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REPORT

FINAL REPORT

Midline findings from the evaluation of the Ananya program in Bihar

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EXECUTIVE SUMMARY

The Bill & Melinda Gates Foundation created the Ananya program to address some of the important family health challenges in Bihar, one of India's most populous and poorest states. Ananya started as a five-year program (2011–2015) with the long-term goals of reducing the rates of maternal, newborn, and child mortality; fertility; and child undernutrition in Bihar. The program funds an integrated set of grants to improve health outcomes for young children and their mothers through interventions at the household, community, health facility, and provider levels.

The Ananya program was initially implemented from 2011 to 2013 in eight focus districts in western and central Bihar. The program evolved over time, and in late 2013 the Foundation created a technical support unit (TSU) to support the Government of Bihar (GoB) to scale up successful Ananya interventions, strengthen the government health system, and facilitate the implementation of its reproductive, maternal, newborn, child, and adolescent health (RMNCH+A) strategy through 2017.

Mathematica Policy Research, with its partners the Public Health Foundation of India (PHFI) and Sambodhi Communications Inc., conducted a midline evaluation to examine the effects of Ananya on reproductive, maternal, newborn, and child health (RMNCH) outcomes. The midline evaluation relies on data collected from a cohort of beneficiaries at baseline (before the implementation of Ananya) and from a new cohort approximately two years after the start of the program (before the implementation of the TSU). It focuses primarily on the impacts of two of the Ananya grants that were implemented intensively during this period in the eight focus districts.

This report summarizes the findings from the midline evaluation. In this summary, we first provide an overview of the Ananya program and its interventions. We then describe our evaluation approach to assess the effects of the two Ananya grants using a comparison group design. Finally, we present our key findings on the extent to which households were exposed to key elements of the Ananya program and the impacts of Ananya on key health behaviors at midline.

The Ananya program in Bihar

In May 2010, the Foundation and GoB signed a memorandum of cooperation to work together to reduce maternal and child mortality and improve other key health outcomes for women and children in Bihar. The memorandum indicated the technical, management, and program design support that the Foundation would provide through nongovernmental organizations (NGOs), starting with a set of interventions that would initially be implemented in 8 focus districts (among Bihar's 38 districts). This set of interventions eventually became known as the Ananya program. The original intent of the Ananya program was that the lessons learned and good practices identified during the initial two-year implementation phase would then be implemented in a statewide scale-up of the program over the subsequent three years (by 2015).

The Ananya program evolved over time, and the TSU was subsequently set up in late 2013 to facilitate the originally envisaged scale-up of select Ananya interventions across the state, and

to engage in broader efforts to strengthen Bihar's public health system through 2017. Specifically, it plans to strengthen data systems, facilitate evidence-based decision making, build leadership and management capabilities among government officials, tackle supply chain bottlenecks, and address critical policy gaps over this period. In practice, the two phases of the Ananya program therefore consisted of implementation in the eight focus districts (2011–2013), followed by a transition to the TSU (2013–2017). This report focuses on estimating the effects of the interventions implemented by the program in the first phase of implementation. It thus enables us to provide evidence on the impact of these interventions before the advent of the TSU.

Ananya's grants rely on a variety of supply- and demand-side interventions to achieve the program's goals. On the supply side, the grants seek to improve the coverage and quality of services provided at the primary care level, including services from facilities, private providers, and frontline health workers (FLWs). On the demand side, they seek to increase awareness of and demand for high quality family health services among households with pregnant women and young children through increased interactions with FLWs, as well as through media and community forums. These interventions focus on reaching women during the 1,000-day window (that is, the time from early pregnancy through a child's second year), a period that research has shown that can be critical to achieving many of the Millennium Development Goal targets (Menon 2011). The Ananya theory of change posits that the demand- and supply-side interventions will together improve coverage, service uptake, and behavior related to RMNCH.

The midline evaluation focuses primarily on two of the initial Ananya grants, the Integrated Family Health Initiative (IFHI) and Shaping Demand and Practices (SDP) grants. These grants targeted the key family health outcomes that the evaluation was designed to measure and were implemented sufficiently early and with sufficient scale to have plausibly affected outcomes by midline. They largely provided the following interventions:

- Promoting the **enumeration and mapping** of areas within a subcenter's catchment area, to ensure that all mothers and children, including those in remote areas, have access to care and receive attention from FLWs. These efforts aimed to identify populations not receiving health services, which are disproportionately composed of marginalized people (that is, those who might be otherwise excluded from receiving government services because of their religion, caste, literacy, or wealth).
- Convening and supporting **monthly subcenter platform meetings,** at which FLWs developed the skills required to increase the quantity and improve the quality of visits to households. These meetings, which include the accredited social health activists (ASHAs) and anganwadi workers (AWWs) in each subcenter's catchment areas, as well as the auxiliary nurse midwife (ANM), have covered a range of thematic areas, including birth preparedness, newborn care, breastfeeding, complementary feeding, and family planning. FLWs were also provided a job-aid kit that included various items to facilitate their interactions with households, such as a uterus model to facilitate discussion related to reproductive health and a bowl and spoon to demonstrate recommended complementary feeding practices (Sridharan et al. 2014).
- **Training for FLWs on interpersonal communication skills** and distribution of **mobile kunji,** a novel job-aid tool, to improve FLWs' communication with households. All FLWs in the eight focus districts received three days of training on interpersonal communication

skills to improve the quality of their interactions with households. As part of these trainings, they were provided and trained to use the mobile kunji tool, which included (1) a deck of plastic cards that illustrates key health practices to follow during pregnancy and early childhood and (2) a set of short codes (short telephone numbers) to dial into a series of audio recordings on key health messages delivered by a fictional character named Dr. Anita. The mobile kunji covers topics across the continuum of care. From May 2012 to March 2014, FLWs used the mobile kunji to play a total of almost 7 million minutes of health messages in the eight focus districts.

- Providing health information via **mass media.** The media campaign involved a wide range of interventions, including (1) a 36-episode, long-format radio show broadcast throughout Bihar called *Khirki Mehendiwali* (consisting of 3 episodes per week and a weekly omnibus), which tells the story of a young girl as she negotiates day-to-day challenges emanating from poverty, illiteracy, and low female empowerment, all of which ultimately influence health care decisions; (2) two television commercials broadcast across Bihar that provide information on family planning and birth preparedness; (3) a mobile van campaign to increase exposure to the television commercials in areas with limited television access; and (4) street theater performances to communicate health messages. In addition, beneficiaries could register for the Kilkari Family Time Line to receive timely calls focused on recommended health practices throughout pregnancy and early childhood on critical practices, although this intervention was rolled out only just before the midline evaluation.
- **Community mobilization efforts,** including integrating health messages into community groups and use of street theater performances to promote health messaging. For instance, radio listener clubs were integrated into community (self-help) groups in order to increase exposure to *Khirki Mehendiwali* and encourage discussions about its messages. Street theater shows about family health were designed to communicate behavior change messages about family health through interactive and entertaining performances in the community.
- Conducting **quality improvement activities at public health facilities.**[1] Primary health centers (PHCs) received assistance creating quality improvement teams, conducting structured assessments, identifying gaps in coverage, and developing and implementing action plans for improvement.
- Providing extensive **facility-based skills training** to staff delivering infants at PHCs. A team of two trained nurses with bachelor's or master's degrees provided ANMs and nurses in charge of delivery at facilities both classroom and technical training on delivery care. The training was provided at each facility and lasted five days per month for about 10 months. Topics covered included safe delivery, detecting emergencies, hygiene, and infection control.

Research questions and evaluation design

The overarching goal of the midline impact evaluation is to determine the overall effects of the integrated set of approaches implemented under Ananya—in particular under the IFHI and

[1] Because midline data collection from facilities is still under design, the midline evaluation described in this report did not explicitly focus on Ananya's facility-based interventions (quality improvement activities and facility-based training). However, we list them here because they were an important component of the IFHI grant.

SDP grants—after two years of implementation. More specifically, it seeks to answer the following questions:

- Did Ananya lead to increased and improved interactions between FLWs and households, and exposure to other key program elements?
- After two years, did Ananya's integrated demand- and supply-side approaches contribute to improved family health outcomes in the focus districts?
- Which program elements were most highly correlated with improvements in outcomes? Are the findings consistent with Ananya's theory of change?
- How did the effects of the program vary by key population subgroups? Did the program improve outcomes for the more marginalized women? Did it lead to reductions in any existing disparities in FLW–beneficiary interactions or health outcomes?

We used a comparison group design to answer these questions, drawing on data collected from a cohort of beneficiaries at baseline (early 2012) and from a new cohort of beneficiaries at midline (early 2014). Specifically, we compared changes in outcomes between baseline and midline for beneficiaries in the 8 focus districts (where these Ananya interventions were implemented) to the changes in outcomes for beneficiaries in the remaining 30 nonfocus districts. This approach is known as difference-in-differences (DD) and accounts for trends in outcomes in the focus districts that are unrelated to Ananya.[2] Before conducting the analysis, we considered several approaches to select the comparison group and determined that using all nonfocus districts was the optimal approach to obtain a similar comparison group (Rotz et al. 2014a). We also conducted sensitivity analyses to verify the robustness of our results to alternative comparison groups by selecting or excluding different sets of districts and found that the results were robust (Rotz et al. 2014b).[3]

The key assumption to attribute these DD estimates to Ananya is that the changes in the focus districts would have been the same as the changes in the nonfocus districts in the absence of the program. Although this assumption cannot be tested directly, our analysis suggests it is likely to hold. Specifically, nonfocus districts were statistically similar to focus districts in baseline outcomes and demographic characteristics, and pre-Ananya trends were similar in focus and nonfocus districts. Therefore, we interpret the DD estimates—which account for the few existing differences at baseline—as the impacts of Ananya. For some outcomes, baseline data were not available and we were restricted to estimating differences between focus and nonfocus

[2] All analyses also control for differences in households' characteristics, including controls for the woman's religion, caste, age, parity, education, and literacy; husband's education; and household wealth index quartile and rural location.

[3] Specifically, our results were robust to (1) using a different method to select the comparison group (the synthetic control approach), (2) excluding nonfocus districts in which other development partners were active from the comparison group, and (3) excluding from the comparison group nonfocus districts in which scale-up of some of the Ananya interventions began just before the midline.

districts at midline. These comparisons have a lower degree of attribution to Ananya, because they could reflect existing baseline differences.[4]

The comparison group design relied on baseline and midline data from beneficiaries to estimate changes over time in key outcomes. In both the baseline and midline rounds, we collected data from a representative sample of women across Bihar who had given birth in the previous 12 months (that is, women whose children were ages 0 to 11 months). This was motivated by the fact that *most* of the interventions evaluated in this report aim to improve outcomes from the last trimester of pregnancy to a child's first birthday. The two rounds were conducted during the same season (January through April) and collected data from households in the same villages, though they surveyed different households because a different cohort of women had given birth in the previous 12 months.

The midline survey also included an additional sample of mothers of children ages 12 to 23 months in the sampled villages that was not included at baseline but enabled us to report key outcomes for this age group at midline. The survey used for this age group was an abbreviated version of the survey for mothers of children ages 0 to 11 months. Unless otherwise specified, this summary considers only the results from the sample of mothers with children ages 0 to 11 months.

The response rates to our baseline and midline surveys were high. The response rate for the sample of mothers of children 0 to 11 months was 89 percent at baseline (13,069 completed interviews) and 87 percent at midline (12,015 completed interviews). The response rate for the additional 12-to-23-month sample that was included only at midline was 89 percent (2,549 completed interviews). Our sample is similar to the broader population of women of reproductive age in Bihar in terms of demographic characteristics such as religion, literacy, and scheduled caste/scheduled tribe (SC/ST) status, but women in our sample tend to be younger and have fewer children because the sample includes only women who gave birth recently.

Key findings

We measured impacts of the Ananya interventions on measures related to program exposure (FLW–beneficiary interactions and media) and on key health outcomes across the domains targeted by the interventions. We also explored how the Ananya interventions affected different groups of women and the relationship between program exposure and health outcomes suggested by the theory of change.

Exposure to Ananya

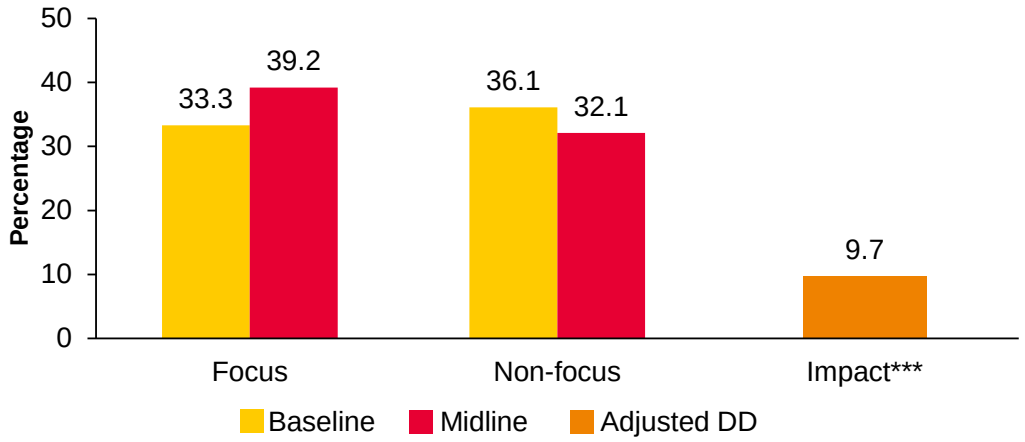
Ananya had a positive and statistically significant impact on the number of FLW–beneficiary interactions during pregnancy, but impacts on the number of home visits immediately after delivery were statistically insignificant.

Ananya aimed to increase the number of interactions with households across the continuum of care by promoting the complete enumeration and mapping of beneficiaries (pregnant women and mothers of young children) and improving the skills and confidence of FLWs to

[4] For these outcomes we controlled for baseline levels of related outcomes to adjust for existing differences to the extent possible, even though the exact outcome was not available at baseline.

communicate with them. Our analysis suggests that the program had a statistically significant impact on the number of women who received at least two FLW home visits in the final trimester of pregnancy (Figure 1). At baseline, 33 percent of women in the focus districts and 36 percent of women in nonfocus districts received at least two FLW visits during their final trimester. At midline, these rates had increased in focus districts to 39 percent and declined in nonfocus districts to 32 percent. The changes imply that Ananya led to a 10 percentage point increase in the share of women receiving two or more home visits in their final trimester.

Figure 1. Received two or more home visits from FLW in the final trimester of pregnancy



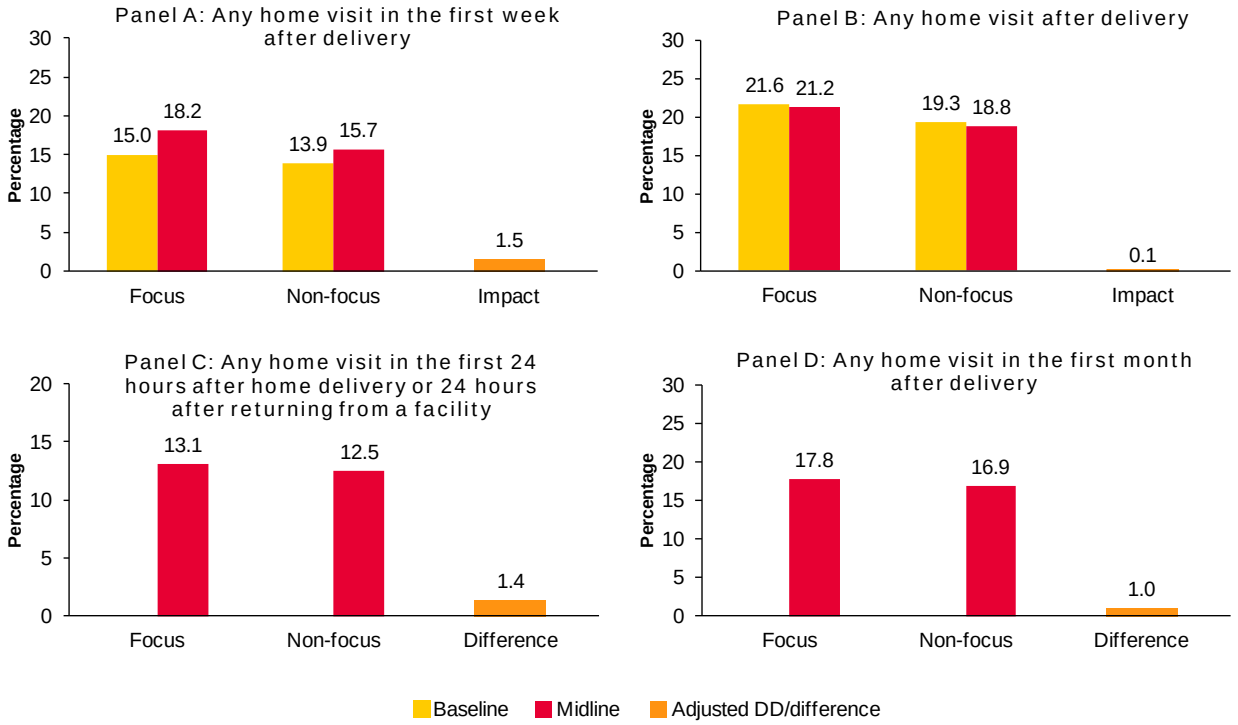
Sources: Ananya baseline and midline surveys conducted by Sambodhi in collaboration with Mathematica and PHFI in spring 2012 and spring 2014, respectively.

