the advice and health advise network. Please see Figure 1 in appendix A.4 for illustrations of the network from three different villages. The results presented in this section robust to alternative networks such as the general advice and health-advice networks.

[38]To take into account that the number of women included in our study differ by village, we control in our regressions for village population and the overall number of PKH recipients. However, we ultimately abstained from presenting results on other network centrality measures such as eigenvector centrality since these measures appear to be highly sensitive to differences in sample sizes even after controlling for population figures.

[39]The number of observations drop as in three of the 127 villages only one mother was eligible for the intervention. We control for the total size of a mother's social network, the number of eligibles as well as the total number of PKH beneficiaries in each village. All results hold when controlling for other respondent characteristics, such as personality traits, subjective welfare measures, cognitive ability and bargaining power (see Table B.7) in the online appendix A.4).

Figure 1 shows the related margin plots. While the treatment is estimated to be ineffective for mothers who have a small network (mostly < 7),[40] it becomes more effective the larger the network.[41]

Figure 1 about here.

In summary, we believe that social networks play an important role for information campaigns that target individuals. People seem to need their network to exchange about the new information; furthermore, a larger network might allow them to observe behavioural changes that they can adopt.

7. Discussions

7.1. Role of conditionality criteria

The previous mechanisms section focused on channels that are common to many mHealth information campaigns. Considering our particular CCT context, one might wonder if our results might be driven by mothers desire to comply with PKH's conditionality criteria. According to this line of argument, the text messages would increase the salience of being a CCT beneficiary and only functioned as a reminder but not necessarily as actual conveyor of new information (Aker and Ksoll, 2019).

In fact, we observe improvements in health indicators which are closely related to PKH conditionality criteria such as vaccinations and the ownership of maternal and child health books. If, however, the text messages worked solely as a reminder of eligibility criteria, then we would not necessarily expect any changes in knowledge and behavior in health domains that are not part of the conditionality criteria. Since we observe such improvements (e.g. in hygiene) we are confident that our results are caused not only by mothers' considerations of PKH conditionality critieria. Thus, while we ultimately cannot rule out that the sms campaign might also have reminded beneficiaries of the eligibility criteria, we are confident that this circumstance is not the main driver behind our findings.

7.2. Changes in health care supply

The information campaign was low-cost and did not involve the coordination and contact with local and regional health care providers. Since mothers in treatment villages on average improved health knowledge and practices it could be that villages and/or local health care providers increased supply to address increases in health care demand.

Unfortunately, the baseline and endline surveys did not involve the collection of primary and administrative data from local health care providers. To assess whether our intervention led and/or interacted with increases in local health

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[40]The cut-off value '7' is the median value of outdegree network size.

[41]It is a puzzle that mothers in the control group are less likely to vaccinate their child the larger their network. Further research is needed to understand the underlying mechanisms.

care supply we leverage data from Indonesia's village census (PODES) which is conducted every three to four years and which collects information on the number of local health posts, midwives, and operational hours of local health clinics (posyandu).

Table A.20 in appendix A.5 shows treatment effects for our study villages using the above mentioned health care supply indicators from PODES 2018.[42] Overall, we do not observe any differences in health care supply between treatment and control villages. Assuming that any change in health care supply that was triggered by the intervention did not disappear after three years, we conclude that changes in local health care supply are unlikely to explain our findings.

7.3. Beyond knowledge and behavior: Health outcomes

The information campaign was designed to improve health knowledge and behavior among PKH households in the short-term. Since results from PKH's main impact evaluation (Cahyadi et al., 2020) had suggested that improvements in health outcomes such as anemia and child anthropometrics could only be measured after several years of sustained exposure to the CCT, short-term changes in health outcomes were not an objective of the sms campaign.

Ultimately, it is, however, of importance to understand whether the observed impacts translated into improvements in maternal and child health outcomes too. Table 11 depicts treatment effects for the two health outcome indicators for which data was collected on: mothers' anemia status and child anthropometrics. For both indicators we find no impact of the intervention. Neither did the prevalence of anemia reduce nor are children less likely to be wasted or stunted.

Table 11 about here.

This is a rather dissatisfactory finding given the substantial changes we observe in knowledge and behavior. Yet, health outcomes were elicited just shortly after the intervention ended - perhaps, too early in order to observe improvements in children's weight and height.

Changes in anemia might have been more likely as changes in the diet and the intake of iron pills can have immediate direct effects. Our findings on anemia, however, link to the strand of literature that finds little or no effect of anemia preventing interventions (Attanasio et al., 2014; Andrew et al., 2016).

Furthermore, it is important to note our clustered RCT is likely to be underpowered to detect realistic impacts on health outcomes such as anemia and stunting. After all, in our context the impact on specific health outcomes operates only conditional on mothers improving health knowledge and behavior.[43]

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[42]Health care supply at baseline (based on information from PODES 2014) did not differ between treatment and control villages (see Table A.2 in appendix A.1). Since not all health supply indicators were already collected in PODES 2014, the regression specifications do not control for 'baseline' (PODES 2014) health supply indicators.

[43]Please see Table C.4 in the online appendix for minimum detectable effects (MDE) in our setting.The MDE for stunting is about 8.6 percentage points and for wasting 6.5 percentage points. We believe that this detectable effect size is very large. Usually, the

8. Conclusion

In this paper, we examined to what extent a simple and inexpensive text message information intervention can contribute to short-term improvements in health knowledge and behavior among CCT beneficiaries in Indonesia. To address this question we implemented a clustered RCT involving 127 villages and 1,821 beneficiaries.

Our study finds substantial gains in health knowledge and improvements in health practices for most health indicators as a result of the information campaign. Knowledge about anemia improved by 6 ppt (40%), about postnatal care by 7 ppt (36%), and about hygiene by 3 ppt (12%). In addition, we find that mothers are more likely to follow hygiene recommendations, while children are more likely to be vaccinated.

We further show that the results are driven – albeit not exclusively – by two factors. Mothers with lower initial levels of health knowledge and practices benefit relatively more from the intervention. The intervention thus contributed to narrowing health knowledge and practice gaps among CCT beneficiaries. In contrast, we do not find that mothers who are better educated or possess higher cognitive skills benefit relatively more from the intervention. This is a reassuring finding as it suggests that text messages were easy to understand and the intervention did not discriminate against mothers of lower education.

Moreover, we observe that in particular women with a larger social network improve health knowledge and practices. This provides suggestive evidence on the need to verify and re-confirm novel health information with peers before adopting new knowledge and behavior.

Overall, we believe the results demonstrate that mHealth components can be an effective and efficient tool to improve crucial maternal and child health indicators among CCT beneficiaries.

There are two important limitations of the intervention and the tranferability of our findings to other contexts. First, the success of the intervention seems to depend on the phone usage behavior of the targeted population. The information campaign might not receive the required attention if phones are used too frequently and/or if beneficiaries already receive many text messages from other providers. Under these circumstances, text messages might be less effective in improving health knowledge and changing practices.

Second, our results provide evidence for short-term impacts only. Due to the lack of a long-term data collection process, we do not know whether the mothers' improved knowledge and health practices persist in the medium- and long-term and whether they eventually translate into improved health outcomes.

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more comprehensive CCT package involving cash transfers and health conditionalities only leads to moderate stunting and wasting improvements. For instance, only 5 out of 13 reviewed studies on short-term impacts of CCTs showed any improvement in child anthropometrics with the average impact was well below 4 percentage points (Bastagli et al., 2016). In contrast, data on maternal anemia rates are rarely an indicator in CCT impact evaluations. In their review Glassman et al. (2013) report that Opportunidades in Mexico reduced maternal anemia by 1 percentage point in the short run. Moreover, we are not aware of information campaigns that in fact measured actual child anthropometrics and/or maternal anemia status.

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9. Tables

Table 1: Summary statistics: Outcome Variables - Knowledge and Behavior

Variable	Mean	Median	SD	Min	Max	Obs.
PANEL A: BASELINE (ALL RESPONDENTS)						
Anemia Knowledge (base)	0.16	0.14	0.17	0.00	0.58	1821
Breastfeeding Knowledge (base)	0.67	0.75	0.27	0.00	1.00	1821
Postnatal Care Knowledge (base)	0.24	0.33	0.21	0.00	0.81	1821
Vaccination Knowledge (base)	0.33	0.33	0.18	0.00	0.88	1821
Knowledge Index (base)	0.35	0.35	0.13	0.00	0.71	1821
Postnatal Care Practice (base)	0.27	0.00	0.39	0.00	1.00	1821
Hygiene Practice (base)	0.27	0.36	0.22	0.00	0.81	1821
PANEL B: BASELINE (RE-INTERVIEWED RESPONDENTS)						
Anemia Knowledge (base)	0.16	0.14	0.17	0.00	0.58	1726
Breastfeeding Knowledge (base)	0.67	0.75	0.27	0.00	1.00	1726
Postnatal Care Knowledge (base)	0.24	0.33	0.21	0.00	0.81	1726
Vaccination Knowledge (base)	0.33	0.33	0.18	0.00	0.88	1726
Knowledge Index (base)	0.35	0.35	0.13	0.00	0.71	1726
Postnatal Care Practice (base)	0.27	0.00	0.39	0.00	1.00	1726
Hygiene Practice (base)	0.26	0.36	0.22	0.00	0.81	1726
PANEL C: ENDLINE						
Anemia Knowledge (end)	0.18	0.00	0.23	0.00	0.81	1725
Breastfeeding Knowledge (end)	0.44	0.50	0.43	0.00	1.00	1726
Postnatal Care Knowledge (end)	0.24	0.11	0.25	0.00	0.93	1726
Vaccination Knowledge (end)	0.36	0.36	0.17	0.00	0.84	1726
Hygiene Knowledge (end)	0.24	0.13	0.16	0.00	0.88	1726
Knowledge Index (end)	0.29	0.26	0.18	0.01	0.79	1725
Postnatal Care Practice (end)	0.55	0.50	0.44	0.00	1.00	1726
Vaccination Practice (end)	1.27	1.00	1.63	0.00	14.00	1726
Hygiene Practice (end)	0.26	0.07	0.28	0.00	0.79	1726

Notes: Anemia Knowledge - average of eight knowledge questions related to anemia. *Breast Feeding Knowledge*: average of four knowledge questions related to breast feeding. *Postnatal Care Knowledge*: average of three knowledge questions related to post natal care. *Vaccination Knowledge*: average of two knowledge questions related to vaccination. *Hygiene Knowledge*: average of two knowledge questions related to handwashing. *Knowledge Index*: average over all knowledge questions. For all knowledge questions knowledge is defined as the share of correct responses to each respective question. *Hygiene Practice* - Proportion of correct handwashing practices performed by respondent (oberseved by enumerator). *Vaccination Practice* - Number of vaccinations a child received. *Postnatal Care Practice* - Share of child health record books (presented to enumerator).

Table 2: Impact on Knowledge

Outcome Variables	(1)	(2)
Anemia Knowledge	0.060	0.063
	(0.017)***	(0.015)***
Breastfeeding Knowledge	0.039	0.047
	(0.035)	(0.029)
Postnatal Care Knowledge	0.074	0.076
	(0.017)***	(0.016)***
Vaccination Knowledge	0.009	0.017
	(0.012)	(0.009)*
Hygiene Knowledge	0.026	0.024
	(0.009)***	(0.009)***
Knowledge Index	0.042	0.045
	(0.014)***	(0.012)***
Individual and household controls	No	Yes
Village controls	No	Yes
Subdistrict FE	No	Yes

Notes: OLS Estimators. Standard errors are depicted in parentheses and clustered at the village level. Knowledge is defined as the share of correct responses to each respective question. *Anemia Knowledge* - average of eight knowledge questions related to anemia. *Breast Feeding Knowledge*: average of four knowledge questions related to breast feeding. *Postnatal Care Knowledge*: average of three knowledge questions related to post natal care. *Vaccination Knowledge*: average of two knowledge questions related to vaccination. *Hygiene Knowledge*: average of two knowledge questions related to handwashing. *Knowledge Index*: average over all knowledge questions. Individual and household controls include the gender and age of the respondent, whether she is married, whether she heads the household, whether she is Muslim, her years of education, household size, whether the respondent is pregnant at baseline, the number of children below five and the age of the youngest child. Village controls includes the number of families in the village, the number of early childhood facilities in the village, whether there is a midwife available in the village, whether the village is located in rural areas, distance to the subdistrict capital, whether agriculture is the main economic sector, and phone signal strength. */**/*** denote significance levels at 10/5/1 percent respectively.