Note: Sample includes 12,310 mothers of children ages 0–11 months (baseline) and 11,651 mothers of children ages 0–11 months (midline).

However, estimates of Ananya's impacts on a variety of measures of FLW home visits immediately after delivery were all less than 2 percentage points and statistically insignificant (Figure 2). These include measures of home visits in the first day, week, month, or any time after delivery (some of these measures were not mentioned in a comparable way at baseline; we therefore report midline-only differences rather than DD impact estimates). Levels of post-delivery home visits also remained low at midline. For example, only 18 percent of women in focus districts and 16 percent of women in nonfocus districts received a visit in the first week after delivery.

We observed a significantly higher number of home visits related to complementary feeding in focus districts at midline (14 percent compared with 5 percent in the nonfocus districts, a statistically significant difference of 9 percentage points; not shown). However, there was no evidence of impacts of Ananya on home visits related to family planning, despite the fact that these topics were also discussed at subcenter platform meetings. The DD estimates for impacts on visits related to family planning were statistically insignificant, for these visits during pregnancy and after delivery, and fewer than 15 percent of women reported these types of visits at midline (not shown).

Figure 2. Received home visits from an FLW after delivery



Sources: Ananya baseline and midline surveys conducted by Sambodhi in collaboration with Mathematica and PHFI in spring 2012 and spring 2014, respectively. Baseline measures not available for visits in the first 24 hours and first month after delivery.

Note: Sample includes 11,640 to 12,384 mothers of children ages 0–11 months (baseline) and 11,652 to 11,654 mothers of children ages 0–11 months (midline).

Ananya was associated with improved FLW–beneficiary interactions in home visits.

Improving the knowledge and communication skills of FLWs through subcenter meetings, supported by job-aid tools (including the job-aid kit and mobile kunji), was intended to facilitate improved interactions with beneficiaries. Our analysis of three measures potentially reflecting better-quality FLW home visits—provision of specific types of advice, duration of visits, and extent to which job-aid tools were used—suggests that there were improvements in interactions in the focus districts. Specifically, beneficiaries in the focus districts were more likely to receive advice on targeted topics from FLWs, particularly birth preparedness and newborn care, in home visits during pregnancy (Table 1). For example, women in focus districts were 8 to 10 percentage points more likely to be exposed to information on delivery preparation (such as the importance of saving money for delivery) than women in nonfocus districts. Home visits also tended to last about 20 percent longer in the focus districts compared with nonfocus districts (a marginally significant difference, compared with a mean of 10 minutes in the nonfocus districts; not shown).

Although Ananya provided FLWs with job-aid tools, these tools were used at the discretion of the FLWs Examining the extent of these tools' use is therefore an important measure of the effective level of program exposure by beneficiaries. The midline data suggest that many FLWs in the focus districts used the mobile kunji and other job-aid tools introduced by Ananya to improve communication with households (Figure 3). For example, 39 percent of women visited in the six months before our midline survey in the focus districts reported being exposed to the

mobile kunji, with 35 percent reporting viewing the cards and 34 percent reporting they heard any of the mobile kunji messages. For other job-aid tools, we focused on relevant visits (for example, use of family planning tools in visits in which family planning was discussed), and found that exposure varied from about 14 to 37 percent across tools.

Table 1. Advice provided by FLWs in home visits during pregnancy, at midline

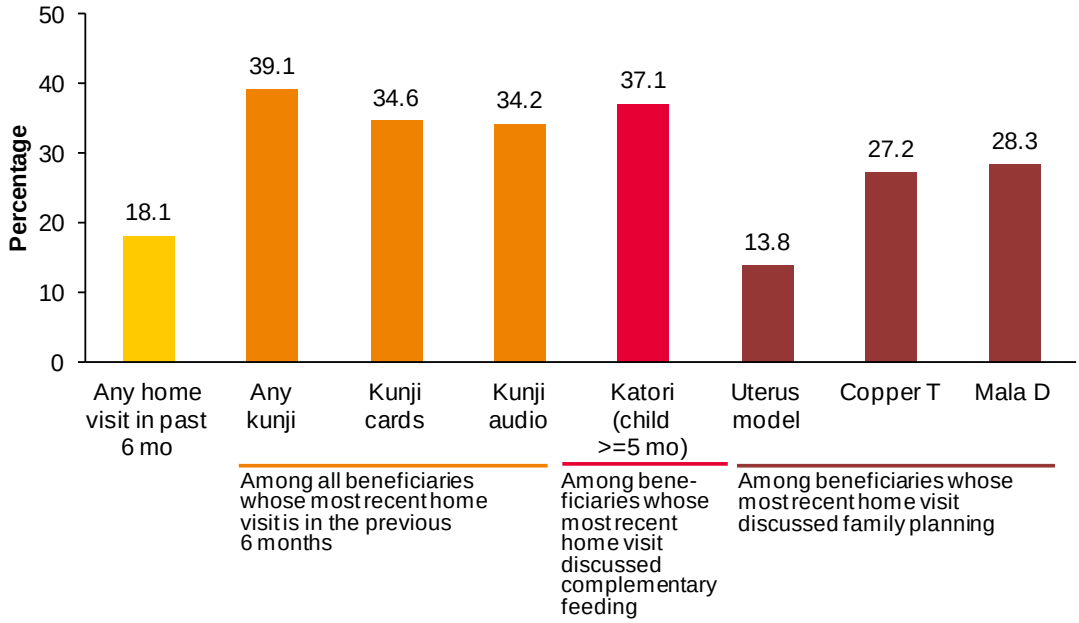
Topic	Focus district mean	Nonfocus district mean	Adjusted difference (percentage points)
Keeping important telephone numbers (ASHA, ambulance, hospital) ready for delivery	25.5	17.3	8.7***
Saving money for delivery	34.0	24.0	9.9***
Identifying transport to a health facility for delivery	28.7	19.1	8.7***
Specific maternal danger signs	19.2	13.7	5.8**
Not applying anything to the cord	30.8	23.0	8.5***
Skin-to-skin care	38.5	28.8	10.6***
Immediate breastfeeding	42.7	31.8	11.5***
Newborn danger signs	15.7	15.3	3.0

Source: Ananya midline survey conducted by Sambodhi in collaboration with Mathematica and PHFI in spring 2014. Baseline measures not available.

Note: Sample includes 11,654 mothers of children ages 0 to 11 months.

*p < 0.10, **p < 0.05, ***p < 0.01 for adjusted differences.

Figure 3. Use of Ananya job tools by FLWs in the most recent FLW home visit, among those who received a home visit in the previous six months



Source: Ananya midline survey conducted by Sambodhi in collaboration with Mathematica and PHFI in spring 2014.

Note: Sample includes mothers of children ages 0 to 11 months in the focus districts: 3,072 mothers (yellow bar), 715 mothers (orange bars), 118 mothers (red bar), and 113 mothers (maroon bars).

Exposure to Ananya media-based interventions was limited, with fewer than 10 percent of women exposed to each program element.

Ananya's media-based interventions included television ads and radio shows with health-related messages. However, only about 10 percent of beneficiaries were exposed to Ananya television ads, and only about 5 percent to the radio shows (not shown). These findings are likely due to limited access to these forms of mass media in Bihar; only 36 percent of women in focus districts had watched television, listened to the radio, or read (or heard someone reading) a newspaper in the three months before our midline survey (not shown). Therefore, these interventions are unlikely to have a substantial affect on our impact estimates (in any case, these interventions were not restricted to the focus districts and would not be captured by our evaluation design).

Impacts of Ananya on maternal, newborn, and child health

Ananya was associated with higher levels of birth preparedness.

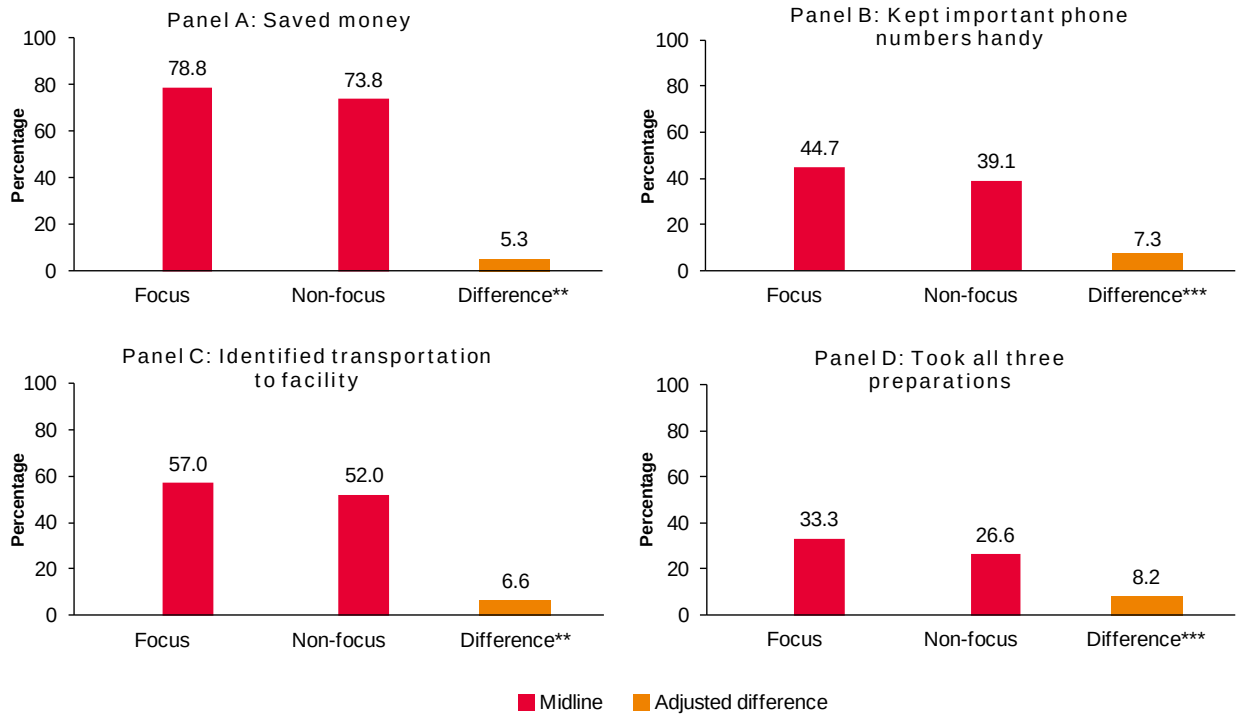
During pregnancy, Ananya's messages to beneficiaries emphasized several aspects of birth preparedness, including saving money to pay costs associated with delivery, keeping important telephone numbers ready, and planning for transportation to a facility. Women in focus districts were significantly more likely than those in nonfocus districts to take each of these actions (Figure 4). In focus districts, 33 percent of women took all three key preparatory actions (saving money, keeping important telephone numbers at hand, and identifying transportation to a facility), compared with 27 percent of women in nonfocus districts. The regression-adjusted difference of 8 percent was statistically significant. However, we did not see effects on other outcomes related to planning for a birth that were not explicitly targeted by Ananya. For example, there was no significant impact on the number or quality of antenatal care (ANC) check-ups or rate of facility deliveries, as both increased by a similar percentage in focus and nonfocus districts (not shown).

Ananya had a positive impact on some, but not all, newborn care practices.

Ananya's messages focused on several newborn care practices that could reduce the risk of neonatal mortality and/or lead to improved long-term child health. Our data indicate that Ananya had a statistically significant impact of 7 percentage points on clean umbilical cord care and a statistically insignificant impact of 10 percentage points on skin-to-skin care (Table 2).[5] However, there were no statistically significant impacts on our immediate breastfeeding or delayed bathing measures. Despite some improvements, overall coverage levels were low for many newborn care indicators, and considerable room for improvement remains.

[5] Also known as kangaroo care, skin-to-skin care is defined as a health worker placing the child unclothed in skin-to-skin contact on the mother's chest or abdomen after delivery.

Figure 4. Delivery preparation



Source: Ananya midline survey conducted by Sambodhi in collaboration with Mathematica and PHFI in spring 2014. Baseline measures not available.

Note: Sample includes 10,363 mothers of children ages 0 to 11 months.

*$p < 0.10$, **$p < 0.05$, ***$p < 0.01$ for adjusted difference.

Table 2. Impacts of Ananya on key newborn care practices

Practice	Focus district baseline mean	Nonfocus district baseline mean	Focus district midline mean	Nonfocus district midline mean	DD impact of Ananya (percentage points)
Clean cord care[a]	23.7	24.1	30.3	23.2	7.4**
Skin-to-skin care[b]	19.5	18.1	43.0	31.9	9.5
Delayed bathing child for 2 or more days	54.6	46.0	65.1	54.4	2.1
Breastfed within 1 hour of delivery	47.0	44.0	52.1	46.4	2.7

Sources: Ananya baseline and midline surveys conducted by Sambodhi in collaboration with Mathematica and PHFI in spring 2012 and spring 2014, respectively.

Note: Sample includes 12,325 to 12,397 mothers of children ages 0 to 11 months (baseline), and 11,057 to 11,612 mothers of children ages 0 to 11 months (midline).

[a]Defined as a clean blade used to cut the cord, a clean thread used to tie it, and nothing applied to the cord after cutting or to the umbilicus after the cord drops off.

[b]Defined as a health worker placing the child unclothed in skin-to-skin contact on the mother's chest or abdomen after delivery.

*$p < 0.10$, **$p < 0.05$, ***$p < 0.01$ for adjusted DD impacts.

Ananya had significant impacts on some complementary feeding practices, but many children were still not receiving appropriate nutrition as recommended.

Because appropriate nutrition is critical to a child's physical and cognitive development, FLWs were encouraged to emphasize the importance of introducing age-appropriate complementary feeding of solid or semisolid foods at the recommended age of 6 months, as well as the appropriate frequency and quantity of feeding. The program also provided a job-aid tool—the katori (bowl) and spoon—for FLWs to demonstrate the appropriate quantities of food.

Ananya had an impact of 8 percentage points on the proportion of children ages 6 to 11 months who began eating solid or semisolid foods at 6 months, 9 percentage points on the share of such children currently receiving solid or semisolid food, and 8 percentage points on the share who were fed cereal-based foods in the previous day (Table 3). Some of these impacts are driven by decreases over time in the nonfocus districts, which are difficult to explain from our data alone and will require further investigation. This suggests that, although many of these outcomes remained at similar levels in the focus districts at baseline and midline, Ananya slowed or reversed a decline that would have happened in the absence of the program.

Despite these estimated impacts, there were few significant differences between focus and nonfocus districts in measures of the frequency, diversity, and quantity of complementary feeding (not shown). These measures were also at relatively low levels—in the focus districts at midline, only 29 percent of children ages 6 to 11 months received the appropriate frequency of complementary feeding, and only 2 percent received the appropriate quantity of feeding in the previous day.[6]

Table 3. Impacts of Ananya on nutrition outcomes

Practice	Focus district baseline mean	Nonfocus district baseline mean	Focus district midline mean	Nonfocus district midline mean	DD impact of Ananya (percentage points)
Currently fed solid or semisolid food	64.7	67.9	65.5	61.0	8.5*
Began feeding solid or semisolid food by age 6 months	47.5	44.7	48.9	39.0	7.7**
Fed cereal-based food in the previous day (rice, roti, or khichdi)	60.7	58.1	59.8	49.5	8.2**

Sources: Ananya baseline and midline surveys conducted by Sambodhi in collaboration with Mathematica and PHFI in spring 2012 and spring 2014, respectively.

Note: Sample includes 4,895 to 4,904 mothers of children ages 6 to 11 months (baseline), and 4,923 mothers of children ages 6 to 11 months (midline).

*$p < 0.10$, **$p < 0.05$, ***$p < 0.01$ for adjusted DD impact.

[6] These measures are based on programmatic definitions. The appropriate frequency of solid and semisolid foods is two feedings per day (children ages 6 to 8 months) or three feedings per day (children ages 9 to 11 months); the appropriate quantity is 100ml per day (children ages 6 to 8 months) or 200ml per day (children ages 9 to 11 months), including only foods fed to the child from a separate bowl by an adult.

We did not observe any significant impacts of Ananya on immunization rates.

Receiving routine immunizations according to the recommended schedule protects children against serious childhood diseases that can cause severe illness, disability, or even death. The Ananya program emphasized both the importance of completing the full set of immunizations and completing them on time.

Focusing on children ages 12 to 23 months, the age group for which immunization is typically reported, the rate of most vaccinations was higher in the focus districts than nonfocus districts at midline, but the difference was not statistically significant (Table 4). Because we do not have baseline data for this age group, we are able to report only these midline differences rather than DD impacts. For children ages 6 to 11 months, we measured immunizations at baseline and midline and can therefore estimate DD impacts. Routine immunization rates were mostly flat over time for this group in both focus and nonfocus districts, and there were no statistically insignificant impacts (Table 4).

Table 4. Impacts of Ananya on receipt of vaccinations

	Focus district baseline mean	Nonfocus district baseline mean	Focus district midline mean	Nonfocus district midline mean	Adjusted difference (6 to 11 months) or DD impact (12 to 23 months) (percentage points)
Children ages 12 to 23 months					
DPT1	NA	NA	94.5	93.1	2.3
DPT3	NA	NA	82.3	82.2	3.2
Measles	NA	NA	82.7	77.5	2.4
Fully immunized	NA	NA	71.2	66.7	6.0
Children ages 6 to 11 months					
DPT1	82.5	88.3	85.1	92.7	-1.5
DPT3	62.7	63.0	65.7	64.6	2.2
Fully immunized (except measles)	51.1	52.5	54.8	58.2	-0.2

Sources: Ananya baseline and midline surveys conducted by Sambodhi in collaboration with Mathematica and PHFI in spring 2012 and spring 2014, respectively. Baseline measures not available for the sample of children ages 12 to 23 months.

Note: Sample includes 2,347 to 2,483 mothers of children ages 12 to 23 months and 4,825 to 4,897 mothers of children ages 6 to 11 months.

*$p < 0.10$, **$p < 0.05$, ***$p < 0.01$ for adjusted difference.

NA = not available.

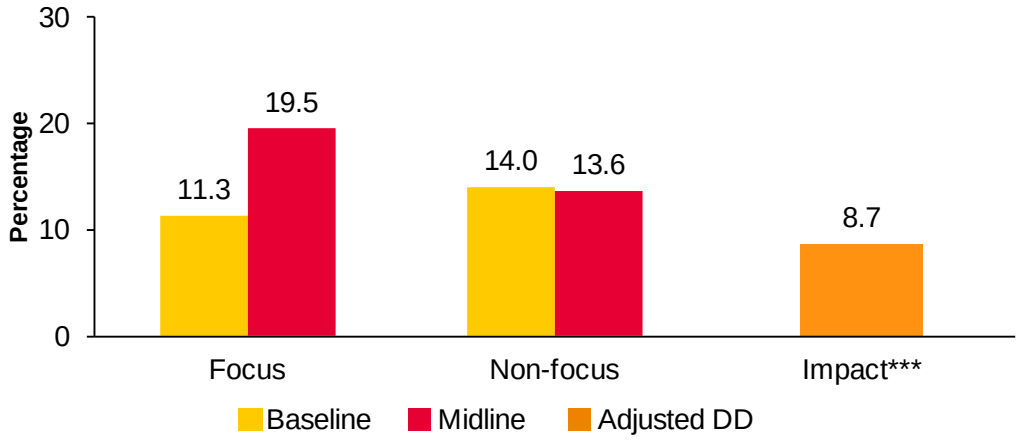
Impacts on reproductive health

Ananya increased the use of modern contraceptive methods by 9 percentage points (compared with a rate of use of 11 percent in focus districts at baseline).

Ananya aimed to improve women's reproductive health, with a focus on increasing postpartum contraceptive use, particularly the use of intrauterine devices (IUDs) and female sterilizations. FLW and media efforts also attempted to stimulate awareness of and demand for family planning related to limiting and spacing births. Overall, we found the use of modern contraceptive methods was very low among the women we sampled at baseline, with 11 percent of women in focus districts and 14 percent of women in nonfocus districts using any modern

method.[7] We found that Ananya had a statistically significant impact of 9 percentage points on the use of modern contraception (Figure 5). This impact was mostly driven by increases in the use of temporary methods, such as condoms and oral contraceptives, and not IUDs (not shown). Reports from grantees suggest these results are likely to be driven by the low availability of trained providers in Bihar who offer IUD services.

Figure 5. Use of any modern method of contraception



Sources: Ananya baseline and midline surveys conducted by Sambodhi in collaboration with Mathematica and PHFI in spring 2012 and spring 2014, respectively.

Note: Sample includes 12,283 mothers of children ages 0 to 11 months (baseline), and 11,521 mothers of children ages 0 to 11 months (midline). We defined the following methods of contraception as modern methods: female or male sterilization, pills, injectable contraception, IUDs, and condoms.

*$p < 0.10$, **$p < 0.05$, ***$p < 0.01$ for adjusted DD impacts.

In addition, we found that Ananya had larger impacts on the contraceptive use of women with more than one child compared with those who just had given birth the first time (not shown), suggesting that the program's messages might have a stronger impact on women of higher parity. Furthermore, we found larger impacts of Ananya for women whose most recent child was female than for women whose most recent child was male (not shown).

We also found that Ananya was associated with a statistically significant difference in unmet need for family planning.[8] At midline in the focus districts, 47 percent of women with children younger than 2 years had an unmet need for family planning, compared with 51 percent of women with children younger than 2 years in nonfocus districts (not shown). The regression adjusted difference was 5 percentage points and was marginally statistically significant.

[7] We defined the following methods of contraception as modern methods: female or male sterilization, pills, injectable contraception, IUDs, and condoms. Rates of contraception were lower in our sample than for Bihar as a whole (for example, Annual Health Survey [AHS] data suggest that 31 percent of all married women in Bihar ages 15 to 49 used some form of modern contraception in 2009–2011). This lower rate of contraceptive use is likely due to the fact that our sample includes those who recently gave birth, leading to a sample that is younger and has lower birth parity than the group of all women of reproductive age in Bihar.

[8] Women are defined as having an unmet need for family planning if they (1) are not currently pregnant, (2) can physically become pregnant, (3) are not using a modern method of contraception, and (4) either do not want any more children or would like to wait 25 or more months before becoming pregnant with their next child.

Variation in Ananya's impact by key subgroups

Ananya reduced disparities between marginalized and nonmarginalized women for some coverage indicators, but not others.

Although improving equity was not an explicit focus of the Ananya program, some interventions focused specifically on improving the health of more marginalized women (defined as women who might have less access to the health care system based on their religion, caste, literacy, or socioeconomic status). For example, early enumeration and mapping efforts by the IFHI grant were intended to identify populations not receiving health services; these populations are disproportionately composed of marginalized people. Moreover, Ananya sought to improve maternal and child health across Bihar. If marginalized women initially had poorer health behaviors, there would be more room for improvement and Ananya could potentially have a larger impact on these groups.

At baseline we observed statistically significant disparities in several coverage indicators between marginalized and nonmarginalized women, especially for measures of ANC, facility deliveries, immunization, and modern contraceptive use (not shown). Thus, we explored whether Ananya might have closed equity gaps in health. However, gaps were not apparent for all outcomes and marginalization indicators. For example, immediate breastfeeding rates varied little by measures of marginalization, as did complementary feeding. We even see some reverse gaps, wherein more marginalized women appear to have better health behaviors than less marginalized women.

To examine how Ananya might have mitigated disparities in health, we examined the impact of Ananya for subgroups of marginalized women (summarized in Table 5). For some outcomes and indicators, Ananya's effects were stronger within more marginalized groups, suggesting that Ananya might help to close equity gaps. For example, our results suggest a decrease in ANC disparities across several marginalized groups. In other cases, Ananya had larger impacts on less marginalized women. For example, Ananya was associated with a 12 percentage point increase in modern contraceptive use for non-SC/ST women but a change of only 2 percentage points for SC/ST women. This finding suggests that Ananya could contribute to an emerging gap in contraceptive use. That is, the program leads non-SC/ST women, but not SC/ST women, to increase contraceptive use. A gap thus emerges as behaviors diverge, though population levels of contraceptive use only increase. Overall, disparities continue to persist for many health outcomes, suggesting that interventions might have to more closely target marginalized women to reduce equity gaps.

Exposure indicators and health outcomes

Strong correlations between key program elements and relevant behaviors support the Ananya theory of change.

According to the Ananya theory of change, improvements in the number and quality of FLW–household interactions will improve health behaviors. If the theory of change is valid, we should see better health behaviors among women who received more or higher quality home visits. These relationships exist across many of the domains that we considered (summarized in Table 6). Home visits in the final trimester of pregnancy were significantly correlated with birth preparedness and facility delivery, whereas home visits focused on complementary feeding and

Table 5. The impacts of Ananya, by subgroup

Variable	Impacts										
	Overall	Wealth Q1	Wealth Q4	Illiterate	Literate	SC/ST non-Muslims	Non-SC/ST non-Muslims	Muslims	Non-Muslims	Most marginalized	Least marginalized
Visited by FLW two or more times in last trimester	9.6***	16.9***	3.3	13.2***	5.2	13.9**	6.9*	13.5*	9.0***	14.8**	1.7
Received post-delivery visit from FLW	0.1	0.6	-2.5	2.3	-2.4	-1.1	0.4	3.5	-0.7	-5.9	-7.1
Received three or more ANC check-ups	4.6	13.2**	4.8	6.8**	1.4	4.1	5.2	5.8	4.3	12.0**	1.1
Delivered at facility	-0.4	-1.0	-5.3**	-0.4	-1.1	2.7	0.3	-0.4	0.0	2.2	-1.1
Clean cord care[a]	7.4***	7.0	5.1	8.3***	5.9*	13.6***	6.8*	-1.3	9.2**	11.1*	5.2
Breastfed child within an hour of birth	2.7	7.0	3.3	5.5	-0.6	14.2***	2.0	-10.1	5.4*	23.9***	6.4
Child received DPT3 (ages 6–11 months)	2.2	5.9	-1.8	-3.5	5.2	5.7	5.3	2.9	1.0	9.3	3.2
Child receives any solid or semisolid foods (ages 6–11 months)	8.5*	12.1*	2.0	4.3	11.3**	10.5*	7.2	8.9	7.8*	22.1***	-0.7
Used modern method of contraception[b]	8.3***	9.9***	7.5**	11.2***	5.1**	1.7	11.8***	11.0***	8.3***	7.4	0.7
Sample size (outcomes for mothers of children ages 0–11 months)	**24,037**	**6,021**	**6,745**	**13,571**	**10,466**	**6,172**	**13,597**	**4,268**	**19,769**	**2,858**	**3,741**

Sources: Ananya baseline and midline surveys conducted by Sambodhi in collaboration with Mathematica and PHFI in spring 2012 and spring 2014, respectively.

Note: Sample includes 4,889 mothers of children ages 6–11 months (baseline), 4,923 mothers of children ages 6–11 months (midline), 12,384 mothers of children ages 0–11 months (baseline), and 11,654 mothers of children ages 0–11 months (midline). All estimates are for mothers of children ages 0–11 months unless otherwise specified. Impacts are DD estimates. Green squares marked with a plus sign are positive, significant impacts. Dark blue squares marked with a minus sign are negative impacts. The most marginalized women are SC/ST or Muslim, illiterate, and in the lowest wealth quartile. The least marginalized women are non-SC/ST, non-Muslim, literate, and in the highest wealth quartile.

[a]Defined as nothing applied to the cord after cutting or to the umbilicus after the cord drops off.

[b]We defined the following methods of contraception as modern methods: female sterilization, male sterilization, pills, injectable contraception, IUDs, and condoms.

*$p < 0.10$, **$p < 0.05$, ***$p < 0.01$ for adjusted DD impacts.

Table 6. Summary of correlations between key outcomes and measures of program exposure, in focus districts at midline

Exposure measure	Mean exposure at midline (percentage points)	Outcome	Adjusted mean if not exposed (percentage points)	Adjusted mean if not exposed (percentage points)	Adjusted difference (percentage points)	Adjusted difference (percent)	Summary
FLW interactions							
Received at least two FLW home visits in the final trimester of pregnancy	39.2	Received ANC three or more times	36.2	46.1	10.0***	28%***	Medium-strong correlation with behaviors related to pregnancy and delivery
		Consumed 90 or more IFA tablets	10.0	21.1	11.0***	110%***	
		Delivery preparation—saved money	74.2	86.0	11.8***	16%***	FLW last trimester visits a significant predictor of delivery preparation after controlling for other types of exposure (Chapter X)
		Delivery preparation—arranged transportation to facility	52.7	63.7	10.9***	21%***	
		Delivery preparation—had important telephone numbers handy	35.8	58.5	22.7***	63%***	
		Delivered at a facility	74.8	82.1	7.3***	10%***	
Received any FLW home visit related to complementary feeding	14.3	Children ages 6–11 months who are currently receiving any solid or semisolid food	66.7	75.9	9.3*	14%*	Medium correlation with certain complementary feeding behaviors
		Children ages 6–11 months who received cereal-based food in the previous day	56.6	66.8	10.2**	18%**	FLW visits not a significant predictor of complementary feeding after controlling for other types of exposure (Chapter X)
		Children ages 6–11 months who began complementary feeding at age 6 months	44.4	46.3	1.8	4%	
FLW visit to discuss family planning during pregnancy	13.8	Use of any modern method of contraception	17.7	30.7	13.0***	73%***	Strong correlation with use of modern methods
FLW visit to discuss family planning after delivery	14.1	Use of any modern method of contraception	17.8	29.6	11.8***	66%***	Only visits during pregnancy are a significant predictor of use of modern methods after controlling for other types of exposure (Chapter X)
Mobile Kunji							
Exposed to mobile kunji cards or audio in previous 6 months[a]	9.4	Delivery preparation—saved money, arranged transport, and kept important phone numbers (children ages 0–6 months)	57.8	30.0	27.9***	48%***	Mixed findings—strong correlations for delivery preparation and medium for complementary feeding, but insignificant for other behaviors
		Delivered at a facility (children ages 0–6 months)	77.9	76.8	1.1	1%	
		Children ages 6–11 months old who received DPT3	57.2	63.4	-6.2	-11%	These correlations for delivery preparation and

Exposure measure	Mean exposure at midline (percentage points)	Outcome	Adjusted mean if not exposed (percentage points)	Adjusted mean if not exposed (percentage points)	Adjusted difference (percentage points)	Adjusted difference (percent)	Summary
		Children ages 6–11 months who are currently receiving any solid or semisolid food	80.4	66.9	13.5**	17%**	complementary feeding hold after controlling for other types of exposure (Chapter X)
		Use of any modern method of contraception	24.6	19.0	5.6	23%	
		Media					
Exposed to relevant media messages in previous year	29.8	Delivery preparation—saved money, arranged transport, and kept important phone numbers (children ages 0–6 months)	38.4	31.1	7.3***	19%**	Mixed findings—medium correlations for delivery preparation and use of modern methods
	24.5	Children ages 6–11 months who are currently receiving any solid or semisolid food	69.5	67.3	2.2	3%	These correlations are not significant after controlling for other types of exposure (Chapter X)
	29.2	Use of any modern method of contraception	22.3	18.3	4.0*	18%*	

Source: Women in focus districts in the Ananya baseline and midline surveys. All outcomes apply to women with children ages 0–11 months unless otherwise noted. Adjusted means and differences account for differences in demographic characteristics. Medium correlations are defined as statistically significant regression-adjusted differences of less than 25 percent of the nonexposed mean and are highlighted in light green. Strong correlations are defined as statistically significant regression-adjusted differences of 25 percent or more of the nonexposed mean and are highlighted in dark green.

[a]Results are for general exposure to mobile kunji; information on exposure to information on specific topics through the kunji is not available.

*$p < 0.10$, **$p < 0.05$, ***$p < 0.01$ for adjusted differences.

family planning were highly correlated with adoption of these behaviors. FLWs' use of mobile kunji in the previous six months was also strongly associated with birth preparedness and complementary feeding but not with other practices, such as use of modern methods of contraception. These correlations suggest that certain behaviors might be more responsive to the use of the mobile kunji than others. Correlations between media exposure and behavior were generally weaker.

Overall, the correlations between FLW interactions and household behavior support the Ananya theory of change and the strong programmatic focus on improving FLW interactions (including through mobile kunji) as a mechanism to improve household practices. However, other elements of the program that were implemented at the same time, as well as unobserved differences in the characteristics of households in which interactions did and did not take place, could also have helped drive observed correlations. These alternative explanations cannot be disentangled in a definite causal sense with the current Ananya evaluation design.

Conclusion

This report summarizes the effects of the interventions implemented under the Ananya program's IFHI and SDP grants after two years of implementation in the eight focus districts. We examined effects on both proximal measures of exposure to the various intervention elements, as well as effects on health outcomes across the continuum of care targeted by the program. To estimate these effects, we compared changes in outcomes between baseline and midline in the eight focus districts to the changes in the nonfocus districts over this period (a DD approach). Given the similarity in the pre-Ananya levels and trends of key outcomes in the focus and nonfocus districts, we contend that these DD estimates can be interpreted as the midline impacts of Ananya.

Table 7 provides a summary of our findings on the midline impacts of Ananya on key outcomes. We focus on outcomes measured at baseline and midline, enabling us to produce DD impact estimates.[9] The table shows the baseline level of each outcome in the focus districts (column 1), how the outcome changed between baseline and midline (column 2), and the impact of Ananya estimated using DD (column 3). To enable us to compare impacts across outcomes with different baseline levels, we also converted the percentage point impacts into a percentage of the baseline mean (column 4).[10] We highlight all impacts that were statistically significant at least at the 10 percent level. We consider statistically significant impacts of less than 25 percent to be medium (light green) and those more than 25 percent to be strong (dark green).

Table 7. Summary of Ananya's impacts on key outcomes across domains

Outcome	Baseline mean in focus districts (percentage points)	Change in focus districts from baseline to midline (percentage points)	Midline regression-adjusted impact (percentage points)	Midline regression-adjusted impact (percent)	Summary of findings
FLW interactions					
Received two or more home visits from an FLW in the final trimester of pregnancy	33.3	+5.9**	+9.7***	+29%***	Increase in the focus districts was driven by Ananya; there would have been a decrease in the absence of the program.
Received a home visit by an FLW within 1 week of delivery	15.0	+3.2	+1.5	+10%	No significant change in focus or nonfocus districts; no evidence of Ananya impacts.
Any FLW home visit related to family planning after delivery	8.3	+5.8**	+2.3	+28%	Increase in focus districts was largely driven by external factors, rather than by Ananya.