Table 3: Impact on Behavior

Outcome Variables		
	(1)	(2)
Postnatal Care Practice	0.079	0.052
	(0.035)**	(0.025)**
Vaccination Practice	0.891	0.739
	(0.116)***	(0.084)***
Hygiene Practice	0.106	0.099
	(0.021)***	(0.021)***
Individual and household controls	No	Yes
Village controls	No	Yes
Subdistrict FE	No	Yes

Notes: OLS Estimators. Standard errors are depicted in parentheses and clustered at the village level. *Postnatal Care Practice* - Share of child health record books (presented to enumerator). *Vaccination Practice* - Number of vaccinations a child received. *Hygiene Practice* - Proportion of correct handwashing practices performed by respondent (oberseved by enumerator). Individual and household controls include the gender and age of the respondent, whether she is married, whether she heads the household, whether she is Muslim, her years of education, household size, whether the respondent is pregnant at baseline, the number of children below five and the age of the youngest child. Village controls include the number of families in the village, the number of early childhood facilities in the village, whether there is a midwife available in the village, whether the village is located in rural areas, distance to the subdistrict capital, whether agriculture is the main economic sector, and phone signal strength. */**/*** denote significance levels at 10/5/1 percent respectively.

Table 4: Treatment Effect and Phone Usage

	Knowledge Index	Postnatal Care Practices	Vaccination Practices	Hygiene Practices
	(1)	(2)	(3)	(4)
Treatment	0.013	0.058	0.685	0.073
	(0.021)	(0.042)	(0.203)***	(0.035)**
Limited phone use	-0.029	0.007	-0.098	-0.020
	(0.013)**	(0.032)	(0.108)	(0.020)
Treatment x Limited phone use	0.042	-0.008	0.068	0.034
	(0.020)**	(0.044)	(0.210)	(0.035)
N	1725	1726	1726	1726
Village controls	Yes	Yes	Yes	Yes
Subdistrict FE	Yes	Yes	Yes	Yes
Mother controls	Yes	Yes	Yes	Yes

Notes: OLS Estimators. Standard errors are depicted in parentheses and clustered at the village level. *Limited phone use* is a dummy variable indicating that mother uses her phone not more than once a week at baseline (median phone usage). *Knowledge Index*: average over all knowledge questions related to anemia, breastfeeding, postnatal care, vaccination and hygiene. *Postnatal Care Practice* - Share of child health record books (presented to enumerator). *Vaccination Practice* - Number of vaccinations a child received. *Hygiene Practice* - Proportion of correct handwashing practices performed by respondent (oberseved by enumerator). Individual and household controls include the gender and age of the respondent, whether she is married, whether she heads the household, whether she is Muslim, her years of education, household size, whether the respondent is pregnant at baseline, the number of children below five and the age of the youngest child. Village controls include the number of families in the village, the number of early childhood facilities in the village, whether there is a midwife available in the village, whether the village is located in rural areas, distance to the subdistrict capital, whether agriculture is the main economic sector, and phone signal strength. */**/*** denote significance levels at 10/5/1 percent respectively.

Table 5: Treatment Effect and Education

	Knowledge Index	Postnatal Care Practices	Vaccination Practices	Hygiene Practices
	(1)	(2)	(3)	(4)
Treatment	0.061	0.017	0.630	0.133
	(0.017)***	(0.047)	(0.159)***	(0.030)***
Finished at least primary	0.049	-0.021	-0.045	0.026
	(0.012)***	(0.031)	(0.061)	(0.018)
Treatment x Finished at least primary	-0.023	0.041	0.144	-0.043
	(0.019)	(0.054)	(0.185)	(0.029)
N	1724	1725	1725	1725
Village controls	Yes	Yes	Yes	Yes
Subdistrict FE	Yes	Yes	Yes	Yes
Mother controls	Yes	Yes	Yes	Yes

Notes: OLS Estimators. Standard errors are depicted in parentheses and clustered at the village level. *Finished at least primary* is a dummy variable indicating that the mother has at least six years of education. *Knowledge Index*: average over all knowledge questions related to anemia, breastfeeding, postnatal care, vaccination and hygiene. *Postnatal Care Practice* - Share of child health record books (presented to enumerator). *Vaccination Practice* - Number of vaccinations a child received. *Hygiene Practice* - Proportion of correct handwashing practices performed by respondent (oberseved by enumerator). Individual and household controls include the gender and age of the respondent, whether she is married, whether she heads the household, whether she is Muslim, household size, whether the respondent is pregnant at baseline, the number of children below five and the age of the youngest child. Village controls include the number of families in the village, the number of early childhood facilities in the village, whether there is a midwife available in the village, whether the village is located in rural areas, distance to the subdistrict capital, whether agriculture is the main economic sector, and phone signal strength. */**/*** denote significance levels at 10/5/1 percent respectively.

Table 6: Impact on Knowledge by Prior Knowledge

	Anemia Knowledge	Breastfeeding Knowledge	Postnatal-care Knowledge	Vaccination Knowledge	Knowledge Index
	(1)	(2)	(3)	(4)	(5)
Treatment	0.036	0.054	0.083	-0.014	0.034
	(0.023)	(0.039)	(0.021)***	(0.008)*	(0.016)**
Poor prior knowledge	-0.142	-0.100	-0.028	-0.204	-0.072
	(0.013)***	(0.026)***	(0.014)**	(0.009)***	(0.010)***
Treatment x Poor prior knowledge	0.045	-0.007	-0.010	0.037	0.022
	(0.023)*	(0.037)	(0.026)	(0.012)***	(0.017)
N	1725	1726	1726	1726	1725
Village controls	Yes	Yes	Yes	Yes	Yes
Subdistrict FE	Yes	Yes	Yes	Yes	Yes
Mother controls	Yes	Yes	Yes	Yes	Yes

Notes: OLS Estimators. Standard errors are depicted in parentheses and clustered at the village level. *Low prior knowledge* is a dummy variable indicating that the mother had at most median knowledge in the respective knowledge category at baseline. Knowledge is defined as the share of correct responses to each respective question. *Anemia Knowledge* - average of eight knowledge questions related to anemia. *Breast Feeding Knowledge*: average of four knowledge questions related to breast feeding. *Postnatal Care Knowledge*: average of three knowledge questions related to post natal care. *Vaccination Knowledge*: average of two knowledge questions related to vaccination. *Knowledge Index*: average over all knowledge questions. Individual and household controls include the gender and age of the respondent, whether she is married, whether she heads the household, whether she is Muslim, her years of education, household size, whether the respondent is pregnant at baseline, the number of children below five and the age of the youngest child. Village controls includes the number of families in the village, the number of early childhood facilities in the village, whether there is a midwife available in the village, whether the village is located in rural areas, distance to the subdistrict capital, whether agriculture is the main economic sector, and phone signal strength. */**/*** denote significance levels at 10/5/1 percent respectively.

Table 7: Impact on Practices by Prior Practices

	Postnatal Care Practices	Hygiene Practices
	(1)	(2)
Treatment	0.033	0.092
	(0.027)	(0.024)***
Poor prior practice	-0.498	-0.072
	(0.028)***	(0.015)***
Treatment x Poor prior practice	0.083	0.009
	(0.040)**	(0.022)
N	1726	1726
Village controls	Yes	Yes
Subdistrict FE	Yes	Yes
Mother controls	Yes	Yes

Notes: OLS Estimators. Standard errors are depicted in parentheses and clustered at the village level. *Poor prior practice* is a dummy variable indicating that the mother's health practices at baseline are not higher than the median health practices in the sample. *Postnatal Care Practice* - Share of child health record books (presented to enumerator).*Hygiene Practice* - Proportion of correct handwashing practices performed by respondent (oberseved by enumerator). Individual and household controls include the gender and age of the respondent, whether she is married, whether she heads the household, whether she is Muslim, her years of education, household size, whether the respondent is pregnant at baseline, the number of children below five and the age of the youngest child. Village controls includes the number of families in the village, the number of early childhood facilities in the village, whether there is a midwife available in the village, whether the village is located in rural areas, distance to the subdistrict capital, whether agriculture is the main economic sector, and phone signal strength. */**/*** denote significance levels at 10/5/1 percent respectively.

Table 8: Treatment Effect and Openness

	Knowledge Index	Postnatal Care Practices	Vaccination Practices	Hygiene Practices
	(1)	(2)	(3)	(4)
Treatment	0.048	0.089	0.783	0.115
	(0.013)***	(0.027)***	(0.092)***	(0.022)***
Open (Big 5)	-0.004	0.084	-0.030	-0.019
	(0.013)	(0.031)***	(0.050)	(0.017)
Treatment x Open (Big 5)	-0.011	-0.122	-0.153	-0.054
	(0.018)	(0.042)***	(0.126)	(0.031)*
N	1725	1726	1726	1726
Village controls	Yes	Yes	Yes	Yes
Subdistrict FE	Yes	Yes	Yes	Yes
Mother controls	Yes	Yes	Yes	Yes

Notes: OLS Estimators. Standard errors are depicted in parentheses and clustered at the village level. *Open (Big 5)* is a dummy variable indicating that the mother had an above median score of Openness defined based on the Big 5 taxonomy. *Knowledge Index*: average over all knowledge questions related to anemia, breastfeeding, postnatal care, vaccination and hygiene. *Postnatal Care Practice* - Share of child health record books (presented to enumerator). *Vaccination Practice* - Number of vaccinations a child received. *Hygiene Practice* - Proportion of correct handwashing practices performed by respondent (oberseved by enumerator). Individual and household controls include the gender and age of the respondent, whether she is married, whether she heads the household, whether she is Muslim, her years of education, household size, whether the respondent is pregnant at baseline, the number of children below five and the age of the youngest child. Village controls include the number of families in the village, the number of early childhood facilities in the village, whether there is a midwife available in the village, whether the village is located in rural areas, distance to the subdistrict capital, whether agriculture is the main economic sector, and phone signal strength. */**/*** denote significance levels at 10/5/1 percent respectively.

Table 9: Treatment Effect and Bargaining Power

	Knowledge Index	Postnatal Care Practices	Vaccination Practices	Hygiene Practices
	(1)	(2)	(3)	(4)
Treatment	0.044	0.033	0.714	0.103
	(0.013)***	(0.028)	(0.098)***	(0.024)***
High bargaining power	-0.003	-0.034	-0.074	0.008
	(0.011)	(0.035)	(0.051)	(0.020)
Treatment x High bargaining power	0.004	0.049	0.067	-0.009
	(0.016)	(0.046)	(0.132)	(0.030)
N	1725	1726	1726	1726
Village controls	Yes	Yes	Yes	Yes
Subdistrict FE	Yes	Yes	Yes	Yes
Mother controls	Yes	Yes	Yes	Yes

Notes: OLS Estimators. Standard errors are depicted in parentheses and clustered at the village level. *High bargaining power* is a dummy variable indicating that the mother had an above median score in a bargaining index regarding household related decisions and in a bargaining index regarding child related decisions. *Knowledge Index*: average over all knowledge questions related to anemia, breastfeeding, postnatal care, vaccination and hygiene. *Postnatal Care Practice* - Share of child health record books (presented to enumerator). *Vaccination Practice* - Number of vaccinations a child received. *Hygiene Practice* - Proportion of correct handwashing practices performed by respondent (oberseved by enumerator). Individual and household controls include the gender and age of the respondent, whether she is married, whether she heads the household, whether she is Muslim, her years of education, household size, whether the respondent is pregnant at baseline, the number of children below five and the age of the youngest child. Village controls include the number of families in the village, the number of early childhood facilities in the village, whether there is a midwife available in the village, whether the village is located in rural areas, distance to the subdistrict capital, whether agriculture is the main economic sector, and phone signal strength. */**/*** denote significance levels at 10/5/1 percent respectively.

Table 10: Treatment Effect and Networks

	Knowledge Index	Postnatal Care Practices	Vaccination Practices	Hygiene Practices
	(1)	(2)	(3)	(4)
Treatment	-0.123	0.076	-0.678	-0.062
	(0.039)***	(0.083)	(0.320)**	(0.062)
visit-outdegree (PKH)	-0.004	0.022	-0.066	-0.007
	(0.004)	(0.008)***	(0.025)***	(0.006)
Treatment x visit-outdegree (PKH)	0.020	-0.004	0.176	0.019
	(0.005)***	(0.009)	(0.038)***	(0.008)**
N	1722	1723	1723	1723
Village controls	Yes	Yes	Yes	Yes
Subdistrict FE	Yes	Yes	Yes	Yes
Mother controls	Yes	Yes	Yes	Yes
Network controls	Yes	Yes	Yes	Yes

Notes: OLS Estimators. Standard errors are depicted in parentheses and clustered at the village level. *Visit-outdegree (PKH)* indicates the number of other PKH mothers a mother visits or is visited by on a regular basis. *Knowledge Index*: average over all knowledge questions related to anemia, breastfeeding, postnatal care, vaccination and hygiene. *Postnatal Care Practice* - Share of child health record books (presented to enumerator). *Vaccination Practice* - Number of vaccinations a child received. *Hygiene Practice* - Proportion of correct handwashing practices performed by respondent (oberseved by enumerator). Individual and household controls include the gender and age of the respondent, whether she is married, whether she heads the household, whether she is Muslim, her years of education, household size, whether the respondent is pregnant at baseline, the number of children below five and the age of the youngest child. Village controls include the number of families in the village, the number of early childhood facilities in the village, whether there is a midwife available in the village, whether the village is located in rural areas, distance to the subdistrict capital, whether agriculture is the main economic sector, and phone signal strength. Network controls include the total size of a mother's social network, the number of eligibles as well as the total number of PKH beneficiaries in each village. */**/*** denote significance levels at 10/5/1 percent respectively.

Table 11: Impact on Health Outcomes

Outcome Variables		
	(1)	(2)
Mother has Anemia	0.005	-0.008
	(0.008)	(0.006)
Child stunted	-0.004	-0.007
	(0.007)	(0.007)
Child wasted	0.014	-0.014
	(0.045)	(0.034)
Village controls	No	Yes
Subdistrict FE	No	Yes
Mother controls	No	Yes

Notes: OLS Estimators. Individual and household controls include the gender and age of the respondent, whether she is married, whether she heads the household, whether she is Muslim, her years of education, household size, the number of children below five and the age of the youngest child (for *Child stunted* and *Child wasted* the age of the child that was measured). Village controls include the number of families in the village, the number of early childhood facilities in the village, whether there is a midwife available in the village, whether the village is located in rural areas, distance to the subdistrict capital, whether agriculture is the main economic sector, and phone signal strength. Standard errors are depicted in parentheses and clustered at the village level. */**/*** denote significance levels at 10/5/1 percent respectively.
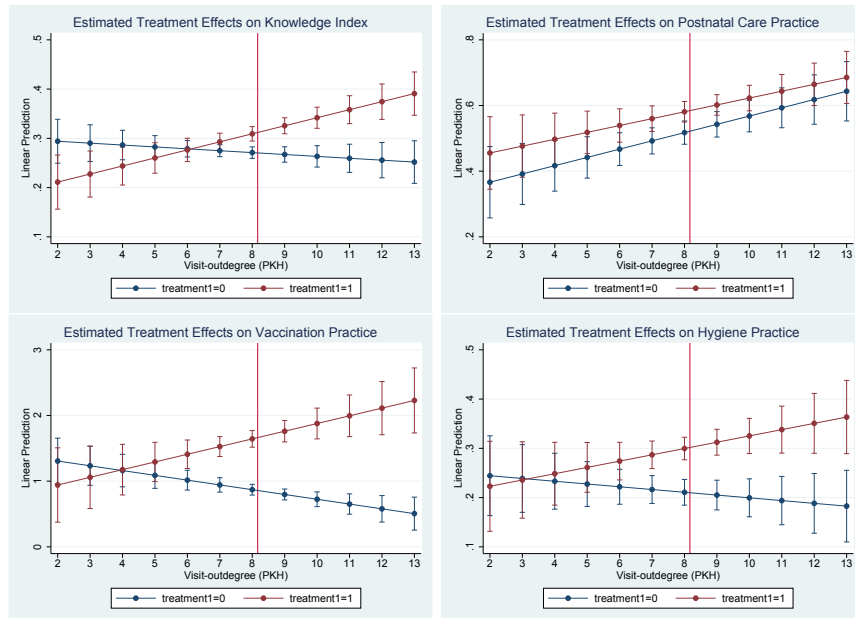
10. Figures

Figure 1: Marginsplot: Impact of Treatment on Knowledge and Behavior according to Network Size

A. Appendix: Background Tables

A.1. Respondent and Village Characteristics

Table A.1: Summary statistics: Respondent and Village Characteristics (at baseline)

Variable	(1) Mean	(2) Median	(3) SD	(4) Min	(5) Max	(6) Obs.
VILLAGE CHARACTERISTICS						
Rural area	0.37	0.00	0.48	0.00	1.00	1821
Agriculture - village economic main sector	0.48	0.00	0.50	0.00	1.00	1821
No of families living in village	4056.03	2028.00	4216.61	0.00	19099.00	1821
Subdistrict capital - distance in hours	1.00	1.00	0.08	0.00	2.00	1821
District capital - distance in hours	1.35	1.00	2.01	0.00	20.00	1821
Village midwife in village	0.64	1.00	0.48	0.00	1.00	1821
No of early childhood facilities	3.99	3.00	3.73	0.00	18.00	1821
No of health centers operating monthly	9.62	8.00	6.69	0.00	25.00	1821
No of health centers operating bimonthly	0.21	0.00	0.68	0.00	5.00	1821
Posyandu - available in village	1.00	1.00	0.03	0.00	1.00	1821
No of PKH groups in village	4.55	4.00	3.13	1.00	13.00	1821
No of PKH beneficiaries in village	64.67	48.00	46.33	5.00	184.00	1821
Strong phone signal	0.89	1.00	0.32	0.00	1.00	1821
RESPONDENT AND HOUSEHOLD CHARACTERISTICS						
Female	0.99	1.00	0.09	0.00	1.00	1821
Age in years	30.47	30.00	5.07	15.00	42.00	1821
Years of education	7.16	6.00	3.38	0.00	15.00	1821
Married	0.98	1.00	0.14	0.00	1.00	1821
Household head	0.02	0.00	0.15	0.00	1.00	1821
Muslim	0.92	1.00	0.26	0.00	1.00	1821
Household size	5.31	5.00	1.69	3.00	16.00	1821
No of children	2.98	3.00	1.60	0.00	14.00	1821
No of children, age ≤ 5	1.41	1.00	0.65	0.00	5.00	1821
Pregnant	0.04	0.00	0.20	0.00	1.00	1821
First child	0.14	0.00	0.35	0.00	1.00	1821
Subjective assessment of own welfare	1.95	2.00	0.80	1.00	4.00	1816
Subjective wellbeing of respondent	2.98	3.00	0.42	1.00	4.00	1821
Extraversion - Big 5 scale	-0.03	0.30	1.47	-4.39	5.00	1683
Agreeableness - Big 5 scale	0.02	0.49	1.42	-4.69	3.90	1682
Conscientiousness - Big 5 scale	-0.01	-0.68	1.45	-4.08	6.12	1691
Neuroticism - Big 5 scale	-0.05	-0.33	1.46	-5.15	4.36	1677
Openness - Big 5 scale	-0.01	0.58	1.42	-4.26	5.48	1634
Share of math tasks correctly solved	0.65	0.80	0.34	0.00	1.00	1821
Bargaining power wrt household	0.91	0.94	0.10	0.00	1.00	1821
Bargaining power wrt child	0.87	0.91	0.12	0.00	1.00	1821
Phone Use	6.48	7.00	4.20	0.00	28.00	1821
Mother has Anemia	0.45	0.00	0.50	0.00	1.00	1647
Child stunted	0.36	0.00	0.48	0.00	1.00	1434
Child wasted	0.76	1.00	0.43	0.00	1.00	1434

Notes: Information is based on the sample selected for the RCT of 1,821 respondents.

Table A.2: Balance Table: Village Characteristics (at baseline)

	(1)	(2)	(3)
Variable	Mean Control	Mean Treatment	Cont. vs. Treat.
Rural area	0.36	0.38	0.03
	(0.48)	(0.49)	(0.80)
Agriculture - village economic main sector	0.46	0.51	0.05
	(0.50)	(0.50)	(0.65)
No of families living in village	4388.73	3732.33	-656.39
	(4354.75)	(4053.94)	(0.55)
Subdistrict capital - distance in hours	1.00	1.01	0.01
	(0.05)	(0.10)	(0.24)
District capital - distance in hours	1.26	1.44	0.18
	(0.82)	(2.70)	(0.65)
Village midwife in village	0.60	0.68	0.08
	(0.49)	(0.47)	(0.45)
No of early childhood facilities	3.90	4.07	0.18
	(3.85)	(3.60)	(0.83)
No of health centers operating monthly	10.06	9.19	-0.88
	(7.27)	(6.04)	(0.63)
No of health centers operating bimonthly	0.21	0.21	-0.00
	(0.62)	(0.73)	(1.00)
Posyandu - available in village	1.00	1.00	0.00
	(0.05)	(0.00)	(0.33)
No of PKH groups in village	4.69	4.42	-0.26
	(3.53)	(2.69)	(0.80)
No of PKH beneficiaries in village	66.21	63.16	-3.05
	(51.31)	(40.89)	(0.84)
Strong phone signal	0.84	0.93	0.09
	(0.37)	(0.25)	(0.21)
Observations	898	923	1,821

Notes: Information is based on the sample selected for the RCT of 1,821 respondents. (1) and (2): standard errors in parentheses; (3): p-values in parentheses. */**/*** denote significance levels at 10/5/1 percent respectively.