[9] As noted earlier, for outcomes that were available only at midline, we were able to estimate midline differences only between focus and nonfocus districts, which cannot be attributed to Ananya with the same degree of attribution as the DD impact estimates.

[10] For example, an impact of 10 percentage points should be viewed as larger if the baseline level is 10 percentage points (an increase of 100 percent, or a doubling) compared with if the baseline level is 50 percentage points (an increase of 20 percent). Expressing impacts as percentages enables us to make this type of comparison.

Outcome	Baseline mean in focus districts (percentage points)	Change in focus districts from baseline to midline (percentage points)	Midline regression-adjusted impact (percentage points)	Midline regression-adjusted impact (percent)	Summary of findings
Maternal and newborn health					
Received ANC three or more times	29.8	+10.3***	+5.1	+17%	Ananya might have partly contributed to the increase in focus districts, but this contribution is not statistically significant.
Delivered at a facility	68.1	+9.5***	-0.4	0%	Increase in focus districts was driven by external factors, rather than by Ananya.
Nothing applied to cord or umbilicus	23.7	+6.5***	+7.4***	+31%***	Increase in focus districts was driven by Ananya.
Child placed unclothed on mother's chest or abdomen in skin-to-skin contact	19.5	+23.5***	+9.5	+49%	Ananya might have partly contributed to the increase in focus districts, but this contribution is not statistically significant.[a]
First bath delayed by two or more days	54.6	+10.5***	+2.1	+4%	Most of the increase in focus districts was driven by external factors, rather than by Ananya.
Breastfed child within one hour of birth	47.0	+5.1**	+2.7	+6%	Much of the increase in focus districts was driven by external factors, rather than by Ananya.
Child nutrition					
Child exclusively breastfed in past 24 hours, children ages 0–5 months	59.1	+19.2***	+2.9	+5%	Most of the increase in focus districts was driven by external factors, rather than by Ananya.
Children ages 6–11 months who are currently receiving any solid or semisolid food	64.7	+3.3	+8.5*	+13%*	Although there was no significant change in the focus districts, there would have been a decrease in the absence of Ananya. Ananya reversed the decrease, largely maintaining existing levels.
Children ages 6–11 months who received cereal-based food in the previous day	60.7	-2.6	+8.2**	+14%**	Although there was no significant change in the focus districts, there would have been a decrease in the absence of Ananya. Ananya slowed the decrease, largely maintaining existing levels.
Immunization					
Children ages 6–11 months who received DPT3	62.7	+0.2	+2.2	+4%	No significant change in focus or nonfocus districts; no evidence of Ananya impacts.
Reproductive health					
Use of any modern method of contraception	11.3	8.2***	+8.7***	+77%***	All of the increase in focus districts was driven by Ananya.

Sources: Ananya baseline and midline surveys conducted by Sambodhi in collaboration with Mathematica and PHFI in spring 2012 and spring 2014, respectively.

Note: All outcomes apply to women with children ages 0–11 months in the focus districts unless otherwise noted. Columns 1 and 2 show unadjusted numbers; columns 3 and 4 show impact estimates that are regression-adjusted for demographic differences. Medium impacts are defined as statistically significant DD estimates of less than 25 percent of the baseline mean and are highlighted in light green. Strong impacts are defined as statistically significant DD estimates of 25 percent or more of the baseline mean and are highlighted in dark green.

[a]Although the estimated impact on this outcome is large relative to the baseline mean, we verified that it is not statistically significant when the appropriate statistical adjustments are made for district-level correlations in outcomes.

*$p < 0.10$, **$p < 0.05$, ***$p < 0.01$ for adjusted DD estimates.

Overall, our comparison of the changes between baseline and midline in the eight Ananya focus districts with the changes in the other districts in Bihar suggests that the package of Ananya interventions had significant impacts on several important health-related outcomes after two years of implementation. This includes impacts on proximal measures of exposure that are directly linked to the interventions and on several health outcomes across the continuum of care. However, we do not see significant impacts for some indicators. Importantly, levels of many indicators are still low for many outcomes, suggesting that there is room for further improvement.

The estimated midline impacts apply to the Ananya interventions that were intensively implemented in the eight focus districts over the two-year midline period. They therefore do not necessarily reflect the impacts that could be expected across the state moving forward. It is possible that the broader health systems change included in the TSU (for example, addressing supply-side constraints)—together with additional interventions that had not been widely implemented by midline—could result in similar or larger impacts of Ananya at the state level. On the other hand, with less intensive direct support from the program, these impacts might be lower. Further, the midline evaluation focused on proximal health outcomes; impacts on ultimate outcomes related to mortality, fertility, and undernutrition will take longer to manifest and cannot be determined directly from the midline results. Future efforts to study the effectiveness of Ananya will focus on understanding how health systems have improved as a result of the TSU and how these have led to improvements in outcomes and attainment of the RMNCH+A goals and targets set by the GoB at the state level.

ACRONYMS

AHS = Annual Health Survey

ANC = antenatal care

ANM = auxiliary nurse midwife

ASHA = accredited social health activist

AWW = anganwadi worker

BCG = bacillus Calmette-Guerin (tuberculosis vaccine)

BEMONC = basic emergency obstetric and newborn care

CBO = community-based organization

CIFF = Children Investment Fund Foundation

DD = difference-in-differences

DLHS = District Level Household and Facility Survey

DPT = diphtheria, pertussis, and tetanus

FLW = frontline health worker

GoB = Government of Bihar

GoI = Government of India

G2P = Government to Person

ICDS = Integrated Child Development Scheme

IFA = iron folic acid

IFHI = Integrated Family Health Initiative

IUD = intrauterine contraceptive devices

LQAS = lot quality assurance sampling

MDI = minimum detectable impact

MLE = measurement, learning, and evaluation

MNCH = maternal, newborn, and child health

NFHS = National Family Health Survey

NGO = nongovernmental organization

NIPI = Norway India Partnership Initiative

NMR = neonatal mortality rate

NSSO = National Sample Survey Office

PCI = Project Concern International

PHC = primary health center

PNC = postnatal care

PSI = Population Services International

RMNCH = reproductive, maternal, newborn, and child health

RMNCH+A = reproductive, maternal, newborn, child, and adolescent health

SC/ST = scheduled caste/scheduled tribe

SD = standard deviation

SDP = Shaping Demand and Practices

SES = socioeconomic status

SHG = self-help group

SSU = secondary sampling unit

TBGI = team-based goals and incentives

3SI = Support Sustainable Sanitation Improvements

TSU = technical support unit

UNDP = United Nations Development Programme

UFS = Urban Frame Survey

UNFPA = United Nations Population Fund

VHSND = Village Health Sanitation and Nutrition Days

WHO = World Health Organization

WHP = World Health Partners

I. INTRODUCTION

The Bill & Melinda Gates Foundation created the Ananya program to address some of the important family health challenges in Bihar, one of India's most populous and poorest states. Ananya started as a five-year program (2011–2015) with the long-term goals of reducing the rates of maternal, newborn, and child mortality; fertility; and child undernutrition in Bihar. The program funds an integrated set of grants to improve health outcomes for young children and their mothers through interventions at the household, community, health facility, and provider levels.

The Ananya program was initially implemented from 2011 to 2013 in eight focus districts in western and central Bihar. The program evolved over time, and in late 2013 the Foundation created a technical support unit (TSU) to support the Government of Bihar (GoB) to scale up successful Ananya interventions, strengthen the government health system, and facilitate the implementation of its reproductive, maternal, newborn, child, and adolescent health (RMNCH+A) strategy through 2017.

Mathematica Policy Research, with its partners the Public Health Foundation of India (PHFI) and Sambodhi Communications Inc., conducted a midline evaluation to examine the effects of Ananya on reproductive, maternal, newborn, and child health (RMNCH) outcomes. The midline evaluation relies on data collected from a cohort of beneficiaries at baseline (before the implementation of Ananya) and from a new cohort approximately two years after the start of the program (before the implementation of the TSU). It focuses primarily on the impacts of two of the Ananya grants that were implemented intensively during this period in the eight focus districts.

This report summarizes the findings from the midline evaluation. Next, we provide basic context for the findings by describing the broader Bihar context and the introduction of the Ananya program, the government health infrastructure in Bihar, and the Ananya theory of change and its main program elements. We then provide a road map for the remaining chapters of the report.

A. The Bihar context

Bihar is one of India's most populous and poorest states, and its health and development indicators point to high levels of poverty and poor health. Despite recent improvements, Bihar's literacy rate is the lowest in the country (62 percent, according to Census 2011), and its per capita income is less than half of the national average (Central Statistics Office 2012). The state also faces continuing public health challenges, with high rates of child and maternal mortality, fertility, and undernutrition. In 2011, Bihar had an infant mortality rate of 44 per 1,000 live births, a maternal mortality rate of 261 per 100,000 live births, and a total fertility rate of 3.6 (Sample Registration System 2011). Accounting for about 8 percent of India's population and 10 percent of its annual births, Bihar contributes to 12 percent of national maternal deaths, 12 percent of neonatal deaths, and 15 percent of underweight children.[11]

[11] Bill & Melinda Gates Foundation Request for Letter of Inquiry, Family Health Initiative for Bihar (2010–2015).

Under strong government leadership, the GoB has made major strides in the past several years, introducing new policies aimed at strengthening the health, transportation and physical infrastructure, and education sectors. This has resulted in high levels of economic growth, with state gross domestic product almost doubling from 2005 to 2010, albeit from a very low base (Central Statistics Office 2012). Several health indicators also improved substantially over this period; for example, the percentage of women delivering at a facility increased from 22 to 55 percent between 2005-2006 and 2009-2011 (National Family Health Survey 2005–2006, Annual Health Survey 2012–2013).[12] Despite these changes, important gaps persist in the health practices of households and in service provision, and the health outcomes of Bihar's population still need considerable improvement.[13] Responding to this need, several international donors have made large health-sector investments in Bihar in recent years through a variety of interventions (see Chapter II for a summary).

In May 2010, the Foundation and GoB signed a memorandum of cooperation to work together to reduce maternal and child mortality and improve other key health outcomes for women and children in Bihar. The memorandum indicated the technical, management, and program design support that the Foundation would provide through nongovernmental organizations (NGOs), starting with a set of interventions that would initially be implemented in 8 focus districts (among Bihar's 38 districts). This set of interventions eventually became known as the Ananya program. The original intent of the Ananya program was that the lessons learned and good practices identified during the initial two-year implementation phase would then be implemented in a statewide scale-up of the program over the subsequent three years (by 2015).

The Ananya program evolved over time, and the TSU was subsequently set up in late 2013 to enable the originally envisaged scale-up of select Ananya interventions across the state, as well as to engage in broader efforts to strengthen Bihar's public health system through 2017. Specifically, it plans to strengthen data systems, facilitate evidence-based decision making, build leadership and management capabilities among government officials, tackle supply chain bottlenecks, and address critical policy gaps over this period. In practice, the two phases of the Ananya program therefore consisted of implementation in the eight focus districts (2011–2013), followed by a transition to the TSU (2013–2017). This report focuses on estimating the effects of the interventions implemented by the program in the first phase of implementation. It thus enables us to provide evidence on the impact of these interventions before the advent of the TSU.

B. Overview of the government health system in Bihar

The Ananya grants were implemented primarily through the existing government health system in Bihar. This includes frontline workers (FLWs), who operate at the village or community level and have the most direct interaction with households, as well as a tiered network of public health facilities. In this section, we describe the three main cadres of FLWs, their roles, and the organization of public health facilities.

FLWs. At the community level, households interact directly with two cadres of FLWs: anganwadi workers (AWWs) and accredited social health activists (ASHAs). AWWs operate out

[12] For a more detailed discussion of trends in key health outcomes using external data sources, see Appendix E.

[13] See, for example, Rangarajan et al. (2013); Noznesky et al. (2012); Mohanan et al. (2014); and Rao et al. (2011).

of anganwadi centers in villages, where they provide take-home rations to pregnant women and young children, monitor children's weight, and conduct informal preschool activities. In addition, they hold village health and nutrition days, during which immunizations and antenatal care (ANC) checkups are provided. AWWs are responsible for the mapping and enumeration of all the households in their jurisdictions. They are also expected to conduct home visits that focus on monitoring children's growth. AWWs are expected to have completed a 10th-grade education and participate in a 26-day training course before starting work. They are paid an honorarium for their services.

Connected to the catchment area of each anganwadi center are one or more ASHAs, who were introduced into rural India in 2006 (urban areas do not have ASHAs). ASHAs are responsible for increasing awareness of important family health practices and helping households access available services. For instance, they conduct home visits to pregnant women and mothers with young children, accompany women to public health facilities for delivery, promote family planning and accompany women to facilities for sterilization, ensure that children receive immunizations, and distribute basic medications and contraceptives. ASHAs are required to have completed the 8th grade and participate in a 23-day induction training course that is conducted over several rounds during their first year in the position. They do not receive a salary or honorarium, but they typically earn incentives for facilitating institutional deliveries, sterilizations, and immunizations for children.

The final cadre of FLWs consists of auxiliary nurse midwives (ANMs), who supervise the ASHAs.[14] The ANMs' center of operations is the health subcenter, which is the lowest level of public facility (see below) and typically incorporates anganwadi center catchment areas from five or six villages. ANMs are responsible for services related to ANC, newborn care, family planning services, and immunization. They regularly travel to the anganwadi centers in their subcenter catchment areas to provide immunizations and ANC checkups at village health and nutrition days. ANMs are required to take a one-year diploma course and complete a 21-day skilled birth attendant training. They are paid a salary for their work.

Public health facilities. Public health facilities in Bihar are organized in a tiered system. The lowest tier is composed of health subcenters, which typically cover a population of 3,000 to 5,000. Subcenters are staffed by ANMs and are the first point of contact between the community and the formal health system. They are intended to provide essential primary health services, including immunizations, maternal and child health care, family planning, and medications for minor ailments.

Subcenters fall under the jurisdiction of primary health centers (PHCs). Each block (the administrative unit below the district in rural India) contains one PHC that, for most rural households, is the first point of contact with a qualified medical doctor. These facilities typically serve a population of about 30,000, and offer an inpatient ward with six beds, as well as infrastructure and equipment for delivery, family planning, basic surgical procedures, and some

[14] ASHAs and ANMs fall under the National Rural Health Mission (NRHM) that is managed by the Ministry of Health and Family Welfare, whereas AWWs fall under the Intergrated Child Development Scheme (ICDS program) that is managed by the Ministry of Women and Child Development. Therefore, ANMs supervise ASHAs, whereas AWWs are supervised by a separate lady supervisor.

diagnostic testing. The head of each PHC is the medical officer-in-charge, a qualified medical doctor who is assisted by other medical officers, nurses and/or ANMs (who manage the labor room), and other medical and administrative staff.

PHCs may refer cases to higher-tier facilities. The first referral unit for PHCs in Bihar is typically the district hospital, although some areas have referral facilities at the subdistrict level. Women who experience delivery complications are ideally referred to the district hospital, which typically provides specialist care in areas such as internal medicine, obstetrics and gynecology, general surgery, and pediatrics.

C. The Ananya theory of change and its grant portfolio

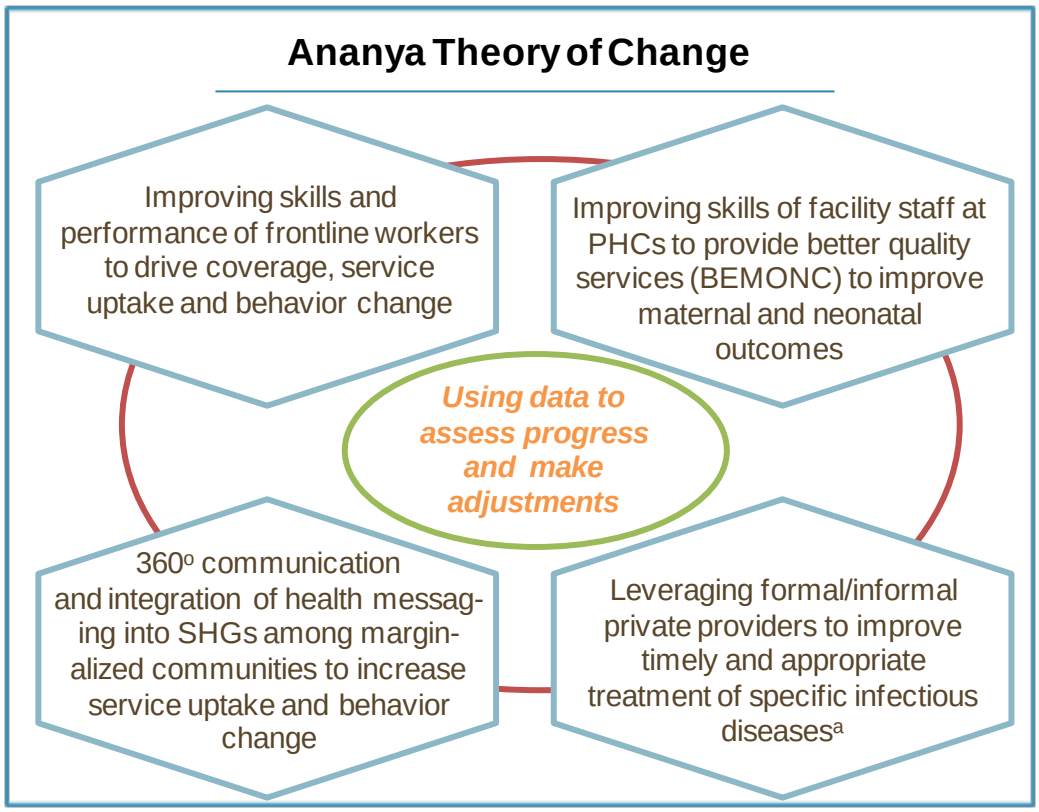
1. The Ananya theory of change

Working with several grantees, the Foundation conceived a coordinated, complementary set of demand- and supply-side interventions to improve health outcomes under the Ananya program. These interventions were designed to operate through four main elements, as shown in the initial Ananya theory of change (Figure I.1):[15] (1) interventions to improve the skills and performance of FLWs, (2) a multifaceted communication strategy around key health messages, (3) facility-level interventions to improve service quality at PHCs, and (4) using private providers to treat specific infectious diseases. Because midline data collection from facilities is still under design, and because the infectious disease element was outside of the scope of the Mathematica measurement, learning, and evaluation (MLE) effort, the midline evaluation described in this report focuses primarily on the first two elements of the theory of change.