Table A.3: Balance Table: Respondent Characteristics (at baseline)

	(1)	(2)	(3)
Variable	Mean Control	Mean Treatment	Cont. vs. Treat.
Female	0.99	0.99	0.00
	(0.10)	(0.08)	(0.38)
Age in years	30.55	30.40	-0.15
	(5.04)	(5.10)	(0.74)
Years of education	7.30	7.02	-0.28
	(3.51)	(3.25)	(0.34)
Married	0.99	0.97	-0.01*
	(0.12)	(0.16)	(0.06)
Household head	0.02	0.02	-0.00
	(0.15)	(0.14)	(0.65)
Muslim	0.92	0.93	0.02
	(0.28)	(0.25)	(0.72)
Household size	5.41	5.22	-0.19
	(1.67)	(1.70)	(0.22)
No of children	3.02	2.94	-0.08
	(1.56)	(1.64)	(0.66)
No of children, age ≤ 5	1.44	1.37	-0.07*
	(0.67)	(0.63)	(0.06)
Pregnant	0.03	0.05	0.02*
	(0.18)	(0.22)	(0.06)
First child	0.12	0.16	0.03
	(0.33)	(0.36)	(0.21)
Subjective assessment of own welfare	1.99	1.91	-0.08
	(0.81)	(0.79)	(0.12)
Subjective wellbeing of respondent	2.99	2.97	-0.02
	(0.40)	(0.45)	(0.43)
Extraversion - Big 5 scale	0.02	-0.09	-0.11*
	(1.54)	(1.41)	(0.09)
Agreeableness - Big 5 scale	-0.07	0.11	0.18*
	(1.40)	(1.44)	(0.07)
Conscientiousness - Big 5 scale	0.06	-0.08	-0.13*
	(1.47)	(1.44)	(0.09)
Neuroticism - Big 5 scale	-0.05	-0.06	-0.02
	(1.47)	(1.46)	(0.84)
Openness - Big 5 scale	0.00	-0.01	-0.01
	(1.45)	(1.39)	(0.85)
Share of math tasks correctly solved	0.65	0.64	-0.01
	(0.34)	(0.34)	(0.40)
Bargaining power wrt household	0.91	0.91	0.00
	(0.10)	(0.11)	(0.94)
Bargaining power wrt child	0.87	0.87	0.00
	(0.12)	(0.12)	(0.83)
Phone Use	6.60	6.36	-0.25
	(4.28)	(4.12)	(0.35)
Mother has Anemia	0.49	0.40	-0.09*
	(0.50)	(0.49)	(0.07)
Child stunted	0.36	0.35	-0.01
	(0.48)	(0.48)	(0.68)
Child wasted	0.77	0.76	-0.01
	(0.42)	(0.43)	(0.60)
Observations	898	923	1,821

Notes: Information is based on the sample selected for the RCT of 1,821 respondents. (1) and (2): standard errors in parentheses; (3): p-values in parentheses. */**/*** denote significance levels at 10/5/1 percent respectively.

Table A.4: Balance Table: Outcome Variables - Knowledge and Behavior (at baseline)

Variable	(1) Mean Control	(2) Mean Treatment	(3) Cont. vs. Treat.
Anemia Knowledge (base)	0.16	0.16	0.00
	(0.17)	(0.16)	(0.94)
Breastfeeding Knowledge (base)	0.67	0.66	-0.01
	(0.27)	(0.27)	(0.69)
Postnatal Care Knowledge (base)	0.24	0.24	-0.00
	(0.21)	(0.21)	(0.76)
Vaccination Knowledge (base)	0.33	0.33	0.00
	(0.19)	(0.18)	(0.83)
Knowledge Index (base)	0.35	0.35	-0.00
	(0.13)	(0.12)	(0.86)
Postnatal Care Practice (base)	0.29	0.24	-0.04
	(0.39)	(0.38)	(0.13)
Hygiene Practice (base)	0.26	0.27	0.02
	(0.22)	(0.22)	(0.18)
Observations	898	923	1,821

Notes: Information is based on the sample selected for the RCT of 1,821 respondents, with the exception of Handwashing Knowledge and Vaccination Practice, which were only included in the endline survey. *Anemia Knowledge* - average of eight knowledge questions related to anemia. *Breast Feeding Knowledge*: average of four knowledge questions related to breast feeding. *Postnatal Care Knowledge*: average of three knowledge questions related to post natal care. *Vaccination Knowledge*: average of two knowledge questions related to vaccination. *Hygiene Knowledge*: average of two knowledge questions related to handwashing. *Knowledge Index*: average over all knowledge questions. For all knowledge questions knowledge is defined as the share of correct responses to each respective question. *Hygiene Practice* - Proportion of correct handwashing practices performed by respondent (oberseved by enumerator). *Postnatal Care Practice* - Share of child health record books (presented to enumerator). (1) and (2): standard errors in parentheses; (3): p-values in parentheses. */**/*** denote significance levels at 10/5/1 percent respectively.

A.2. Robustness Checks

A.2.1. Lee-Bound Analysis

Table A.5: Impact on Knowledge with Lee-Bounds

	Anemia Knowledge	Breastfeeding Knowledge	Postnatal-care Knowledge	Vaccination Knowledge	Hygiene Knowledge	Knowledge Index
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment						
lower	0.051	0.030	0.064	0.003	0.003	0.018
	(0.012)***	(0.023)	(0.012)***	(0.008)	(0.008)	(0.008)**
upper	0.063	0.047	0.078	0.015	0.015	0.029
	(0.012)***	(0.023)**	(0.012)***	(0.009)*	(0.009)*	(0.007)***
Observations	1820	1821	1821	1821	1821	1821

Notes: Lee-Bound analysis (Lee, 2009). Bootstrapped standard errors with 250 repetitions, depicted in parentheses. Knowledge is defined as the share of correct responses to each respective question. *Anemia Knowledge* - average of eight knowledge questions related to anemia. *Breast Feeding Knowledge*: average of four knowledge questions related to breast feeding. *Postnatal Care Knowledge*: average of three knowledge questions related to post natal care. *Vaccination Knowledge*: average of two knowledge questions related to vaccination. *Hygiene Knowledge*: average of two knowledge questions related to handwashing. *Knowledge Index*: average over all knowledge questions. */**/*** denote significance levels at 10/5/1 percent respectively.

Table A.6: Impact on Behavior with Lee-Bounds

	Hygiene Practices	Vaccination Practices	Postnatal Care Practices
	(1)	(2)	(3)
Treatment			
lower	0.099	0.792	0.073
	(0.014)***	(0.076)***	(0.021)***
upper	0.287	0.920	0.089
	(0.033)***	(0.074)***	(0.022)***
Observations	1821	1821	1821

Notes: Lee-Bound analysis (Lee, 2009). Bootstrapped standard errors with 250 repetitions, depicted in parentheses. *Postnatal Care Practice* - Share of child health record books (presented to enumerator). *Vaccination Practice* - Number of vaccinations a child received. *Hygiene Practice* - Proportion of correct handwashing practices performed by respondent (oberseved by enumerator). */**/*** denote significance levels at 10/5/1 percent respectively.

A.2.2. Multiple Hypotheses Testing

Table A.7: Romano-Wolf Multiple Hypothesis Correction (Clarke et al., 2019)

Outcome Variables	Column (1) Model p-value	Column (2) Resample p-value	Column (3) Romano-Wolf p-value
Anemia Knowledge	0.000	0.001	0.002
Breastfeeding Knowledge	0.056	0.262	0.400
Postnatal Care Knowledge	0.000	0.000	0.001
Vaccination Knowledge	0.258	0.436	0.436
Hygiene Knowledge	0.001	0.002	0.071
Knowledge Index	0.000	0.004	0.010
Postnatal Care Practice	0.000	0.018	0.057
Vaccination Practice	0.000	0.000	0.000
Hygiene Practice	0.000	0.000	0.000

Bootstrapped standard errors clustered on desa level with 5000 replications. No controls included.

A.2.3. Conley Standard Errors

Table A.8: Impact on Knowledge

Outcome Variables	(1)	(2)
Anemia Knowledge	0.060 (0.023)***	0.063 (0.022)***
Breastfeeding Knowledge	0.039 (0.024)	0.047 (0.033)
Postnatal Care Knowledge	0.074 (0.012)***	0.076 (0.009)***
Vaccination Knowledge	0.009 (0.012)	0.017 (0.010)*
Hygiene Knowledge	0.026 (0.007)***	0.024 (0.010)**
Knowledge Index	0.042 (0.015)***	0.045 (0.016)***
Individual and household controls	No	Yes
Village controls	No	Yes
Subdistrict FE	No	Yes

Notes: OLS Estimators. Standard errors are depicted in parentheses and are corrected for spatial correlation using the `acreg` approach based on the Conley correction (Conley, 1999; Colella et al., 2019). Knowledge is defined as the share of correct responses to each respective question. *Anemia Knowledge* - average of eight knowledge questions related to anemia. *Breast Feeding Knowledge*: average of four knowledge questions related to breast feeding. *Postnatal Care Knowledge*: average of three knowledge questions related to post natal care. *Vaccination Knowledge*: average of two knowledge questions related to vaccination. *Hygiene Knowledge*: average of two knowledge questions related to handwashing. *Knowledge Index*: average over all knowledge questions. Individual and household controls include the gender and age of the respondent, whether she is married, whether she heads the household, whether she is Muslim, her years of education, household size, whether the respondent is pregnant at baseline, the number of children below five and the age of the youngest child. Village controls includes the number of families in the village, the number of early childhood facilities in the village, whether there is a midwife available in the village, whether the village is located in rural areas, distance to the subdistrict capital, whether agriculture is the main economic sector, and phone signal strength. */**/*** denote significance levels at 10/5/1 percent respectively.

Table A.9: Impact on Behavior

Outcome Variables	(1)	(2)
Postnatal Care Practice	0.079	0.052
	(0.048)*	(0.031)*
Vaccination Practice	0.891	0.739
	(0.095)***	(0.105)***
Hygiene Practice	0.106	0.099
	(0.007)***	(0.010)***
Individual and household controls	No	Yes
Village controls	No	Yes
Subdistrict FE	No	Yes

Notes: OLS Estimators. Standard errors are depicted in parentheses and are corrected for spatial correlation using the `acreg` approach based on the Conley correction (Conley, 1999; Colella et al., 2019). *Postnatal Care Practice* - Share of child health record books (presented to enumerator). *Vaccination Practice* - Number of vaccinations a child received. *Hygiene Practice* - Proportion of correct handwashing practices performed by respondent (oberseved by enumerator). Individual and household controls include the gender and age of the respondent, whether she is married, whether she heads the household, whether she is Muslim, her years of education, household size, whether the respondent is pregnant at baseline, the number of children below five and the age of the youngest child. Village controls include the number of families in the village, the number of early childhood facilities in the village, whether there is a midwife available in the village, whether the village is located in rural areas, distance to the subdistrict capital, whether agriculture is the main economic sector, and phone signal strength. */**/*** denote significance levels at 10/5/1 percent respectively.

A.2.4. Change in Functional Form

Table A.10: Impact on Knowledge (changed functional form)

Outcome Variables		
	(1)	(2)
Anemia Knowledge	0.405	0.453
	(0.119)***	(0.107)***
Breastfeeding Knowledge	0.159	0.199
	(0.141)	(0.120)*
Postnatal Care Knowledge	0.404	0.429
	(0.090)***	(0.088)***
Vaccination Knowledge	0.040	0.073
	(0.053)	(0.038)*
Hygiene Knowledge	0.144	0.135
	(0.046)***	(0.050)***
Knowledge Index	0.202	0.224
	(0.069)***	(0.058)***
Individual and household controls	No	Yes
Village controls	No	Yes
Subdistrict FE	No	Yes

Notes: GLM estimation, fractional logit. Standard errors are depicted in parentheses and clustered at the village level. Knowledge is defined as the share of correct responses to each respective question. *Anemia Knowledge* - average of eight knowledge questions related to anemia. *Breast Feeding Knowledge*: average of four knowledge questions related to breast feeding. *Postnatal Care Knowledge*: average of three knowledge questions related to post natal care. *Vaccination Knowledge*: average of two knowledge questions related to vaccination. *Hygiene Knowledge*: average of two knowledge questions related to handwashing. *Knowledge Index*: average over all knowledge questions. Individual and household controls include the gender and age of the respondent, whether she is married, whether she heads the household, whether she is Muslim, her years of education, household size, whether the respondent is pregnant at baseline, the number of children below five and the age of the youngest child. Village controls include the number of families in the village, the number of early childhood facilities in the village, whether there is a midwife available in the village, whether the village is located in rural areas, distance to the subdistrict capital, whether agriculture is the main economic sector, and phone signal strength. */**/*** denote significance levels at 10/5/1 percent respectively.