Ananya's grants rely on a variety of supply- and demand-side interventions to drive the various elements of the theory of change. On the supply side, the grants seek to improve the coverage and quality of services provided at the primary care level, including services from facilities, private providers, and FLWs. On the demand side, they seek to increase awareness of and demand for high quality family health services among households with pregnant women and young children through increased interactions with FLWs, as well as through media and community forums. These interventions focus on reaching women during the 1,000-day window (the time from early pregnancy through a child's second year), a period that research has shown can be critical to achieving many of the Millennium Development Goal targets (Menon 2011). The Ananya theory of change posits that the demand- and supply-side interventions will together improve coverage, service uptake, and behavior related to RMNCH.

[15] As described earlier, the Ananya program evolved over time and a state-level TSU has been created to support the scale-up of some of the Ananya interventions and to strengthen the government health system more broadly. The creation of the TSU implies that additional elements have been added to the theory of change. For example, an important element of the TSU is supporting the use of data to improve the use of human resources and infrastructure and to remove critical supply bottlenecks in the public health system. We do not focus on these elements in this report, because the midline evaluation focuses on the pre-TSU period.

Figure I.1. Ananya theory of change during the initial implementation phase (2011–2013)



Source: Bill & Melinda Gates Foundation. "Ananya's Evolving Journey …." Presentation at Partners Meeting, Patna, India, August 2014.

[a]Specific infectious diseases include visceral leishmaniasis, tuberculosis, childhood pneumonia, and child diarrhea.

BEMONC = basic emergency obstetric and newborn care; SHG = self-help group (community group).

2. Ananya grant portfolio

In this section, we describe the Ananya grants that were implemented before the midline to drive the various elements in the theory of change. The midline evaluation focuses on the first two of these grants, the Integrated Family Health Initiative (IFHI) and Shaping Demand and Practices (SDP) grants. These grants were intensively implemented in the focus districts over the evaluation period and targeted outcomes that the evaluation was designed to measure. The full set of Ananya grants implemented before the midline included the following:[16]

[16] The program also funded two additional grants which we do not describe here because broad implementation had not begun before the midline (they will be evaluated separately, but not by Mathematica). The first is the Government to Person (G2P) health payments grant, which is being implemented by the International Finance Corporation and aims to facilitate the payment of salaries, incentive payments, and fees to health care personnel, beneficiaries, and private providers. The second is the Support Sustainable Sanitation Improvements (3SI) program, which is being implemented by Population Services International; it aims to create a sustainable, market-based supply chain and stimulate demand for sanitation products and services.

a. Integrated Family Health Initiative (IFHI) in Bihar

IFHI, led by CARE, worked closely with the GoB to implement innovative supply-side approaches to improve the coverage, quality, and uptake of critical RMNCH services in Bihar. The main interventions implemented under IFHI in the eight focus districts starting in late 2011 include the following:

- Promoting the **enumeration and mapping** of areas within a subcenter's catchment area, in order to ensure that all mothers and children, including those in remote areas, have access to care and receive attention from FLWs. These efforts aimed to identify populations not receiving health services, which are disproportionately composed of marginalized people (that is, those who might be otherwise excluded from receiving government services because of their religion, caste, literacy, or wealth).
- Convening and supporting **monthly subcenter platform meetings,** at which FLWs developed the skills required to increase the quantity and improve the quality of visits to households. These meetings, which include the ASHAs and AWWs in each subcenter's catchment areas, as well as the ANM, have covered a range of thematic areas, including birth preparedness, newborn care, breastfeeding, complementary feeding, and family planning. FLWs were also provided a job-aid kit that included various items to facilitate their interactions with households, such as a uterus model to facilitate discussion related to reproductive health and a bowl and spoon to demonstrate recommended complementary feeding practices (Sridharan et al. 2014).
- Conducting **quality improvement activities at public health facilities.** PHCs received assistance creating quality improvement teams, conducting structured assessments, identifying gaps in coverage, and developing and implementing action plans for improvement.
- Providing extensive **facility-based skills training** to staff delivering infants at PHCs. A team of two trained nurses with bachelor's or master's degrees provided ANMs and nurses in charge of delivery at facilities both classroom and technical training on delivery care. The training was provided at each facility and lasted five days per month for approximately 10 months. Topics covered included safe delivery, detecting emergencies, hygiene, and infection control.

b. Shaping Demand and Practices to improve family health in Bihar

The SDP grant, which BBC Media Action is implementing, aims to increase demand for key family health services and improve family health practices by using a 360-degree approach that reinforces the same family health messages through different channels (FLWs, mass media, and community mobilization). Many of the FLW-related interventions are implemented in close collaboration with IFHI, by integrating them into subcenter platform meetings. The SDP grant includes the following interventions:

- **Training for FLWs on interpersonal communication skills** and distribution of **mobile kunji,** a novel job-aid tool, to improve FLWs' communication with households. All FLWs in the eight focus districts received three days of training on interpersonal communication skills to improve the quality of their interactions with households. As part of these trainings, they were provided and trained to use the mobile kunji tool, which included (1) a deck of plastic cards that illustrates key health practices to follow during pregnancy and early childhood and (2) a set of "short codes" (short telephone numbers) to dial into a series of audio recordings on key health messages delivered by a fictional character named Dr. Anita. The mobile kunji covers topics across the continuum of care. From May 2012 to March 2014, FLWs used the mobile kunji to play a total of almost 7 million minutes of health messages in the eight focus districts.
- Providing health information via **mass media.** The media campaign involved a wide range of interventions, including (1) a 36-episode, long-format radio show broadcast throughout Bihar called *Khirki Mehendiwali* (consisting of 3 episodes per week and a weekly omnibus), which tells the story of a young girl as she negotiates day-to-day challenges emanating from poverty, illiteracy, and low female empowerment, all of which ultimately influence health care decisions; (2) two television commercials broadcast across Bihar that provide information on family planning and birth preparedness; (3) a mobile van campaign to increase exposure to the television commercials in areas with limited television access; and (4) street theater performances to communicate health messages. In addition, beneficiaries could register for the Kilkari Family Time Line to receive timely calls focused on recommended health practices throughout pregnancy and early childhood on critical practices, although this intervention was only rolled out just prior to the midline evaluation.
- **Community mobilization efforts,** including integrating health messages into community groups and use of street theater performances to promote health messaging. For instance, radio listener clubs were integrated into community (self-help) groups in order to increase exposure to *Khirki Mehendiwali* and encourage discussions about its messages. Street theater shows about family health were designed to communicate behavior change messages about family health through interactive and entertaining performances in the community.

c. Engaging private providers to manage infectious diseases

World Health Partners (WHP) is implementing a supply-side grant that aims to improve the availability and quality of health care provided by the private sector, but focuses specifically on four infectious diseases: tuberculosis, visceral leishmaniasis, childhood pneumonia, and child diarrhea. The grant aims to improve detection, diagnosis, and treatment of these diseases by establishing a multitiered, high quality, branded private-sector health service delivery network. Due to its focus on infectious diseases, this grant is outside the scope of our evaluation and is the focus of a separate evaluation conducted by COHESIVE-India.

d. Community mobilization and social accountability

Project Concern International (PCI) is implementing the community mobilization and social accountability grant through its Parivartan program. The program focuses on improving family health outcomes for marginalized women (in particular, those belonging to a scheduled caste/scheduled tribe [SC/ST]), who might still lag in access to and demand for health services because of lack of awareness, discrimination, and other reasons. The program creates new

community groups, strengthens existing groups, and provides structured inputs and training modules to these groups to facilitate mutual learning and collective action related to the key targeted health behaviors. The program is currently working with Jeevika community groups in Bihar and providing training to group leaders to include discussions about maternal and child health topics. This grant is relevant to our evaluation because it targets similar family health outcomes as the IFHI and SDP grants. However, implementation began only in mid-2013, shortly before the midline, targeted only a subset of areas in the focus districts,[17] and focused specifically on marginalized women. Therefore, although we examine community group participation as part of this report for completeness, this grant is unlikely to play a major role in the impacts on health outcomes that we report. Instead, it will be the subject of a separate evaluation by the Population Council.

3. Program logic for IFHI and SDP interventions

In Figure I.2, we illustrate the program logic underlying the IFHI and SDP grants that are the focus of the midline evaluation, showing the expected activities and outputs, proximal and intermediate outcomes, and ultimate impacts of the relevant interventions.

The IFHI and SDP interventions directly target FLWs and facility providers, as well as households (primarily through the SDP grant's media- and community-based interventions). The outcomes most proximal to the interventions covered by the midline evaluation involve improved FLW capabilities and service provision, as well as improved household knowledge about appropriate health behaviors (as noted above, we do not focus directly on the facility-based interventions and related outcomes in this report). Because we did not survey FLWs at midline, we do not have direct measures of their knowledge and capabilities. Instead, to measure these outcomes, the midline evaluation focuses on FLW service provision (for example, by examining the frequency and nature of FLW interactions as reported by households), and on some measures of household knowledge. Intermediate outcomes consist largely of improved health behaviors across the continuum of care, which are ultimately intended to result in impacts on mortality, fertility, and undernutrition. Because these ultimate impacts will likely take longer to materialize, the midline evaluation focused on estimating changes in these intermediate behavioral outcomes.

D. Road map of the report

The rest of this report is organized as follows. In Chapter II, we provide additional context for the evaluation by reviewing the literature on interventions that are related to the Ananya interventions covered by the midline evaluation, and by describing the activities of other development partners in Bihar over the evaluation period. In Chapter III, we describe the research questions, evaluation design, and data collection for the midline evaluation. Subsequent chapters present the midline evaluation results, organized by domain. In Chapter IV, we examine the impacts of Ananya on exposure to key program elements, including FLW–household interactions, media, and community groups. Subsequent chapters analyze the impacts of Ananya

[17] The program was implemented in 55 of 137 blocks in the focus districts. These had limited overlap with the blocks in our evaluation sample; only about 40 percent of our sample blocks overlapped with the Parivartan blocks.

Figure I.2. Logic model for Ananya interventions during the initial implementation phase (2011–2013)

Activities/outputs

Targeting providers

- Develop integrated family health services package along the continuum of care covering the antenatal period to age two
- Refine and integrate responsibilities for health workers in ICDS and NRHM (AWWs and ASHAs)
- Facilitate improvements in the enumeration and mapping process and integration of left-out households
- Pilot innovative tools and job aids for FLWs (e.g. Mobile Kunji, Mobile Academy, and Job Aid Kit)
- Strengthen training for ASHAs and AWWs on family health practices, effective communication, and planning and tracking of home visits (via the sub-center platform and IPC trainings)
- Strengthen supervision and data-driven management
- Institute quality improvement and skill development activities at primary health facilities

Targeting households

- Develop and implement 360-degree multi-media behavior change communication strategy
- Create and broadcast television and radio programming on important family health practices
- Conduct community mobilization activities to reach programming to remote areas (including radio listener clubs, street theater, and a mobile van campaign)
- Develop and roll out Kilkari Family Timeline Service, through which families register to receive calls informing them about critical family health practices

Proximal outcomes

FLW capabilities

- Improved FLW knowledge and communication skills

FLW service provision

- Increased service provision to left-out and marginalized households
- Regular and timely FLW interactions with households
- Comprehensive and accurate information provided to households
- More effective communication and use of interactive tools to explain information

Household knowledge

- Improved household awareness of preventative health practices and family health services
- Changes in social norms to support long-term adoption of healthy behaviors

Intermediate outcomes

Increased adoption of important family health behaviors along the continuum of care:

- Antenatal care (e.g. # visits, quality of check-ups, consumption of IFA tablets)
- Delivery (e.g. place of delivery, birth preparedness)
- Newborn care (e.g. cord care, thermal care, immediate breastfeeding)
- Nutrition (e.g. exclusive breastfeeding, complementary feeding)
- Routine child immunizations
- Reproductive health (e.g. use of modern contraceptive methods, unmet need)

Reductions in family health disparities for marginalized groups

Impacts

Mortality

- Reduced maternal mortality
- Reduced neonatal and infant mortality
- Reduced under-5 mortality

Health outcomes

- Reduced total and age-specific fertility rates
- Reduced child stunting and wasting

ICDS = Integrated Child Development Services; IFA = iron and folic acid tablets; IPC = interpersonal communication; NRHM = National Rural Health Mission.

in different domains. We analyze the impacts for MNCH practices in Chapter V, child nutrition outcomes in Chapter VI, immunizations in Chapter VII, and reproductive health practices in Chapter VIII. In Chapter IX, we examine the variation in impacts by key subgroups and the extent to which Ananya reduced disparities for marginalized groups. In Chapter X, we explore whether the associations between Ananya programmatic elements and health outcomes in the data support the underlying theory of change. We conclude our findings in Chapter XI.

In a set of appendices, we provide additional details about the midline analysis and additional supporting information requested by the Foundation and other stakeholders. In Appendix A, a technical appendix, we provide more information about the sampling and analysis approach for the midline evaluation and verify the assumptions underlying its design. In Appendix B, we conduct several additional analyses to verify the robustness of our main evaluation findings; in Appendix C we break down these findings for different geographical areas within Bihar. In Appendix D, we provide detailed definitions for all the outcomes analyzed in this report. In Appendix E we attempt to validate the data used for the midline evaluation by comparing them with data from external data sources. Finally, in Appendix F, we present an analysis of intimate partner violence based on our midline survey data.

II. ADDITIONAL CONTEXT: LITERATURE REVIEW AND ACTIVITIES OF OTHER DEVELOPMENT PARTNERS

In this chapter, we provide additional context for the interpretation of the estimated impacts of Ananya presented in this report. We begin by reviewing the existing literature on related interventions in India and elsewhere in the developing world, focusing on the elements of Ananya implemented during the midline evaluation period. We then summarize the activities of other development partners in Bihar over the evaluation period. This is important both to contextualize the introduction of Ananya in Bihar and because these activities might influence the outcomes measured as part of the midline evaluation (in Chapter III we investigate the implications of these other activities for the midline evaluation design).

A. Literature review

Our literature review seeks to contextualize the estimated impacts in this report by summarizing the existing evidence on the impacts of similar non-Ananya interventions in India and other developing countries. However, an important caveat to this review is that the Ananya program differed in many ways from other programs that are typically implemented and evaluated in similar settings, even though the interventions themselves might be similar or have overlapping elements. First, Ananya consisted of a varied package of interventions targeting a range of outcomes, rather than a single intervention targeting a specific outcome. Second, the program was rolled out rapidly on a very large scale (across eight districts), rather than piloted and evaluated in a smaller setting, as is typical for many novel interventions. Third, it was implemented largely through government functionaries (with the support of program staff), rather than through program staff alone. Therefore, although these aspects of the program are likely to promote effective scale-up and sustainability, the estimated impacts might not be directly comparable with those from other more targeted, small-scale interventions.

We focus the literature review on the elements of the Ananya program implemented during the midline evaluation period: improving interaction of FLWs with households; improving facility quality and upgrading skills of facility-based health workers; and providing health information through media messaging campaigns and through women's participatory groups. Although the midline evaluation does not explicitly focus on Ananya's facility-based interventions and has a limited focus on women's participatory groups (the focus of the PCI community mobilization grant), we include these elements in this review for the sake of completeness.

1. Interventions focusing on FLW interactions with households

The Ananya interventions have focused on improving the ability of FLWs to identify their target population and to deliver timely, appropriate, and high quality services to households. Specifically, FLWs undertake a mapping and enumeration process to accurately identify households containing members of their target population (pregnant women, infants, and children) and use training provided by Ananya as well as new job aids to deliver information during their visits to target households. Below, we report the results from several studies that

have examined the impact of increased interactions between FLWs and households on health outcomes.

Interactions with FLWs during pregnancy have been shown to increase the likelihood of ANC and facility delivery in a variety of developing country settings. For example, several quasi-experimental studies in Kenya have demonstrated that exposure to community health workers can double the proportion of deliveries that take place in a facility (Adam 2014; Olayo et al. 2014). Combining exposure to community health workers with other community-based activities such as strengthening referral linkages and creating community-based health monitoring systems increased the odds of receiving ANC by a factor of 21 relative to no exposure (Olayo et al.2014). However, the effects on other health outcomes, such as vaccine coverage and the use of insecticide-treated nets, were smaller and not statistically significant. Similarly, a package of maternal and child health programs implemented by CARE in Bangladesh, which included provision of home-based care and education for low socioeconomic status (SES) women by community health workers, significantly increased service utilization, including a 16 percent increase in the number of women receiving at least one ANC visit and a 9 percent increase in the number receiving at least three ANC visits (Kamiya et al. 2013).

FLW interactions after delivery have also been shown to potentially improve postnatal care (PNC) and newborn and child health outcomes—especially neonatal mortality, one of the key ultimate goals of the Ananya program. A nonexperimental study of a home-based newborn care intervention implemented through community workers in the Indian state of Maharashtra found a 62 percent reduction in neonatal morality and a significant decline in neonatal sepsis (Bang et al. 1999). A cluster RCT in Sylhet district, Bangladesh, compared two interventions against a control group: the first intervention involved home-based PNC and referrals by community health workers; the second involved group sessions by community mobilizers to provide information on PNC. The study found a 34 percent reduction in the risk of neonatal mortality in the community health worker group relative to the control group, but no difference between the community-care group and the control group (Baqui et al. 2008).

Findings for impacts on other more proximal PNC outcomes have found mixed results across different outcomes. For example, a recent cluster RCT in rural Tanzania evaluating home-based counseling by community volunteers (Penfold et al. 2014) found that 4 of 14 newborn care practices were significantly more common in intervention than comparison areas: delaying the baby's first bath by at least six hours (81 versus 68 percent), exclusive breastfeeding in the three days after birth (83 versus 71 percent), putting nothing on the cord (87 versus 70 percent), and, for home births, tying the cord with a clean thread (69 versus 39 percent). Another study in Nigeria compared a group of communities that received community-based education sessions as well as individual visits from community health workers to a control group (Findley 2013). The authors found significant differences with the control group in several newborn care outcomes, such as appropriate cord care (35 percent versus 6 percent), immediate breastfeeding (46 percent versus 16 percent), and kangaroo care (a newborn care technique that involves holding the infant in skin-to-skin contact with the mother; 22 percent versus 13 percent). However, there was little difference in some of the other outcomes considered, such as newborn vaccinations.

Overall, these findings suggest that increasing direct interactions between FLWs and households has the potential to improve health behaviors, although not all behaviors may be responsive.

2. Improving facility quality and upgrading skills of facility-based health workers

As discussed earlier, the Ananya interventions have focused on two main activities related to health facilities. The first uses a set of self-assessment tools to help PHC staff identify and address gaps in equipment, infrastructure, supplies, and human resources in their facilities, and to work collaboratively to upgrade facility quality by addressing these gaps. The second involves training nurses and PHC-based ANMs in delivery and newborn care techniques.

Similar to the Ananya program, facility upgrading efforts often include complementary facility-based worker training and other interventions. Several studies have therefore examined the combined effect of a package of facility-based interventions. For example, a World Bank-funded health project in Gansu Province, China, included an infrastructure component with skills training for staff and an expansion of access to health insurance. Although out-of-pocket expenses fell among treated households, results on the quality of provision were mixed and there was no clear link between infrastructure improvements and health outcomes (Wagstaff and Yu 2007). Another study in Tanzania similarly assessed the impact of a quality improvement program that included skills training and infrastructure upgrades at facilities and found that these interventions improved both uptake of reproductive health services and the perceived quality of these services reported by clients (Atherton 1999). A randomized controlled trial (RCT) evaluation of a health program in Peru disentangled the impact of infrastructure and staff training components of a packaged intervention. It found that infrastructure improvements increased deliveries per facility by 1.3 per month but training increased the same measure by 4.3 (Diaz and Jaramillo 2009).

Focusing specifically on staff training, interventions that improve staff skills and facility management capacity are important strategies for improving health outcomes—particularly neonatal and child mortality (Dickson et al. 2014). These interventions can also have important effects on more proximal health outcomes. For example, a package of programs focused on reducing child mortality in rural Bangladesh that included trainings for facility-based workers, had little effect on the mortality rate within the time frame of the evaluation. However, the intervention was associated with positive changes in health behaviors, including a 10 percentage point increase in exclusive breastfeeding for infants younger than six months and an 18 percentage point increase in the number of children receiving appropriate treatment for diarrhea (Arifeen et al. 2009). Another study in Nepal found that a one-hour educational intervention with nurses improved their knowledge and practice of newborn care methods immediately post-intervention, with gains sustained through three months after the intervention (Shrestha et al. 2013).

3. Improving health information through media messaging campaigns

Ananya's range of mass media interventions includes television advertising campaigns and radio programs on key family health topics. It is challenging to provide an overall assessment of the effectiveness of these types of media campaign programs, because they vary widely in the particular communication activities they use (for example, posters, handouts, public service announcements, discussion groups, workplace or clinic-based counseling, and in-school

presentations) and their content. Analyses of national household surveys in India suggest that access to media is correlated with better health behaviors and outcomes, such as the choice between sterilization and other contraceptive methods (Thind 2005), mother's age at first birth, pregnancy complications, whether the last child was wanted, abortion, stillbirth, mother's body mass index, and anemia (Prakash et al. 2011). However, factors such as maternal SES, which are likely to be correlated both with media access and health behaviors, are likely to confound these relationships.

Many media interventions that have been studied in the literature focus on family planning, which is also the focus of one of the SDP grant's media interventions. These mass media campaigns are often very successful, particularly among segments of the population who are highly motivated to limit their own childbearing (Wakefield 2010). In general, the more rigorous evaluations of communication programs show that these can be effective in changing family planning behavior. For example, a study of a specific campaign in Burkina Faso showed that even low exposure to the campaign (defined as exposure to one of the two campaign components—either promotional messages delivered through print materials and community mobilization or infomercials) was linked to a 7 percentage point increase in contraceptive use (Babalola and Vonrasek 2005). High exposure to the same program (defined as exposure to both components of the campaign) led to a 22 percentage point increase.

A meta-analysis of media campaigns focused specifically on family planning in developing countries suggested that these campaigns generaly had large impacts on knowledge of modern family planning methods for both men and women (an average 15 percentage point mean increase; Snyder et al. 2003). These campaigns also tended to have positive effects on partner communication about family planning (an average 9 percentage point increase), approval of family planning by husbands (8 percentage point increase), intention to use family planning (7 percentage point increase), and use of modern methods of family planning (6 percentage point increase).

Mass media campaigns can also be effective in improving other health behaviors. A recent review by Naugle and Hornik (2014) examined 111 evaluations of mass media campaigns addressing health topics relevant to child survival, including diarrhea, immunizations, malaria, child nutrition, preventing mother-to-child transmission of HIV, and respiratory disease, in addition to reproductive health (the most common topic). Although many of these studies do not have a rigorous design, the authors find that the stronger studies do provide eveidence that media campaigns can positively impact a wide range of child survival health behaviors. However, they caution that likely publication bias (studies of weaker campagins or those that show small impacts are less likely to be publish) may overstate the average effects of these campaigns.

4. Improving health information through women's participatory groups

As mentioned earlier, the PCI community mobilization grant of the Ananya program seeks to integrate health-related messages into participatory community groups aimed at marginalized women. A systematic review and meta-analysis of seven trials of women's groups practicing participatory learning and action related to maternal and child health concluded that these groups led to substantial reductions in neonatal and maternal mortalities in rural, low-resource settings (Prost 2013). The proportion of pregnant women participating in groups and the population coverage of groups were key predictors on mortality outcomes, with exposure to these groups

associated with a mean 37 percent reduction in maternal mortality, 23 percent reduction in neonatal mortality, and 9 percent (statistically nonsignificant) reduction in stillbirths.

A specific intervention based on women's group-led community mobilization for maternal and newborn health outcomes was implemented in Bolivia, and then replicated in Nepal and India (Jharkhand and Orissa states). In these groups, women met monthly to discuss problems related to pregnancy, childbirth, and the postnatal period. Working with local facilitators, they also formulated strategies to address these issues. Cluster RCTs in Nepal showed strong reductions in newborn and maternal mortality rates associated with the program. The study of the intervention in India also showed a 45 percent reduction in neonatal mortality in the last two years of the intervention, largely driven by improvements in safe practices for home deliveries (hand washing, clean cord care, and the use of safe delivery kits) (Manandhar et al. 2004; Rath et al. 2010).

5. Impacts of integrated health programs

The literature also includes some important general findings about the success of integrated health programs such as Ananya. Several studies have indicated that comprehensive programs that target a wide range of health outcomes can have significant impacts on some health outcomes, although they seldom succeed in making improvements in all domains. For example, an intervention package called the Safe Mother Promotion Project in Bangladesh involved a range of integrated activities, including assessment and upgrading of health facilities, ANC and PNC training for community health workers and traditional birth attendants, and several community mobilization activities. This package effectively increased ANC visits by 16 percent and use of emergency obstetric care services postpartum by 31 percent, but did not significantly increase attendance at birth of skilled practitioners or use of emergency obstetric care services during pregnancy or delivery (Kamiya et al. 2013). Similarly, Arifeen et al. (2009) found that the Integrated Management of Childhood Illness strategy in Bangladesh produced a range of benefits for child health, including increased breastfeeding and decreased prevalence of stunting. However, there was no difference between intervention and comparison communities in other key outputs and outcomes, such as the percentage of sick children who were appropriately referred to higher-level facilities or the prevalence of wasting.

Despite these mixed impacts, packages of interventions are often more logical to implement than one-off programs. These packages also facilitate a continuum of care across maternal, neonatal and child health, thus better integrating these services and ensuring the well-being of mothers and their children through a more holistic approach (Darmstadt et al. 2005; Bhutta et al. 2005). Further, some large, comprehensive programs can have long-term effects that might not be immediately apparent, such as the sustained decrease in measles, mumps, and rubella seen seven years after the introduction of the safe motherhood program in China (Feng et al. 2010). Therefore, the Ananya program could be a viable approach to addressing the broad range of gaps in RMNCH in Bihar.

B. Activities of other development partners in Bihar

The Ananya program was introduced in the context of a dynamic health sector in Bihar, in which several development partners—as well as the GoB and Government of India (GoI)—were active. These entities were implementing a variety of interventions targeting many similar health

outcomes as Ananya. As mentioned earlier, understanding the nature and scale of these interventions is important both to contextualize the introduction of Ananya in Bihar and because they might have implications for the evaluation design, as we discuss in Chapter III.

Here, we begin by listing the key development partners that were operating in Bihar around the period of the midline evaluation and provide a broad overview of the nature and the scale of their activities. We then describe the programs implemented by these development partners, as well as the GoB and GoI, in the following thematic areas: (1) pregnancy and delivery, (2) PNC, (3) child nutrition and survival, (4) reproductive health, and (5) immunization.[18]

1. Key development partners in Bihar

Although many organizations are working on various aspects of RMNCH in Bihar, we focus more specifically on development partners that have worked on programs affecting similar outcomes as Ananya or have had a prominent presence as technical experts to the GoB. We extended the time frame of our review of development partners' activities to a slightly earlier period (2010 to 2014) than the midline evaluation of Ananya in order to capture the immediate lead-up to Ananya.

Overall, there was substantial variation in the activities of the development partners over this period. In addition to differences in the scope and goals of their interventions, the modalities of interventions also differed substantially across these partners over this period, with some providing only technical guidance, some layering financial assistance onto their technical guidance, and the rest directly implementing programs. The scope, scale, and area of intervention of development partners over this period included the following (see Table II.1 for a summary):

- The government of the United Kingdom's **Department of International Development (DFID**), in collaboration with the GoB, is implementing a health sector reform program called Sector-Wide Approach to Strengthen Health. A technical assistance support team for Bihar (B-TAST) implements this program, which provides both financial and technical assistance to GoB. Its main goals are to reduce maternal and child deaths, undernutrition, and unwanted pregnancies, and to lessen the burden of communicable diseases such as visceral leishmaniasis. The program has operated across all 38 districts in Bihar, but with a specific focus on 12 non-Ananya focus districts.
- **The Norway India Partnership Initiative (NIPI)** and its consortium partners have worked in three non-Ananya focus districts of Bihar since 2010, implementing a variety of interventions with a focus on improving child health (for example, strengthening newborn care practices and improving facilities). NIPI does not implement programs directly, but typically provides technical assistance in the implementation of interventions by the GoB using existing government structures.

[18] The information in this section was obtained from a web-based search of development partner activities, as well as qualitative semistructured interviews with technical leads of development partners. These interviews focused on the content, timing, and scale of their RMNCH-related interventions.

- **UNICEF** has worked in Bihar for more than 30 years to provide technical expertise on child-health related interventions, such as improving child nutrition, immunization rates, and quality of care at health institutions. Although UNICEF facilitates capacity-building across the 38 districts in Bihar, it has a special focus on Vaishali district.
- **The United Nations Population Fund (UNFPA)** also provides technical support across Bihar, but with a focus on two non-Ananya focus districts; it aims to strengthen the capacity of government officials working on improving reproductive health services by developing training materials and assessing the quality of the training.
- The **MacArthur Foundation** has funded several activities in Bihar that focus on reproductive health and seek to reduce the incidence of maternal mortality and morbidity as well as address reproductive health rights and awareness among adolescents. In addition, the foundation funds programs that bridge the gap of quality secondary education for marginalized girls. Many of its reproductive health projects have been implemented by Pathfinder and focus on two districts, including Patna (an Ananya focus district).
- The **Children Investment Fund Foundation (CIFF)** aims to improve child survival, learning gains, and nutritional outcomes. It has collaborated with NGOs such as the Micronutrient Initiative and the GoB toward combating vitamin and mineral deficiencies among mothers and children, with a focus on 15 districts (including some Ananya focus districts).
- **The David and Lucile Packard Foundation** supports reproductive health programs that provide safe family planning options to women, comprehensive educational programs on reproductive health choices for adolescents, and improved access to safe abortions. In Bihar, together with Pathfinder and local community-based organizations (CBOs), the foundation has worked on several programs that spread awareness and seek to change behaviors related to reproductive health.
- Funded by various donors, **DKT International** together with NGOs such as Janani, employs a social marketing and franchisee model toward providing family planning services within Bihar.

Table II.1. Activities of other development partners in Bihar, 2010–2014

Donor	Implementing partner	Year	Consortium partners	Number of districts	Names of districts	Type of program
DFID	B-TAST	2010–present	CARE, IPE, and Options UK	38 districts, with a focus on 9 districts	Since 2010, focused on Araia, Seohar, Supaul, Madhubanai, Kishanganj, Purnia, Madhepura, Jamui, and Banka In 2013, added Gaya, Jahanabad, and Katihar	Technical and financial assistance
NIPI	UNDP	2010–present	Jhpiego, PHFI	3 districts	Nalanda, Shekhpura and Jahanabad	Technical assistance
UNICEF		Past 30 years		38 districts, with a focus in 1 district	Vaishali	Technical assistance
UNFPA		2010–present	Pathfinder	2 districts	Sitamari and Madhubani	Technical assistance

Donor	Implementing partner	Year	Consortium partners	Number of districts	Names of districts	Type of program
MacArthur Foundation	Pathfinder	2009–2012	GoB and CBOs	2 districts	Patna and Vaishali	Direct implementation
CIFF	Micronutrient Initiative	Vitamin A: 2006–present Diarrhea intervention: 2011–present	GoB	Vitamin A: statewide Diarrhea intervention: 15 districts	Diarrhea intervention: Munger, Khagaria, Bhagalpur, Bangka, Sitamarhi, Madhepura, Saharsa, Supaul, East Champaran, Sheohar, Gaya, Jhanabad, Nalanda, Sheikpura and Purnia	Technical and financial assistance
David and Lucile Packard Foundation & UNFPA	Pathfinder	2001–2012	19 local CBOs	Started with 3 districts in 2001 and scaled up to 2 more districts in 2008	Nalanda, Nawada, Patna. In 2008 added Sheikhpura and Gaya	Direct implementation
DkT International	Janani	1996–present	Local private franchised clinics	23 districts	E. Champaran, W. Champaran, Siwan, Saran, Patna, Ara, Rohtas, Aurangabad, Gaya, Nawada, Jamui, Banka, Munger, Bhagalpur, Begusarai, Saharsa, Purnia, Kishanganj, Madhubani, Vaishali, Nalanda, Muzaffarpur, Sitamarhi	Direct implementation

Source: Web-based search of development partners' activities and qualitative semistructured interviews with technical leads of development partners.