Table A.11: Impact on Behavior (changed functional form)

Outcome Variables	(1)	(2)
Postnatal Care Practice	0.322	0.223
	(0.142)**	(0.104)**
Vaccination Practice	0.737	0.608
	(0.075)***	(0.061)***
Hygiene Practice	0.563	0.538
	(0.115)***	(0.116)***
Individual and household controls	No	Yes
Village controls	No	Yes
Subdistrict FE	No	Yes

Notes: GLM estimation, fractional logit for Hygiene Practice and Postnatal Care Practice; Poisson for Vaccination Practice. Standard errors are depicted in parentheses and clustered at the village level. *Postnatal Care Practice* - Share of child health record books (presented to enumerator). *Vaccination Practice* - Number of vaccinations a child received. *Hygiene Practice* - Proportion of correct handwashing practices performed by respondent (oberseved by enumerator). Individual and household controls include the gender and age of the respondent, whether she is married, whether she heads the household, whether she is Muslim, her years of education, household size, whether the respondent is pregnant at baseline, the number of children below five and the age of the youngest child. Village controls include the number of families in the village, the number of early childhood facilities in the village, whether there is a midwife available in the village, whether the village is located in rural areas, distance to the subdistrict capital, whether agriculture is the main economic sector, and phone signal strength. */**/*** denote significance levels at 10/5/1 percent respectively.

A.2.5. Including Baseline Dependent Variable

Table A.12: Impact on Knowledge

Outcome Variables			
	(1)	(2)	(3)
Anemia Knowledge	0.060	0.059	0.060
	(0.017)***	(0.015)***	(0.015)***
Breastfeeding Knowledge	0.039	0.042	0.046
	(0.035)	(0.034)	(0.028)
Postnatal Care Knowledge	0.074	0.074	0.076
	(0.017)***	(0.017)***	(0.016)***
Vaccination Knowledge	0.009	0.006	0.008
	(0.012)	(0.006)	(0.006)
Knowledge Index	0.042	0.043	0.044
	(0.014)***	(0.013)***	(0.011)***
Lagged DV	No	Yes	Yes
Individual and household controls	No	No	Yes
Village controls	No	No	Yes
Subdistrict FE	No	No	Yes

Notes: OLS Estimators. Standard errors are depicted in parentheses and clustered at the village level. Knowledge is defined as the share of correct responses to each respective question. *Anemia Knowledge* - average of eight knowledge questions related to anemia. *Breast Feeding Knowledge*: average of four knowledge questions related to breast feeding. *Postnatal Care Knowledge*: average of three knowledge questions related to post natal care. *Vaccination Knowledge*: average of two knowledge questions related to vaccination. *Knowledge Index*: average over all knowledge questions. Individual and household controls include the gender and age of the respondent, whether she is married, whether she heads the household, whether she is Muslim, her years of education, household size, whether the respondent is pregnant at baseline, the number of children below five and the age of the youngest child. Village controls include the number of families in the village, the number of early childhood facilities in the village, whether there is a midwife available in the village, whether the village is located in rural areas, distance to the subdistrict capital, whether agriculture is the main economic sector, and phone signal strength. */**/*** denote significance levels at 10/5/1 percent respectively.

Table A.13: Impact on Behavior

Outcome Variables			
	(1)	(2)	(3)
Postnatal Care Practice	0.079	0.107	0.083
	(0.035)**	(0.025)***	(0.019)***
Hygiene Practice	0.106	0.104	0.097
	(0.021)***	(0.020)***	(0.021)***
Lagged DV	No	Yes	Yes
Individual and household controls	No	No	Yes
Village controls	No	No	Yes
Subdistrict FE	No	No	Yes

Notes: OLS Estimators. Standard errors are depicted in parentheses and clustered at the village level. *Hygiene Practice* - Proportion of correct handwashing practices performed by respondent (oberseved by enumerator). *Postnatal Care Practice* - Share of child health record books (presented to enumerator). Individual and household controls include the gender and age of the respondent, whether she is married, whether she heads the household, whether she is Muslim, her years of education, household size, whether the respondent is pregnant at baseline, the number of children below five and the age of the youngest child. Village controls include the number of families in the village, the number of early childhood facilities in the village, whether there is a midwife available in the village, whether the village is located in rural areas, distance to the subdistrict capital, whether agriculture is the main economic sector, and phone signal strength. */**/*** denote significance levels at 10/5/1 percent respectively.

A.2.6. Including Other Covariates

Table A.14: Impact on Knowledge

Outcome Variables	(1)	(2)	(3)	(4)
Anemia Knowledge	0.065 (0.015)***	0.062 (0.016)***	0.064 (0.016)***	0.064 (0.016)***
Breastfeeding Knowledge	0.048 (0.029)*	0.048 (0.031)	0.050 (0.031)	0.051 (0.030)*
Postnatal Care Knowledge	0.078 (0.017)***	0.075 (0.017)***	0.076 (0.017)***	0.076 (0.017)***
Vaccination Knowledge	0.018 (0.009)**	0.014 (0.009)	0.016 (0.009)*	0.015 (0.009)*
Hygiene Knowledge	0.024 (0.009)***	0.024 (0.009)**	0.024 (0.009)**	0.023 (0.009)**
Knowledge Index	0.047 (0.012)***	0.045 (0.013)***	0.046 (0.013)***	0.046 (0.013)***
Individual and household controls	Yes	Yes	Yes	Yes
Village controls	Yes	Yes	Yes	Yes
Subdistrict FE	Yes	Yes	Yes	Yes
Welfare controls	Yes	Yes	Yes	Yes
Big5 controls	No	Yes	Yes	Yes
Cognitive controls	No	No	Yes	Yes
Bargaining controls	No	No	No	Yes

Notes: OLS Estimators. Standard errors are depicted in parentheses and clustered at the village level. Knowledge is defined as the share of correct responses to each respective question. *Anemia Knowledge* - average of eight knowledge questions related to anemia. *Breast Feeding Knowledge*: average of four knowledge questions related to breast feeding. *Postnatal Care Knowledge*: average of three knowledge questions related to post natal care. *Vaccination Knowledge*: average of two knowledge questions related to vaccination. *Hygiene Knowledge*: average of two knowledge questions related to handwashing. *Knowledge Index*: average over all knowledge questions. Individual and household controls include the gender and age of the respondent, whether she is married, whether she heads the household, whether she is Muslim, her years of education, household size, whether the respondent is pregnant at baseline, the number of children below five and the age of the youngest child. Village controls include the number of families in the village, the number of early childhood facilities in the village, whether there is a midwife available in the village, whether the village is located in rural areas, distance to the subdistrict capital, whether agriculture is the main economic sector, and phone signal strength. Welfare controls include the respondent's subjective assessment of her welfare and of her well-being. Big5 controls include the five personality measures. Cognitive controls include the share of math tasks the respondent solved correctly. Bargaining controls include the respondent's level of bargaining power with respect to child and household related decisions. */**/*** denote significance levels at 10/5/1 percent respectively.

Table A.15: Impact on Behavior

Outcome Variables				
	(1)	(2)	(3)	(4)
Postnatal Care Practice	0.051	0.068	0.069	0.068
	(0.025)**	(0.026)***	(0.025)***	(0.025)***
Vaccination Practice	0.744	0.787	0.786	0.790
	(0.084)***	(0.082)***	(0.082)***	(0.081)***
Hygiene Practice	0.101	0.100	0.100	0.100
	(0.021)***	(0.022)***	(0.022)***	(0.022)***
Individual and household controls	Yes	Yes	Yes	Yes
Village controls	Yes	Yes	Yes	Yes
Subdistrict FE	Yes	Yes	Yes	Yes
Welfare controls	Yes	Yes	Yes	Yes
Big5 controls	No	Yes	Yes	Yes
Cognitive controls	No	No	Yes	Yes
Bargaining controls	No	No	No	Yes

Notes: OLS Estimators. Standard errors are depicted in parentheses and clustered at the village level. *Postnatal Care Practice* - Share of child health record books (presented to enumerator). *Vaccination Practice* - Number of vaccinations a child received. *Hygiene Practice* - Proportion of correct handwashing practices performed by respondent (oberseved by enumerator). Individual and household controls include the gender and age of the respondent, whether she is married, whether she heads the household, whether she is Muslim, her years of education, household size, whether the respondent is pregnant at baseline, the number of children below five and the age of the youngest child. Village controls include the number of families in the village, the number of early childhood facilities in the village, whether there is a midwife available in the village, whether the village is located in rural areas, distance to the subdistrict capital, whether agriculture is the main economic sector, and phone signal strength. Welfare controls include the respondent's subjective assessment of her welfare and of her well-being. Big5 controls include the five personality measures. Cognitive controls include the share of math tasks the respondent solved correctly. Bargaining controls include the respondent's level of bargaining power with respect to child and household related decisions. */**/*** denote significance levels at 10/5/1 percent respectively.

A.2.7. Alternative Coding

Table A.16: Impact on Knowledge and Behavior using Lenient Coding

Outcome Variables	(1)	(2)
Anemia Knowledge	0.096 (0.033)***	0.108 (0.029)***
Postnatal Care Knowledge	0.087 (0.019)***	0.090 (0.018)***
Vaccination Knowledge	0.025 (0.024)	0.033 (0.018)*
Hygiene Knowledge	0.006 (0.006)	0.003 (0.006)
Knowledge Index	0.051 (0.019)***	0.056 (0.015)***
Hygiene Practice	0.108 (0.032)***	0.105 (0.033)***
Individual and household controls	No	Yes
Village controls	No	Yes
Subdistrict FE	No	Yes

Notes: OLS Estimators. Knowledge is defined as knowing at least one correct response for each respective question. *Anemia Knowledge* - average of eight knowledge questions related to anemia. *Postnatal Care Knowledge*: average of three knowledge questions related to post natal care. *Vaccination Knowledge*: average of two knowledge questions related to vaccination. *Hygiene Knowledge*: average of two knowledge questions related to handwashing. *Knowledge Index*: average over all knowledge questions. *Hygiene Practice* - average over handwashing related practices, for each of which at least one is correctly performed by respondent (oberseved by enumerator). Individual and household controls include the gender and age of the respondent, whether she is married, whether she heads the household, whether she is Muslim, her years of education, household size, whether the respondent is pregnant at baseline, the number of children below five and the age of the youngest child. Village controls include the number of families in the village, the number of early childhood facilities in the village, whether there is a midwife available in the village, whether the village is located in rural areas, distance to the subdistrict capital, whether agriculture is the main economic sector, and phone signal strength. */**/*** denote significance levels at 10/5/1 percent respectively.

A.2.8. Spillover

Table A.17: Spillover Analysis

Variable	(1) Mean Far Control Villages	(2) Mean Close Control Villages	(3) Far vs. Close
Anemia Knowledge	0.12	0.19	0.07***
	(0.19)	(0.21)	(0.00)
Breastfeeding Knowledge	0.39	0.46	0.07
	(0.41)	(0.40)	(0.12)
Postnatal Care Knowledge	0.19	0.21	0.02
	(0.21)	(0.22)	(0.28)
Vaccination Knowledge	0.35	0.36	0.01
	(0.18)	(0.18)	(0.80)
Hygiene Knowledge	0.23	0.22	-0.01
	(0.15)	(0.15)	(0.32)
Knowledge Index	0.26	0.29	0.03
	(0.16)	(0.16)	(0.11)
Postnatal Care Practice	0.51	0.51	-0.00
	(0.43)	(0.43)	(1.00)
Vaccination Practice	0.80	0.80	-0.00
	(0.70)	(0.54)	(0.97)
Hygiene Practice	0.19	0.21	0.01
	(0.24)	(0.24)	(0.69)
Observations	439	385	824

Notes: Close control villages are defined as villages where the distance to the next treatment village was below the median distance in the sample (specified by province). *Anemia Knowledge* - average of eight knowledge questions related to anemia (only asked if mother heard of Anemia). *Breast Feeding Knowledge Index*: average of four knowledge questions related to breast feeding. *Postnatal Care Knowledge Index*: average of three knowledge questions related to post natal care. *Vaccination Knowledge Index*: average of two knowledge questions related to vaccination. *Hygiene Knowledge*: average of two knowledge questions related to handwashing. *Knowledge Index*: average over all knowledge questions. Knowledge is defined as the share of correct responses to each respective question. *Postnatal Care Practice* - Share of child health record books (presented to enumerator). *Vaccination Practice* - Number of vaccinations a child received. *Hygiene Practice* - Proportion of correct handwashing practices performed by respondent (oberseved by enumerator). (1) and (2): standard errors in parentheses; (3): p-values in parentheses. */**/*** denote significance levels at 10/5/1 percent respectively.