2. Summary of non-Ananya interventions

The key interventions implemented by these development partners, as well as the GoB and GoI over this period included the following, arranged by domain (see Table II.2 for a summary):

Pregnancy and delivery

- In 2008, **NIPI–United Nations Development Programme (UNDP)** piloted the Mamta program to address the quality of newborn care at maternity wards with high delivery loads. Nonclinical support and counseling by a trained volunteer called a *mamta* is designed to encourage mothers to immediately breastfeed their children and continue to exclusively breastfeed them until they are 6 months old. Although this program started at the district and subdivisional hospitals, it has now been adopted by GoB and implemented across all the government health facilities in the state. There are ongoing discussions to implement the mamta program at lower-tier facilities. B-TAST, along with UNICEF, has supported training mamtas across the state.
- **UNICEF, DFID, and NIPI** have worked extensively toward improving the quality of services at health facilities through regular facility assessments, capacity-building of facility staff, and providing technical support. At the block level, B-TAST and UNICEF have trained staff for the establishment of newborn care corners at PHCs across the state. At the district level, special newborn care units have been strengthened with the support of NIPI and UNICEF.

- *Janani Suraksha Yojana*, a **GoI** program that has been in place since 2005, promotes institutional delivery by providing cash incentives to mothers and ASHAs for delivery at a public facility. A new addition to this incentive-based approach is the *Janani Sishu Suraksha Karyakram*, launched in 2012. It eliminates out-of-pocket expenses for pregnant women and sick neonates and entitles all pregnant women delivering in public health institutions to a no-expense delivery, including caesarian section if required.
- Another **GoI** scheme to promote facility deliveries is the *Indira Gandhi Matritva Sahyog Yojana*, which compensates pregnant and lactating women for lost wages during childbirth and encourages safe delivery and better infant and young child feeding practices.
- Funded by the **MacArthur Foundation,** Pathfinder implemented a program called *Raksha* to ensure safe facility deliveries from 2009 to 2012. The program provided technical solutions for Active Management of the Third Stage of Labour and introduced a special anti-shock garment for women suffering from postpartum hemorrhage. At the community level, the program trained ASHAs to encourage households to identify blood donors and make arrangements for facility delivery ahead of time.
- In, 2013 **UNICEF** established a quality assurance mechanism in every district hospital across Bihar to understand reasons for the failure of health facilities to follow government protocols. The intervention involved a quarterly internal and external review using a checklist developed by UNICEF.

Postnatal care

- **NIPI** piloted the Home-Based Newborn Care program in 2010 to address PNC for mothers and newborns, by providing cash incentives to ASHAs to visit new mothers in their homes within the first six weeks after delivery. ASHAs were also trained by NIPI on danger signs experienced by mothers and infants and on early childhood development and growth. This pilot was adopted in modified form by the GoB, with a focus on newborn rather than maternal care, and scaled up across Bihar in 2013.

Child nutrition

- Funded by the **GoI** and **GoB,** the *Porak Pooshahar Yojana* program provides supplementary nutrition to pregnant and lactating women and their children ages 6 months to 6 years through provision of raw foods. AWWs identify the beneficiaries of this scheme and distribute food at Anganwadi centers in the form of take-home rations.
- Since 2006, **CIFF** has collaborated with the Micronutrient Initiative and the GoB to implement a four-day vitamin A supplementation program conducted biannually across the state. The program has helped the state develop vitamin A supplementation guidelines, funded and estimated its optimal supply, developed effective educational materials, trained ASHAs, and established monitoring and reporting procedures. From 2011 to 2013, the Micronutrient Initiative focused on childhood diarrhea management and trained ASHAs and AWWs to give oral rehydration solution and zinc to families to treat children with diarrhea across 15 districts in Bihar. The GoB subsequently scaled up the initiative in 2013.

Reproductive health

- In 2012, the **GoI** launched the *Adarsh Dampati Yojana* program, which incentivizes ASHAs to promote family planning among couples. Incentives are awarded for delaying the birth of the first child, birth spacing, limiting, and the promotion of permanent methods of contraception. Beneficiaries (women and men) also receive monetary incentives if they adopt permanent methods of contraception.
- Funded by the **David and Lucile Packard Foundation & UNFPA,** Pathfinder implemented the *Prachar* reproductive health program. It provided CBOs with technical training and funding to work toward changing reproductive health behaviors such as delaying the age of marriage, delaying the birth of the first child, and birth spacing. In 2001, a pilot started in three districts; two more districts were added in 2008. The program ended in 2012; although the GoB approved it for statewide scale-up, no additional funds have been allocated yet.
- To facilitate the adoption of safe family planning methods at facilities, **DFID** in collaboration with *Jpheigo* supported in the establishment of family planning corners and trained facility staff and counselors at PHCs and first referral units across Bihar.
- **DKT International,** in collaboration with ***Janani,*** has worked in Bihar since 1995 to provide contraceptives and low-cost reproductive health services through social marketing and social franchise. *Janani* runs close to 45 of its own clinics and 98 franchised clinics with trained health providers across Bihar. In addition, the organization sells condoms and oral contraceptives to various small private retailers in Bihar. In 2013, it had a presence in 23 districts.

Immunization

- Starting in 2011, **DFID** provided technical assistance to strengthen Village Health Sanitation and Nutrition days (VHSNDs), regular events organized every month at the anganwadi centers, to provide essential health, nutrition, and water and sanitation information to the community. This involved additional orientation regarding VHSNDs for government functionaries at the district and block levels, as well as for the AWWs at the community level. B-TAST district managers monitor and supervise these VHSNDs, provide practical guidance, and promote the use of data.
- Similarly, since 2007 **UNICEF** has supported GoB's statewide immunization campaign under its flagship program *Muskan ek Abiyan,* through which service providers identify and track households with children to ensure every child is immunized.

Table II.2. Summary of non-Ananya interventions in Bihar, 2010–2014

Theme	GoI	GoB	DFID	NIPI	UNICEF	UNFPA	MacArthur Foundation	CIFF	Packard Foundation	DkT International
Pregnancy and delivery	X		X	X	X		X			
Postnatal care				X						
Child nutrition	X	X						X		
Reproductive health	X		X			X			X	X
Immunization			X		X					

Source: Web-based search of development partners' activities and qualitative semistructured interviews with technical leads of development partners.

Overall, our review identified three key differences between the Ananya interventions and the RMNCH interventions implemented by other development partners in Bihar. First, the Ananya interventions differ in the intensity of support provided by program staff during implementation. Non-Ananya interventions typically have a relatively light touch, with the onus of implementation resting largely on government functionaries. In contrast, most Ananya consortium partners have representatives staffed from the regional level down to the block level so that each government functionary has adequate support and sufficient time to understand the program and implement it successfully. Second, the scope of Ananya is wider compared with the other programs, which typically target one particular domain of RMNCH (for example, reproductive health) through a specific intervention. In contrast, Ananya seeks to address the entire RMNCH continuum of care through a *package* of interventions that simultaneously address various supply- and demand-side constraints to improving RMNCH behaviors. Third, the speed and scale of Ananya's rollout across the focus districts was unusual relative to other interventions that often involve a small-scale pilot phase and a more gradual rollout. Specifically, the IFHI and SDP grants sought to reach FLWs across all focus districts in the space of only a few months. Therefore, although there might be similarities with many of the objectives of the other interventions, the intensity, scope, and scale of the Ananya grants remain largely unprecedented in Bihar.

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III. RESEARCH QUESTIONS, STUDY DESIGN, AND DATA COLLECTION

In this chapter, we summarize the research questions for the midline evaluation and describe the evaluation design that we will use to answer them. Specifically, we describe a comparison group design that compares changes in outcomes in the eight focus districts between baseline and midline to the changes in the nonfocus districts over the same period; this design attributes differences in these changes to the effects of the Ananya interventions. We then describe the sampling and data collection for the evaluation and summarize the key characteristics of the evaluation sample.

A. Research questions

The overarching goal of the midline impact evaluation is to determine the overall effects of the integrated set of approaches implemented under Ananya—in particular under the IFHI and SDP grants—after two years of implementation. More specifically, it seeks to answer the following questions:

- Did Ananya lead to increased and improved interactions between FLWs and households, and exposure to other key program elements?
- After two years, did Ananya's integrated demand- and supply-side approaches contribute to improved family health outcomes in the focus districts?
- Which program elements were most highly correlated with improvements in outcomes? Are the findings consistent with Ananya's theory of change?
- How did the effects of the program vary by key population subgroups? Did the program improve outcomes for the more marginalized women? Did it lead to reductions in any existing disparities in FLW–beneficiary interactions or health outcomes?

As mentioned earlier, the core Ananya interventions that are the focus of the midline evaluation were primarily implemented in 8 selected focus districts starting in late 2011 (Figure III.1). Scale-up of these interventions to the remaining 30 districts was still largely in the planning stages by the time the midline was conducted in early 2014. The analysis presented in this report attempts to estimate the impacts of Ananya on outcomes in the 8 focus districts between the baseline (early 2012) and midline (early 2014).

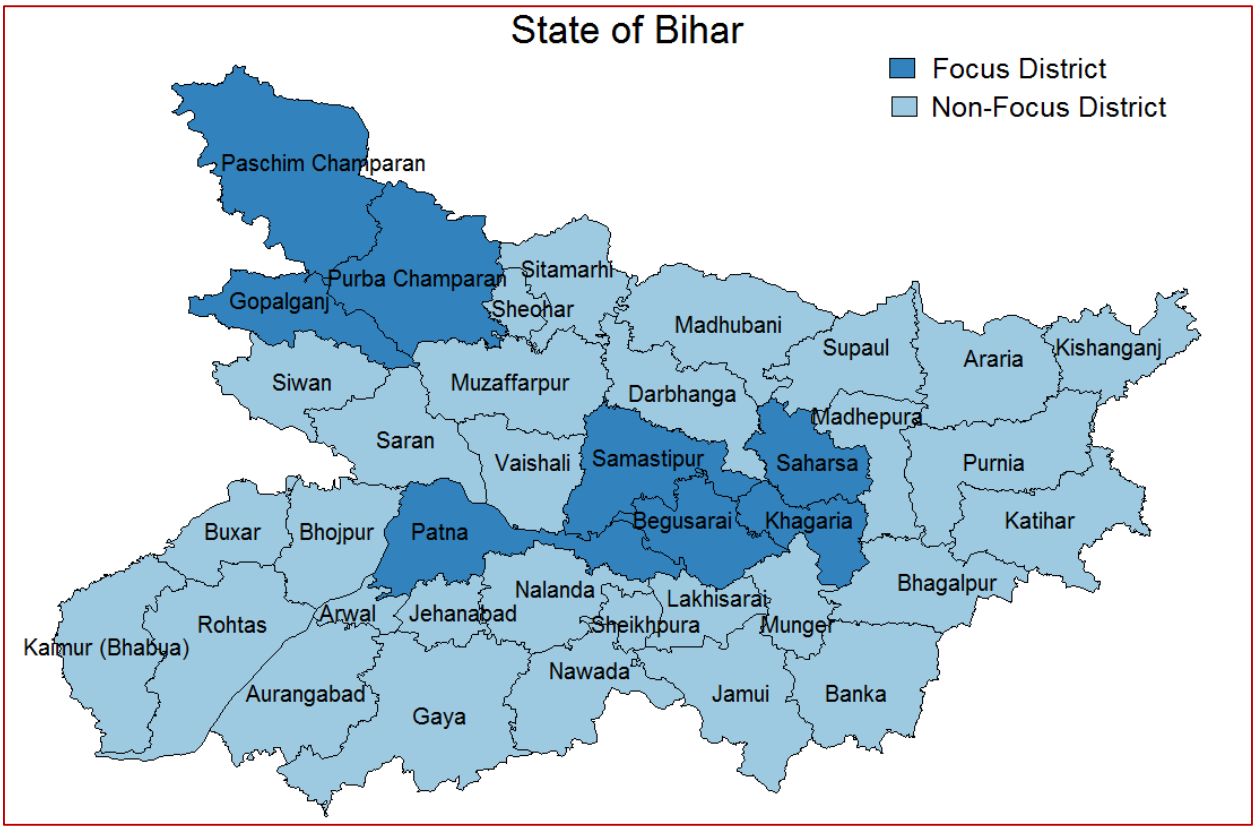
B. Comparison group design

1. Motivation for comparison group design and identification of the comparison group

The simplest approach to estimating these impacts would be to examine changes in outcomes between baseline and midline in the focus districts. However, it would be difficult to attribute these changes to Ananya, because they could partly reflect underlying trends or other interventions across the state or all of India. The possibility of changes in outcomes unrelated to

Ananya is a particular concern given the dynamic health landscape in Bihar over the past few years and the strong trends in many health indicators even before Ananya.[19]

Figure III.1. The eight focus districts of Ananya



Therefore, to improve the attribution of changes in outcomes to Ananya, we implemented a comparison group design. This design involved comparing changes in key outcomes in the focus districts with changes in similar comparison districts between baseline and midline (an approach known as difference-in-differences). The key assumption for attribution to Ananya is that changes in the focus districts would have been the same as the changes in the comparison districts in the absence of the program. Although this assumption cannot be tested directly, it is more plausible if comparison districts are similar to focus districts in baseline outcomes and related characteristics (such as demographics), and if pre-Ananya trends were similar in focus and comparison districts.

We considered several approaches to selecting comparison districts from the 30 nonfocus districts in Bihar. These methods included (1) matching each focus district to a specific similar nonfocus district, (2) using a weighted combination of the nonfocus districts to maximize similarity with the focus districts, and (3) simply using all the nonfocus districts as they are. After carefully considering these options, we determined that it was optimal to simply use all

[19] As just one example, the neonatal mortality rate decreased from 40 per 1,000 live births in the 2005–2006 NFHS to 32 per 1,000 live births in our 2012 Ananya baseline survey. Additional trends in key health outcomes are described in Appendix E.

nonfocus districts as the primary comparison group.[20] These nonfocus districts were very similar to focus districts in key outcomes or demographics at baseline, and there was no evidence of systematic differences in pre-Ananya time trends using existing data sources (see Appendix A for details), suggesting that the key assumption of the comparison group design is likely to be satisfied.

For outcomes measured at baseline and midline, the comparison group design therefore enabled us to plausibly attribute the estimated difference-in-differences to the impacts of Ananya. Nevertheless, some caution is still necessary in making this attribution because of possible unobserved differences between focus and comparison districts in the evolution of outcomes over time. The degree of attribution is therefore lower than in an experimental design; rather, the design should be viewed as a quasi-experiment.

By using a comparison group, we aim to account for underlying trends in key outcomes in the focus districts that are unrelated to Ananya in the impact analysis. In general, we would expect these underlying trends to be positive (if anything), reflecting increased health investments and economic development in Bihar over time. However, for some indicators the trends in the nonfocus districts suggest a negative movement (this is particularly true for some of the indicators related to complementary feeding, which we discuss in Chapter VI). Because these negative trends might be counterintuitive, we highlight any statistically significant negative trends in the nonfocus districts in the report and suggest how to further explore what could be driving them.

At midline, we also measured some outcomes that were not measured (or were measured differently) at baseline. For these outcomes, the lack of a baseline means that we cannot conduct a difference-in-differences analysis. Instead, our analysis is restricted to comparing levels in focus and nonfocus districts at midline.[21] Because focus and nonfocus districts were generally similar in most outcomes at baseline, midline-only comparisons might provide some evidence of the effects of Ananya. However, given the lack of data to adjust for baseline differences in these outcomes, these comparisons have a lower degree of attribution to Ananya, because they could reflect existing baseline differences.[22]

2. Interpretation of estimates from comparison group design

The difference-in-differences impact estimates presented in this report can be interpreted as the impacts of Ananya relative to other interventions that took place in the nonfocus districts (the

[20] We describe more fully the options for selecting the comparison districts and the reasoning behind our preferred choice in a memo we provided to the Foundation (Rotz et al. 2014a). Appendix B investigates the robustness of our results to the main alternative approach that was feasible, which involved a weighted combination of nonfocus districts (known as the synthetic control approach).

[21] Appendix A describes in more detail our technical approach to estimating the difference-in-differences and midline comparisons.

[22] For these outcomes we controlled for baseline levels of related outcomes in the same domain to adjust for existing differences to the extent possible, even though the exact outcome was not available at baseline.

comparison group) over the same period.[23] Because of the activities undertaken by other development partners (described in Chapter II), some improvements in health outcomes in the non-Ananya focus districts between baseline and midline might have been expected. In addition, initial scale-up of Ananya interventions to some of the nonfocus districts began in late 2013, just before the midline, and might have also started to affect outcomes in these districts.[24] Therefore, the impacts of Ananya presented in this report might have been larger if compared with districts in which these other interventions were not implemented.

To determine the extent to which interventions in the Ananya nonfocus districts affect our impact estimates, we investigated the robustness of our results to altering the comparison group. Specifically, we estimated specifications in which we excluded nonfocus districts in which specific development partners were operating—or early scale-up districts—from the comparison group. We also reestimated impacts using only nonfocus districts in which *none* of these partners were intensively working as the comparison group (a clean comparison group).

The findings (Appendix B) suggest that our impact estimates are remarkably robust to these modifications of the comparison group. Therefore, we conclude that the activities of other development partners and early Ananya scale-up did not substantively dampen the estimated impacts of Ananya. This is likely because many of these interventions were implemented in only a handful of nonfocus districts, limiting their scope and ability to affect the overall comparison group. In addition, implementation of many of these other interventions was already well underway by the time of the baseline, suggesting that large changes in outcomes over the evaluation period from early 2012 to early 2014 might not be expected. In contrast, Ananya was rolled out intensively throughout the focus districts over this exact period.