A.3. Mechanism

Table A.18: Treatment Effect and Cognitive Ability

	Knowledge Index	Postnatal Care Practices	Vaccination Practices	Hygiene Practices
	(1)	(2)	(3)	(4)
Treatment	0.042	0.037	0.708	0.101
	(0.012)***	(0.027)	(0.102)***	(0.022)***
High cognitive ability	0.020	-0.027	-0.044	0.007
	(0.011)*	(0.031)	(0.067)	(0.016)
Treatment x High cognitive ability	0.015	0.046	0.094	-0.004
	(0.018)	(0.043)	(0.178)	(0.028)
N	1725	1726	1726	1726
Village controls	Yes	Yes	Yes	Yes
Subdistrict FE	Yes	Yes	Yes	Yes
Mother controls	Yes	Yes	Yes	Yes

Notes: OLS Estimators. Standard errors are depicted in parentheses and clustered at the village level. *High cognitive ability* is a dummy variable indicating that the mother solved all math tasks in the baseline survey correctly. *Knowledge Index*: average over all knowledge questions related to anemia, breastfeeding, postnatal care, vaccination and hygiene. *Postnatal Care Practice* - Share of child health record books (presented to enumerator). *Vaccination Practice* - Number of vaccinations a child received. *Hygiene Practice* - Proportion of correct handwashing practices performed by respondent (oberseved by enumerator). Individual and household controls include the gender and age of the respondent, whether she is married, whether she heads the household, whether she is Muslim, her years of education, household size, whether the respondent is pregnant at baseline, the number of children below five and the age of the youngest child. Village controls include the number of families in the village, the number of early childhood facilities in the village, whether there is a midwife available in the village, whether the village is located in rural areas, distance to the subdistrict capital, whether agriculture is the main economic sector, and phone signal strength. */**/*** denote significance levels at 10/5/1 percent respectively.

A.4. Social network

Table A.19: Summary Statistics: Visit Network

	mean	sd	min	max	p50
Visit-outdegree (PKH)	8.17	1.97	2	13	8
Observations	1723				

Notes: Visit-outdegree (PKH) - number of other PKH mothers a mother visits or is visited by on a regular basis.
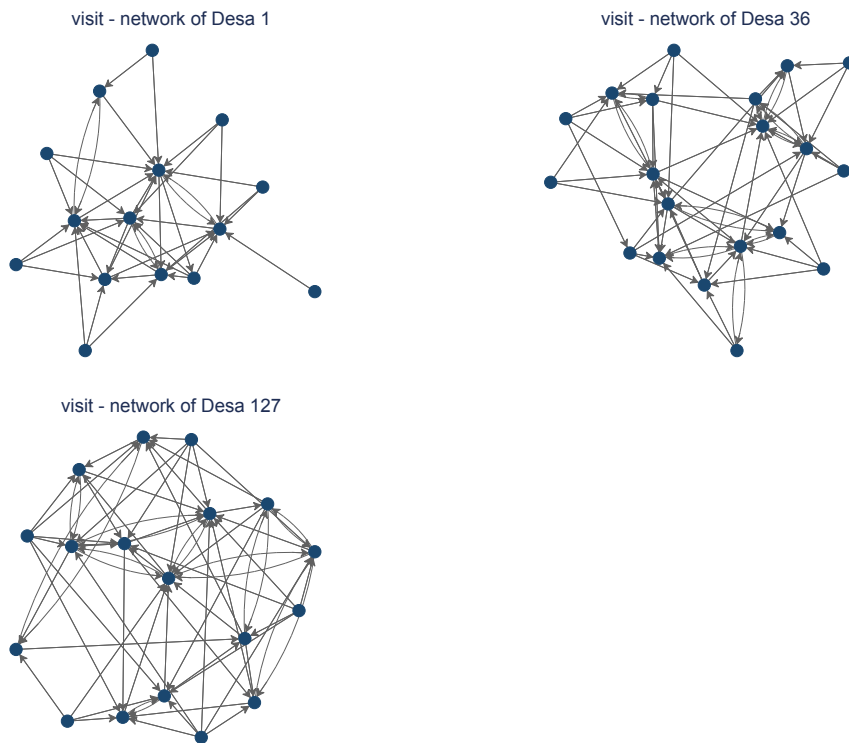

Figure 1: Exemplary Social Network Graphs

A.5. Health Care Supply

Table A.20: Health Care Supply three years after the Intervention

	Health Centers operating monthly	Health Centers operating bimonthly	Health Posts	Village Midwife	Disease Outbreak 2017
	(1)	(2)	(3)	(4)	(5)
Treatment	1.086	0.863	-0.235	0.006	-0.019
	(0.726)	(0.879)	(0.290)	(0.090)	(0.061)
N	117	117	117	117	117

Notes: OLS Estimators. Standard errors in parentheses. Measures based on village census data from 2018. */**/*** denote significance levels at 10/5/1 percent respectively.

B. Online appendix: Part 1 - Additional tables and figures

B.1. Treatment Effect Heterogeneity - Knowledge Questions

B.1.1. Phone Use

Table B.1: Impact on Knowledge by Phone Use

	Anemia Knowledge	Breastfeeding Knowledge	Postnatal-care Knowledge	Vaccination Knowledge	Handwashing Knowledge	Knowledge Index
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment	0.073 (0.015)***	0.068 (0.029)**	0.083 (0.017)***	0.021 (0.010)**	0.028 (0.009)***	0.054 (0.012)***
High phone use	0.038 (0.019)**	0.071 (0.036)**	0.018 (0.014)	0.023 (0.016)	-0.002 (0.014)	0.029 (0.013)**
Treatment x High phone use	-0.047 (0.027)*	-0.095 (0.048)*	-0.031 (0.027)	-0.023 (0.020)	-0.016 (0.019)	-0.042 (0.020)**
N	1725	1726	1726	1726	1726	1725
Village controls	Yes	Yes	Yes	Yes	Yes	Yes
Subdistrict FE	Yes	Yes	Yes	Yes	Yes	Yes
Mother controls	Yes	Yes	Yes	Yes	Yes	Yes

Notes: OLS Estimators. Standard errors are depicted in parentheses and clustered at the village level. Knowledge is defined as the share of correct responses to each respective question. *High phone use* is a dummy variable indicating above median phone use (more than once a week) at baseline. *Anemia Knowledge* - average of eight knowledge questions related to anemia. *Breast Feeding Knowledge*: average of four knowledge questions related to breast feeding. *Postnatal Care Knowledge*: average of three knowledge questions related to post natal care. *Vaccination Knowledge*: average of two knowledge questions related to vaccination. *Hygiene Knowledge*: average of two knowledge questions related to handwashing. *Knowledge Index*: average over all knowledge questions. Individual and household controls include the gender and age of the respondent, whether she is married, whether she heads the household, whether she is Muslim, her years of education, household size, whether the respondent is pregnant at baseline, the number of children below five and the age of the youngest child. Village controls includes the number of families in the village, the number of early childhood facilities in the village, whether there is a midwife available in the village, whether the village is located in rural areas, distance to the subdistrict capital, whether agriculture is the main economic sector, and phone signal strength. */**/*** denote significance levels at 10/5/1 percent respectively.

B.1.2. Education and Cognitive Ability

Table B.2: Impact on Knowledge by Education

	Anemia Knowledge	Breastfeeding Knowledge	Postnatal-care Knowledge	Vaccination Knowledge	Handwashing Knowledge	Knowledge Index
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment	0.083	0.078	0.095	0.018	0.029	0.061
	(0.022)***	(0.041)*	(0.025)***	(0.017)	(0.015)*	(0.017)***
Finished at least primary	0.070	0.060	0.052	0.057	0.001	0.049
	(0.016)***	(0.029)**	(0.018)***	(0.014)***	(0.011)	(0.012)***
Treatment x Finished at least primary	-0.030	-0.043	-0.028	-0.005	-0.006	-0.023
	(0.025)	(0.043)	(0.026)	(0.019)	(0.018)	(0.019)
N	1724	1725	1725	1725	1725	1724
Village controls	Yes	Yes	Yes	Yes	Yes	Yes
Subdistrict FE	Yes	Yes	Yes	Yes	Yes	Yes
Mother controls	Yes	Yes	Yes	Yes	Yes	Yes

Notes: OLS Estimators. Standard errors are depicted in parentheses and clustered at the village level. *Finished at least primary* is a dummy variable indicating that the mother has at least six years of education. Knowledge is defined as the share of correct responses to each respective question. *Anemia Knowledge* - average of eight knowledge questions related to anemia. *Breast Feeding Knowledge:* average of four knowledge questions related to breast feeding. *Postnatal Care Knowledge:* average of three knowledge questions related to post natal care. *Vaccination Knowledge:* average of two knowledge questions related to vaccination. *Hygiene Knowledge:* average of two knowledge questions related to handwashing. *Knowledge Index:* average over all knowledge questions. Individual and household controls include the gender and age of the respondent, whether she is married, whether she heads the household, whether she is Muslim, household size, whether the respondent is pregnant at baseline, the number of children below five and the age of the youngest child. Village controls includes the number of families in the village, the number of early childhood facilities in the village, whether there is a midwife available in the village, whether the village is located in rural areas, distance to the subdistrict capital, whether agriculture is the main economic sector, and phone signal strength. */**/*** denote significance levels at 10/5/1 percent respectively.

Table B.3: Impact on Knowledge by Cognitive Ability

	Anemia Knowledge	Breastfeeding Knowledge	Postnatal-care Knowledge	Vaccination Knowledge	Handwashing Knowledge	Knowledge Index
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment	0.058	0.046	0.071	0.011	0.023	0.042
	(0.016)***	(0.029)	(0.018)***	(0.010)	(0.010)**	(0.012)***
High cognitive ability	0.019	0.040	0.009	0.022	0.008	0.020
	(0.014)	(0.026)	(0.015)	(0.011)*	(0.013)	(0.011)*
Treatment x High cognitive ability	0.018	0.011	0.017	0.023	0.006	0.015
	(0.024)	(0.042)	(0.025)	(0.015)	(0.016)	(0.018)
N	1725	1726	1726	1726	1726	1725
Village controls	Yes	Yes	Yes	Yes	Yes	Yes
Subdistrict FE	Yes	Yes	Yes	Yes	Yes	Yes
Mother controls	Yes	Yes	Yes	Yes	Yes	Yes

Notes: OLS Estimators. Standard errors are depicted in parentheses and clustered at the village level. *High cognitive ability* is a dummy variable indicating that the mother solved all math tasks in the baseline survey correctly. Knowledge is defined as the share of correct responses to each respective question. *Anemia Knowledge* - average of eight knowledge questions related to anemia. *Breast Feeding Knowledge*: average of four knowledge questions related to breast feeding. *Postnatal Care Knowledge*: average of three knowledge questions related to post natal care. *Vaccination Knowledge*: average of two knowledge questions related to vaccination. *Hygiene Knowledge*: average of two knowledge questions related to handwashing. *Knowledge Index*: average over all knowledge questions. Individual and household controls include the gender and age of the respondent, whether she is married, whether she heads the household, whether she is Muslim, her years of education, household size, whether the respondent is pregnant at baseline, the number of children below five and the age of the youngest child. Village controls includes the number of families in the village, the number of early childhood facilities in the village, whether there is a midwife available in the village, whether the village is located in rural areas, distance to the subdistrict capital, whether agriculture is the main economic sector, and phone signal strength. */**/*** denote significance levels at 10/5/1 percent respectively.

B.1.3. Openness

Table B.4: Impact on Knowledge by Openness

	Anemia Knowledge	Breastfeeding Knowledge	Postnatal-care Knowledge	Vaccination Knowledge	Handwashing Knowledge	Knowledge Index
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment	0.064	0.046	0.082	0.022	0.028	0.048
	(0.018)***	(0.032)	(0.017)***	(0.011)**	(0.010)***	(0.013)***
Open (Big 5)	-0.012	-0.016	-0.007	0.015	-0.001	-0.004
	(0.017)	(0.034)	(0.016)	(0.016)	(0.011)	(0.013)
Treatment x Open (Big 5)	-0.004	0.004	-0.021	-0.018	-0.012	-0.011
	(0.023)	(0.043)	(0.024)	(0.021)	(0.018)	(0.018)
N	1725	1726	1726	1726	1726	1725
Village controls	Yes	Yes	Yes	Yes	Yes	Yes
Subdistrict FE	Yes	Yes	Yes	Yes	Yes	Yes
Mother controls	Yes	Yes	Yes	Yes	Yes	Yes

Notes: OLS Estimators. Standard errors are depicted in parentheses and clustered at the village level. *Open (Big 5)* is a dummy variable indicating that the mother had an above median score of Openness defined based on the Big 5 taxonomy. Knowledge is defined as the share of correct responses to each respective question. *Anemia Knowledge* - average of eight knowledge questions related to anemia. *Breast Feeding Knowledge*: average of four knowledge questions related to breast feeding. *Postnatal Care Knowledge*: average of three knowledge questions related to post natal care. *Vaccination Knowledge*: average of two knowledge questions related to vaccination. *Hygiene Knowledge*: average of two knowledge questions related to handwashing. *Knowledge Index*: average over all knowledge questions. Individual and household controls include the gender and age of the respondent, whether she is married, whether she heads the household, whether she is Muslim, her years of education, household size, whether the respondent is pregnant at baseline, the number of children below five and the age of the youngest child. Village controls includes the number of families in the village, the number of early childhood facilities in the village, whether there is a midwife available in the village, whether the village is located in rural areas, distance to the subdistrict capital, whether agriculture is the main economic sector, and phone signal strength. */**/*** denote significance levels at 10/5/1 percent respectively.

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B.1.4. Bargaining Power

Table B.5: Impact on Knowledge by Bargaining Power

	Anemia Knowledge	Breastfeeding Knowledge	Postnatal-care Knowledge	Vaccination Knowledge	Handwashing Knowledge	Knowledge Index
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment	0.061	0.042	0.080	0.016	0.019	0.044
	(0.017)***	(0.031)	(0.017)***	(0.011)	(0.011)*	(0.013)***
High bargaining power	0.000	-0.013	0.001	-0.002	-0.003	-0.003
	(0.014)	(0.027)	(0.014)	(0.014)	(0.011)	(0.011)
Treatment x High bargaining power	0.004	0.014	-0.011	0.001	0.015	0.004
	(0.022)	(0.042)	(0.021)	(0.018)	(0.015)	(0.016)
N	1725	1726	1726	1726	1726	1725
Village controls	Yes	Yes	Yes	Yes	Yes	Yes
Subdistrict FE	Yes	Yes	Yes	Yes	Yes	Yes
Mother controls	Yes	Yes	Yes	Yes	Yes	Yes

Notes: OLS Estimators. Standard errors are depicted in parentheses and clustered at the village level. *High bargaining power* is a dummy variable indicating that the mother had an above median score in a bargaining index regarding household related decisions and in a bargaining index regarding child related decisions. Knowledge is defined as the share of correct responses to each respective question. *Anemia Knowledge* - average of eight knowledge questions related to anemia. *Breast Feeding Knowledge*: average of four knowledge questions related to breast feeding. *Postnatal Care Knowledge*: average of three knowledge questions related to post natal care. *Vaccination Knowledge*: average of two knowledge questions related to vaccination. *Hygiene Knowledge*: average of two knowledge questions related to handwashing. *Knowledge Index*: average over all knowledge questions. Individual and household controls include the gender and age of the respondent, whether she is married, whether she heads the household, whether she is Muslim, her years of education, household size, whether the respondent is pregnant at baseline, the number of children below five and the age of the youngest child. Village controls includes the number of families in the village, the number of early childhood facilities in the village, whether there is a midwife available in the village, whether the village is located in rural areas, distance to the subdistrict capital, whether agriculture is the main economic sector, and phone signal strength. */**/*** denote significance levels at 10/5/1 percent respectively.

B.1.5. Social Networks

Table B.6: Impact on Knowledge by Social Network

	Anemia Knowledge	Breastfeeding Knowledge	Postnatal-care Knowledge	Vaccination Knowledge	Handwashing Knowledge	Knowledge Index
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment	-0.085	-0.320	-0.146	0.012	-0.082	-0.123
	(0.052)	(0.101)***	(0.055)***	(0.035)	(0.035)**	(0.039)***
visit-outdegree (PKH)	-0.002	-0.006	-0.005	-0.002	-0.005	-0.004
	(0.006)	(0.010)	(0.005)	(0.003)	(0.004)	(0.004)
Treatment x visit-outdegree (PKH)	0.017	0.044	0.027	0.001	0.013	0.020
	(0.007)***	(0.012)***	(0.007)***	(0.004)	(0.005)***	(0.005)***
N	1722	1723	1723	1723	1723	1722
Village controls	Yes	Yes	Yes	Yes	Yes	Yes
Subdistrict FE	Yes	Yes	Yes	Yes	Yes	Yes
Mother controls	Yes	Yes	Yes	Yes	Yes	Yes
Network controls	Yes	Yes	Yes	Yes	Yes	Yes

Notes: OLS Estimators. Standard errors are depicted in parentheses and clustered at the village level. *Visit-outdegree (PKH)* indicates the number of other PKH mothers a mother visits or is visited by on a regular basis. Knowledge is defined as the share of correct responses to each respective question. *Anemia Knowledge* - average of eight knowledge questions related to anemia. *Breast Feeding Knowledge:* average of four knowledge questions related to breast feeding. *Postnatal Care Knowledge:* average of three knowledge questions related to post natal care. *Vaccination Knowledge:* average of two knowledge questions related to vaccination. *Hygiene Knowledge:* average of two knowledge questions related to handwashing. *Knowledge Index:* average over all knowledge questions. Individual and household controls include the gender and age of the respondent, whether she is married, whether she heads the household, whether she is Muslim, her years of education, household size, whether the respondent is pregnant at baseline, the number of children below five and the age of the youngest child. Village controls includes the number of families in the village, the number of early childhood facilities in the village, whether there is a midwife available in the village, whether the village is located in rural areas, distance to the subdistrict capital, whether agriculture is the main economic sector, and phone signal strength. Network controls include the total size of a mother's social network, the number of eligibles as well as the total number of PKH beneficiaries in each village. */**/*** denote significance levels at 10/5/1 percent respectively.
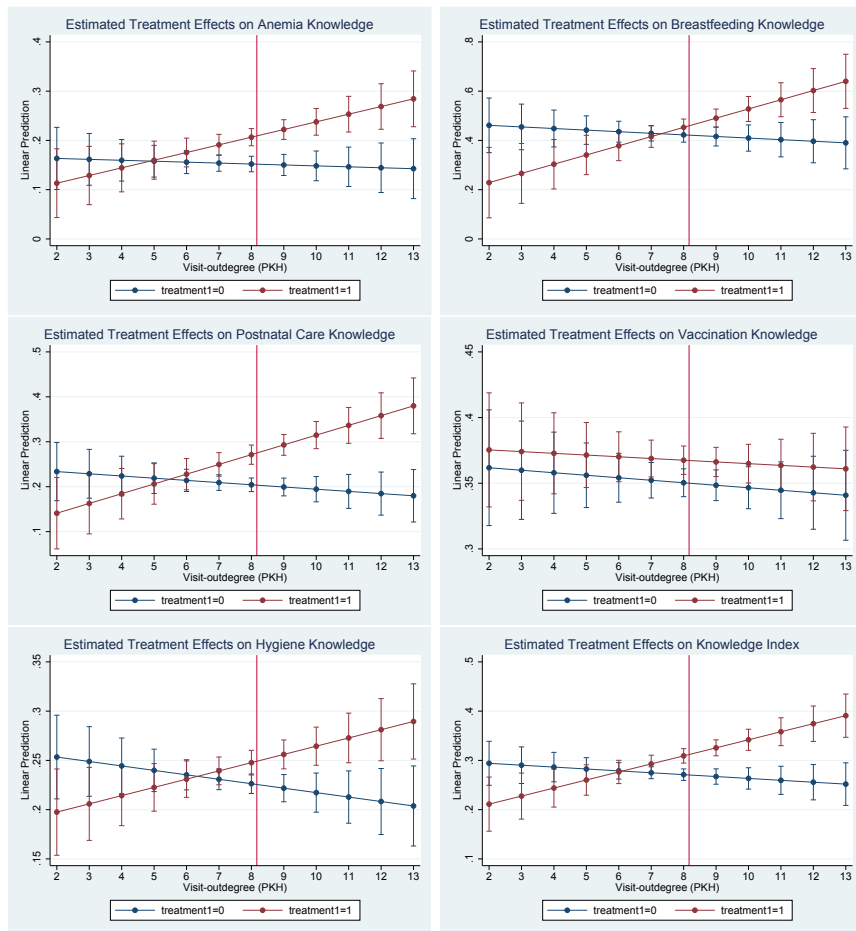
Figure 2: Marginsplot: Impact of Treatment on Knowledge according to Network Size

Table B.7: Treatment Effect and Networks, including additional controls

	Knowledge Index	Postnatal Care Practices	Vaccination Practices	Hygiene Practices
	(1)	(2)	(3)	(4)
Treatment	-0.113	0.098	-0.745	-0.058
	(0.041)***	(0.087)	(0.356)**	(0.066)
visit-outdegree (PKH)	-0.001	0.025	-0.073	-0.006
	(0.004)	(0.009)***	(0.027)***	(0.007)
Treatment x visit-outdegree (PKH)	0.019	-0.004	0.190	0.018
	(0.005)***	(0.010)	(0.043)***	(0.008)**
N	1577	1578	1578	1578
Individual and household controls	Yes	Yes	Yes	Yes
Village controls	Yes	Yes	Yes	Yes
Network controls	Yes	Yes	Yes	Yes
Subdistrict FE	Yes	Yes	Yes	Yes
Welfare controls	Yes	Yes	Yes	Yes
Big5 controls	Yes	Yes	Yes	Yes
Cognitive controls	Yes	Yes	Yes	Yes
Bargaining controls	Yes	Yes	Yes	Yes

Notes: OLS Estimators. Standard errors are depicted in parentheses and clustered at the village level. *Visit-outdegree (PKH)* indicates the number of other PKH mothers a mother visits or is visited by on a regular basis. *Knowledge Index*: average over all knowledge questions related to anemia, breastfeeding, postnatal care, vaccination and hygiene. *Postnatal Care Practice* - Share of child health record books (presented to enumerator). *Vaccination Practice* - Number of vaccinations a child received. *Hygiene Practice* - Proportion of correct handwashing practices performed by respondent (oberseved by enumerator). Individual and household controls include the gender and age of the respondent, whether she is married, whether she heads the household, whether she is Muslim, her years of education, household size, whether the respondent is pregnant at baseline, the number of children below five and the age of the youngest child. Village controls include the number of families in the village, the number of early childhood facilities in the village, whether there is a midwife available in the village, whether the village is located in rural areas, distance to the subdistrict capital, whether agriculture is the main economic sector, and phone signal strength. Network controls include the total size of a mother's social network, the number of eligibles as well as the total number of PKH beneficiaries in each village. Welfare controls include the respondent's subjective assessment of her welfare and of her well-being. Big5 controls include the five personality measures. Cognitive controls include the share of math tasks the respondent solved correctly. Bargaining controls include the respondent's level of bargaining power with respect to child and to household related decisions. */**/*** denote significance levels at 10/5/1 percent respectively.

C. Online appendix: Part 2 - Data and variable construction

C.1. Variable construction

Table C.1: Construction of Variables: Village Characteristics

Variable Name	Description
Rural area	equal to 1 if village is located in a rural area
Agriculture - village economic main sector	equal to 1 if agriculture is the main economic sector in the village.
No of families living in village	number of families living in village
Subdistrict capital - distance in hours	distance to the subdistrict capital
District capital - distance in hours	distance to the district capital
Village midwife in village	equal to 1 if the village has a midwife
No of early childhood facilities	number of early childhood facilities in the village
Posyandu - available in village	equal to 1 if a posyandu exists in the village
No of health centers operating monthly	number of health centers operating monthly
No of health centers operating bimonthly	number of health centers operating bi-monthly
No of PKH groups in village	number of PKH groups in village
No of PKH beneficiaries in village	number of PKH beneficiaries in village
Strong phone signal	equal to 1 if the phone signal in the village is strong

Table C.2: Construction of Variables: Respondent Characteristics

Variable Name	Description
Female	equal to 1 if respondent is female
Age in years	age of respondent
Years of education	number of schooling years
Married	equal to 1 if respondent is married
Household head	equal to 1 if respondent is the household head
Muslim	equal to 1 if respondent is muslim
Household size	number of people in the household
No of children	number of children of respondent
No of children, age ≤ 5	number of children of respondent that are less than six years old
Age of youngest person in hh	age of the youngest person in the household
Pregnant	respondent is pregnant
First child	respondent's child is her first child
Subjective assessment of own welfare	respondent's assessment of own welfare (1-4)
Subjective wellbeing of respondent	respondent's assessment of wellbeing (1-4)
Extraversion - Big 5 scale	Additive index based on 2 standardized questions measuring the degree of extraversion, normalized, taken from IFLS 5
Agreeableness - Big 5 scale	Additive index based on 2 standardized questions measuring the degree of agreeableness, normalized, taken from IFLS 5
Conscientiousness - Big 5 scale	Additive index based on 2 standardized questions measuring the degree of conscientiousness, normalized, taken from IFLS 5
Neuroticism - Big 5 scale	Additive index based on 2 standardized questions measuring the degree of neuroticism, normalized, taken from IFLS 5
Openness - Big 5 scale	Additive index based on 2 standardized questions measuring the degree of openness, normalized, taken from IFLS 5
Share of math tasks correctly solved	share of five math tasks the respondent solved correctly based memory functions; taken from IFLS 5
Bargaining power wrt household	PCA based on 8 questions measuring the degree of bargaining power with respect to household decisions, normalized, taken from IFLS 5
Bargaining power wrt child	PCA based on 2 questions measuring the degree of bargaining power with respect to child related decisions, normalized, taken from IFLS 5
Phone use	average number of times the respondent uses her phone per week
Mother has Anemia	respondent has a mild or severe form of anemia
Child stunted	youngest child is stunted (in comparison to age-gender reference group)
Child wasted	youngest child is wasted (in comparison to age-gender reference group)

Table C.3: Construction of Outcome Variables

Anemia Knowledge	share of correct responses to the following eight questions: (a) what is the minimum number of blood pills you should take during pregnancy? (b) do you know that blood pills can be obtained for free at posyandu or puskesmas? (c) do you know that certain foods should be avoided during pregnancy? (d) what is meant with anemia? (six correct answers possible) (e) what causes anemia in pregnant women? (seven correct answers possible) (f) what are the consequences of anemia? (seven correct answers possible) (g) how do you prevent anemia in pregnant women? (six correct answers possible) (h) what type of food can prevent anemia? (eight correct answers possible)
Breastfeeding Knowledge	share of correct responses to the following four questions: (a) does the frequency of breastfeeding affects milk production? (b) when should breastfeeding start after birth? (c) for how long should breastmilk been given after birth?(d) when should solid food/drinks been given after birth?
Postnatal Care Knowledge	share of correct responses to the following three questions: (a) when should the baby be examined by a health worker / facility after his birth? (b) how many times should the baby be examined by a health worker or health facility during the postpartum period? (c) what are the warning signs of a newborn (0 to -28 days)? (nine correct answers possible)
Vaccination Knowledge	share of correct responses to the following two questions: (a) what type of basic immunization should be given to babies? (sixteen correct answers possible) (b) what are the benefits of immunization to babies? (three correct answers possible)
Hygiene Knowledge	share of correct responses to the following two questions: (a) when are you supposed to wash your hands? (twelve correct answers possible) (b) which illnesses can be prevented by washing your hands? (six correct answers possible)
Knowledge Index	share of correct responses to all questions listed above.
Postnatal Care Practice	share of health record books mother possesses (max 2).
Vaccination Practice	verified number of vaccinations the youngest child received.
Hygiene Practice	share of correct steps mother follows when washing her hands and share of correct handwashing timings practiced (max 14).

Table C.4: Minimum Detectable Effect

Type	Indicator	ICC	MDE
Knowledge	Anemia	0.08	0.036
Knowledge	Breastfeeding	0.001	0.042
Knowledge	Post-natal	0.03	0.039
Knowledge	Vaccinations	0.05	0.035
Knowledge	Hygiene (endline, control)	0.003	0.024
Knowledge	Overall knowledge index	0.21	0.038
Behavior	Post-natal	0.005	0.061
Behavior	Vaccinations (endline, control)	0.008	0.101
Behavior	Hygiene	0.026	0.039
Outcome	Anemia	0.08	0.110
Outcome	Stunting	0.028	0.086
Outcome	Wasting	0.0001	0.065

Notes: ICC refers to 'intra-cluster correlation coefficient' while MDE refers to 'Minimum Detectable Effect'. Effects are calculated for a power of 80% and a 5% significance level. Covariates and serial correlation are not considered in the calculation of the MDE. For the two variables for which baseline values were not available we used information from the control group from the endline survey to derive the ICC and the standard deviation.

C.2. Locations included in clustered RCT

Figure C.1: Selected provinces of Riau (Pekanbaru) and South Sulawesi (Makassar)
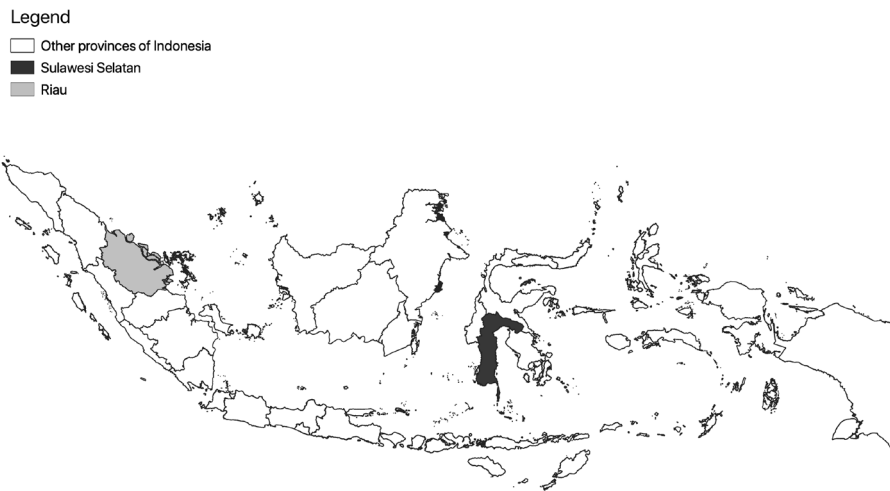
Figure C.2: Selected kabupaten in the province of Riau
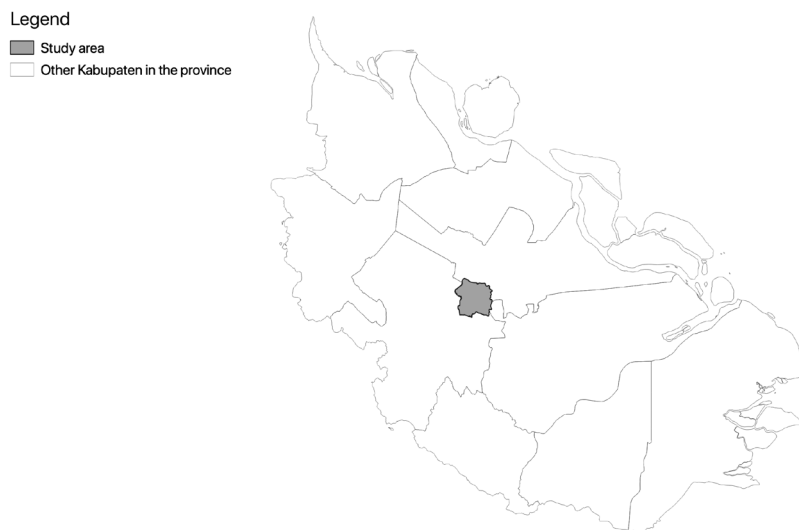

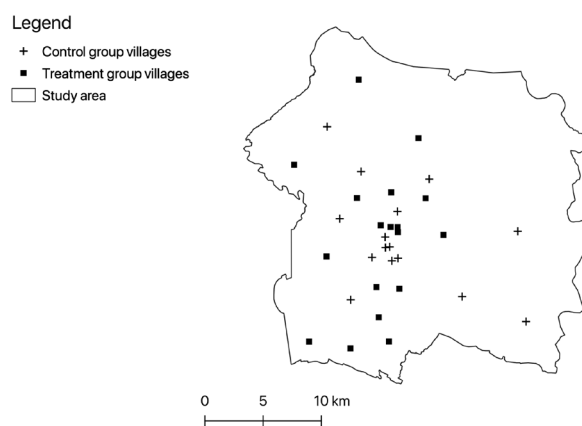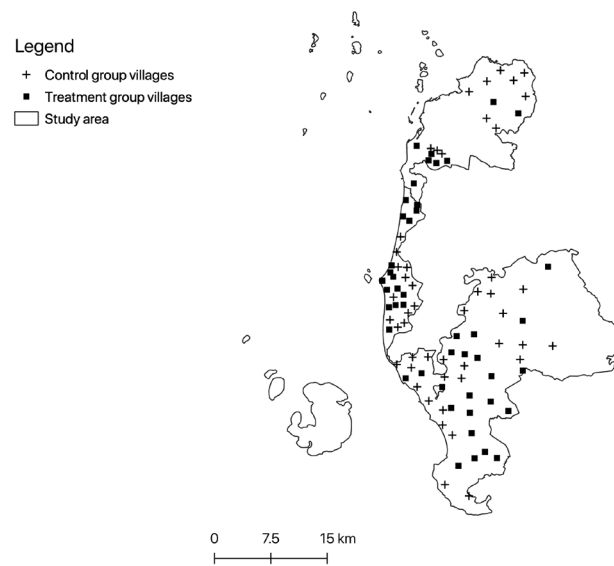Figure C.3: Selected villages in the province of Riau

Figure C.4: Selected kabupaten in the province of Sulawesi

Figure C.5: Selected villages in the province of Sulawesi