3. Subgroup impact estimates

To answer the key research question relating to the effects of the Ananya interventions for different subgroups, we focus on two types of subgroups. The first consists of women with characteristics typically considered to be marginalized in the Bihar social context—for example, women from SCs/STs, Muslims, illiterate women, and those with low SES—who might have less access to the health care system than nonmarginalized women (see for example Balarajan et al. 2011; Kumar et al. 2014; Pathak et al. 2010; and Ghosh et al. 2014). These subgroups are relevant because some of the Ananya interventions focused specifically on improving the health of more marginalized women. For example, early enumeration and mapping efforts by the IFHI grant sought to identify populations not receiving health services, and these populations are disproportionately composed of marginalized people. Moreover, Ananya sought to improve maternal and child health across the focus districts. If marginalized women initially had poorer

[23] Some of the SDP grant's media-based interventions—specifically the radio and television interventions—were implemented state-wide. Therefore, the difference-in-difference impact estimates net out the effects of these interventions, assuming they were similar in the focus and nonfocus districts. However, if there were complementarities between these and other Ananya interventions in the focus districts (as expected from the program logic), then these are captured by the impact estimates.

[24] There is also a question about whether some of the Ananya interventions might have spilled over to neighboring districts during the evaluation period, potentially diluting observed impacts. However, our process study suggests that most of the interventions implemented in the eight focal districts involved considerable effort on the part of the staff of the grantees, and were not likely to have been easily replicated in other districts (Sridharan et al. 2014).

health behaviors, there would be more room for improvement and Ananya could potentially have a larger impact on these groups. (We address the implications of differential impacts on these marginalized groups for equity in Chapter IX).

The second type of subgroup consists of women and children defined by demographic characteristics, such as the age and gender of the child and the birth parity of the mother. The age of the child is an important factor for age-specific behaviors, such as complementary feeding and immunization. Examining differences by a child's gender is important given the well-known social phenomenon of son preference in India (see for example Oster 2009 and Edmeades et al. 2012), which could be reflected in girls receiving less care than boys (Singh and Parasuraman 2014; Malhotra et al. 2008). Finally, women with different birth parity might be expected to have different patterns of behavior—for example, they could be less likely to seek advice from FLWs if they already have experience with previous births (Singh et al. 2014).

In conducting these subgroup analyses, it is important to be cognizant of the multiple comparisons problem (Schochet 2008). Conducting a large number of hypothesis tests across many outcomes and subgroups can lead to spurious statistically significant findings. For example, examining impacts on 20 outcomes by 10 subgroups will result in 200 hypothesis tests, of which one would expect 10 to be statistically significant (at the 95 percent confidence level) solely by chance. To minimize this problem, we focus on subgroup analyses for a limited set of key outcomes in each domain, and on subgroups for which differential impacts might be expected based on the nature of the outcome or the existing literature.

C. Sample and survey approach

To implement the comparison group design, we used data collected from a cohort of beneficiaries at baseline (early 2012) and from a new cohort of beneficiaries at midline (early 2014). The baseline and midline surveys collected data from households in the same villages, which are representative of all villages in Bihar. These villages were drawn using a multistage sampling approach (starting with a random selection of blocks in each of the 38 districts, and then a random selection of villages within each block).[25] In both survey rounds we conducted a listing to identify for inclusion in our household sample all women in these villages who had a live birth in the previous 12 months (about 13 women, on average).[26] The focus on children born in the previous 12 months (ages 0–11 months) was motivated by the fact that *most* of the interventions on which the evaluation focuses aim to improve outcomes between the last trimester of pregnancy and the child's first birthday. Although we conducted the midline survey in the same villages as the baseline, identifying eligible women based on recent births required a different cohort from that surveyed at baseline.

[25] Appendix A describes the sampling approach in more detail. In urban areas we used urban blocks as the secondary sampling unit rather than the village. The term *village* in this report should therefore be interpreted as *village or urban block.*

[26] As described in Appendix A, villages with more than 150 households were organized into equal-sized segments of 75–150 households, and one segment was randomly selected for the sample. Based on birth rates, we calculated that this segment size would enable us to meet our sample size targets for the number of eligible women in each village.

The midline survey also included an additional sample of children ages 12–23 months in the sampled villages, which was not included at baseline. This new sample enabled us to report some key indicators, such as immunization rates and undernutrition, which are typically reported including children in the 12–23-months-old age group. The additional sample also enabled us to analyze some family planning indicators for a sample of women who gave birth more than 12 months ago. This sample might have been more likely than women who gave birth recently to adopt longer-term family planning methods such as sterilization, giving us a better sense of overall use of these methods. Children in the sampled villages who were ages 12–23 months were identified as part of the listing exercise; because the required sample sizes were smaller than for the 0–11 month-old sample (three children per village, on average), children were randomly selected from the eligible group for inclusion in the survey.

To maximize comparability with the baseline survey, the midline survey instrument for mothers of children ages 0–11 months (those born in the previous 12 months) was largely similar to the baseline instrument. However, we made some changes to reflect changes in the focus of the program and specific areas of interest identified by the Foundation or grantees, and to gain a stronger understanding of specific program interventions. Table III.1 shows the domains included in the final midline survey instruments and some example items (the full instruments are available on request). Most of the changes involved adding or removing entire questions from the baseline instrument, although we also made minor changes to the wording of some existing questions to reflect lessons learned from the baseline. For example, we determined that understanding of the term *maternal danger signs* at baseline was poor and, therefore, included examples of specific danger signs in these questions.[27] The survey for the 12–23-months-old sample was an abbreviated version of the 0–11-months-old survey that removed questions whose answers would be difficult to recall for women who gave birth more than a year ago (especially regarding pregnancy, delivery, and newborn care).

Table III.1. Domains and example items from the midline household survey

Domain	Example items
Labor and delivery	Place of delivery; cord care; initiation of breastfeeding
Postpartum and well-baby care	FLW postpartum visits; exclusive breastfeeding; complementary feeding
Immunization	Vaccinations from cards or self-reports
Reproductive health	Use of contraceptive methods; fertility plans
Quality of care (FLWs)	Tools used by FLWs
Community groups	Membership and participation in groups
Media and other information	Access to media; interaction with BBC interventions
Anthropometry	Height and weight
Water, hygiene, and sanitation	Open defecation; hand washing
Domestic violence	Emotional and physical abuse by spouse
Demographics and household characteristics	SC/ST status; dwelling characteristics; food security

[27] In all of our analyses that use baseline and midline data to estimate impacts (difference-in-differences estimates), the questions used to construct the relevant indicators were identical in the two rounds unless otherwise noted. For indicators for which we modified the relevant questions in the midline instrument, we largely focus on the midline-only comparison between focus and nonfocus districts to ensure comparability.

D. Data collection

1. Survey timing and approach

The baseline survey was conducted from January to April 2012, and the midline survey was conducted from January to April 2014. A team from Sambodhi led the midline data collection effort, working closely with Mathematica staff. The listing surveys used to identify eligible women for the household survey were conducted using a CSPro application installed on mobile handsets, whereas the household survey was conducted using a computer-assisted interviewing CSPro program on notebook computers. On average, the household survey took about two hours to complete.

Sambodhi and Mathematica implemented several procedures and checks throughout the data collection process to ensure the quality of data. First, we extensively piloted the instruments before fielding, identifying and adjusting problematic questions and ensuring that the survey length was appropriate. Second, we conducted rigorous trainings for investigators, which included seven days of training, two days of field practice and two days of debriefing after each day of field practice, as well as a written quiz to gauge understanding and select investigators for the survey. Third, we implemented a multitier supervision plan that included experienced observers who accompanied investigators to some interviews, supervisors who conducted back-checks of specific questions for one to three interviews in each village, and external observers from Sambodhi and Mathematica who observed some of the interviews. Feedback from these supervisory activities was shared with individual investigators (for example, through an observation form completed by observers), with teams of investigators during regular debriefs sessions in the field, and with the full group of investigators through written summaries of team debriefs.

To help validate the data collected through our baseline and midline surveys, we compared the findings for key indicators to trends in other external data sources and found that they were generally consistent (see Appendix E for details).

2. Response rates

The response rates to our baseline and midline surveys were high (Table III.2). The response rate for the 0-11 month old sample was 89 percent at baseline (13,069 completed interviews) and 87 percent at midline (12,015 completed interviews). The response rate for the additional 12-23 month old sample that was included at midline only was 89 percent (2,549 completed interviews).[28] Overall, these high response rates suggest that the survey effort was successful in interviewing the targeted populations.

[28] The final analysis sample excluded mothers of children who had aged beyond the targeted age range because of a delay between the listing survey and household survey (about 2 percent of the total sample). In addition, because we surveyed mothers of children who were born in the previous 12 months, some children had died by the time of the survey. To ensure that we had a consistent sample across indicators, some of which were not applicable to children who had died, the final analysis sample also excluded mothers of these deceased children (also about 2 percent of the total sample). The final analysis sample sizes were therefore 12,384 (baseline, 0–11months); 11,654 (midline, 0–11 months); and 2,489 (midline, 0–23 months). The results for the 0–11-month-old sample are highly robust to including the small sample of mothers of children who had died—the means for most indicators changed by a

Table III.2. Sample sizes and response rates

Indicator	Baseline (January-April 2012) Completed	Baseline (January-April 2012) Response rate (percentage)	Midline (January-April 2014) Completed	Midline (January-April 2014) Response rate (percentage)
Listing survey	110,094	94.3	103,551	96.2
Household survey (0-11 months old)	13,069	88.9	12,015	90.7
Household survey (12-23 months old)	NA	NA	2,549	92.4

NA = not applicable.

3. Sample characteristics

The demographic and socioeconomic characteristics of the surveyed women provide important context about the population targeted by the Ananya program (Figure III.2).[29] Almost 90 percent of women in our midline sample live in rural areas; by virtue of our sampling design, this is identical to the proportion of rural dwellers in Bihar in the 2001 census. About 83 percent of the midline sample is Hindu (almost all of the rest are Muslim), whereas 26 percent of all women belong to SCs/STs and 58 percent belong to other backward classes. Levels of education are low, with only 46 percent of the sample being able to read and write. Most of the demographic characteristics of our sample are similar to those in the baseline survey (Rangarajan et al. 2013). However, the percentage that is literate is higher than at baseline (the baseline rate was 38 percent), reflecting a new sample of women who were born slightly later and hence were more likely to attend school than the baseline sample. These demographic characteristics are also similar to those reported in other health surveys in Bihar, such as the National Family Health Survey (NFHS), District-Level Household and Facility Survey (DLHS), and Annual Health Survey (AHS).

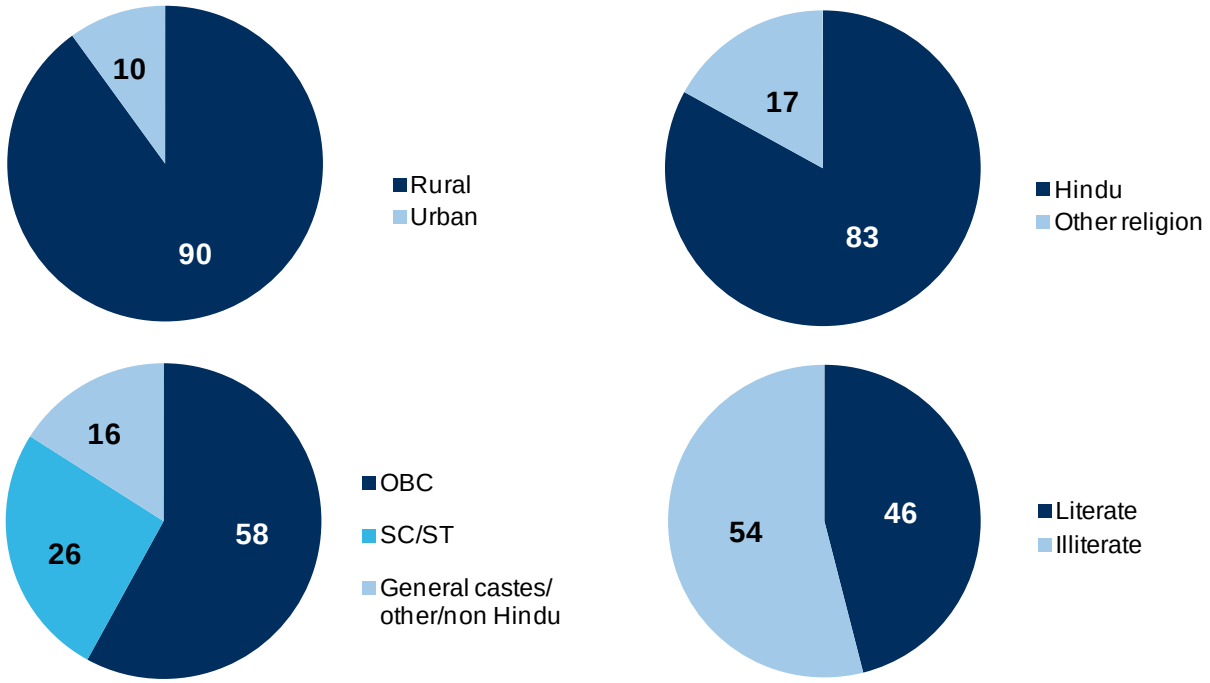
Because the target population for the midline surveys consists of women who gave birth recently (in the previous two years), our sample is younger and has lower birth parity relative to other health surveys in Bihar that include all women or all women of reproductive age (Figure III.3). The median respondent in our midline sample is 25 years old, with about 30 percent of the women surveyed having recently given birth to their first child and about 40 percent having given birth to three or more children to date. The ages of our midline sample of children (focal children)—which consists of the most recent child born to each woman—range from 0 to 23 months of age, with some variation in the age distribution within that range due to seasonality of births. There is also a gender imbalance in our sample of children: about 53 percent are male and 47 percent are female. Except for the age of the focus child, which is

(continued)

fraction of a percentage point, if at all. There was no consistent pattern in the small differences that did exist in key newborn care indicators between the main analysis sample and the sample of mothers of children who had died, except that the latter were more likely to report birth complications.

[29] We report characteristics for the full sample of mothers of 0–23-month-old children across Bihar. The characteristics of mothers of 0–11-month-old children, the focus of much of our analysis, are very similar. These characteristics are also very similar if the sample is restricted to the eight focus districts.

Figure III.2. Basic demographic characteristics of the midline sample

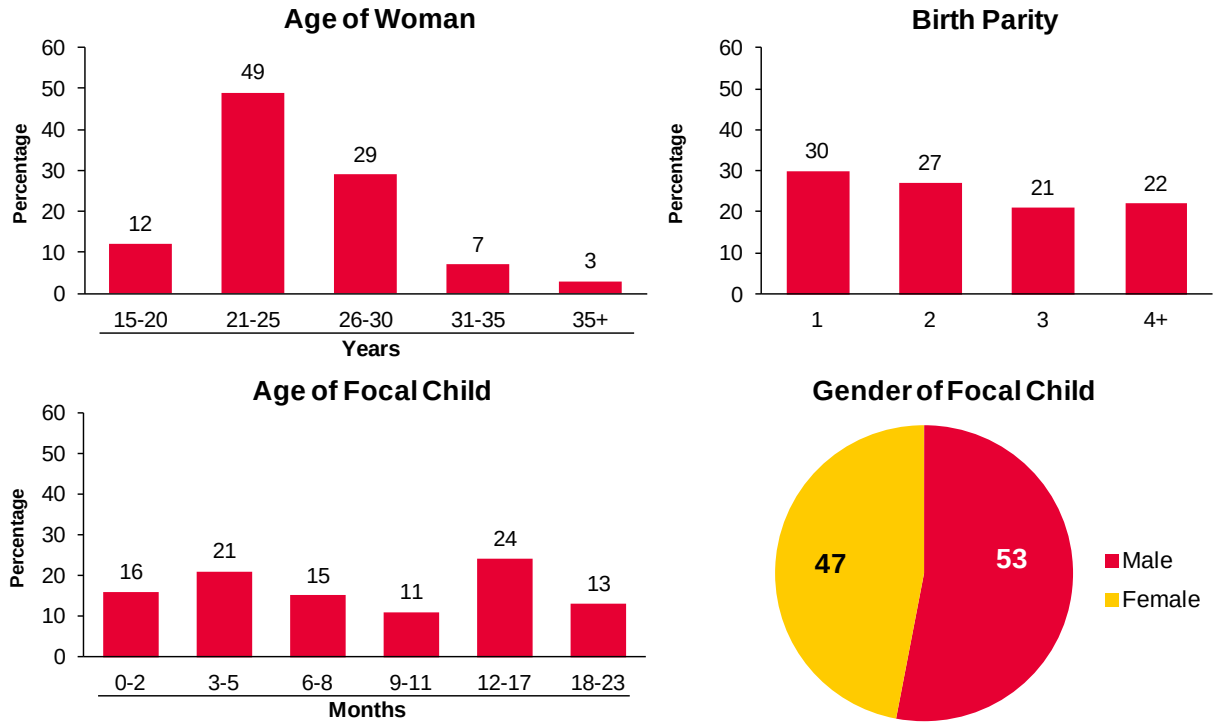


Source: Women with children 0–23 months old in the Ananya midline survey (2014).

Notes: SC/ST is scheduled caste/scheduled tribe. OBC is other backward classes. All numbers are based on the weighted sample and are representative of all mothers of children ages 0–23 months in Bihar. N = 14,143.

affected by the inclusion of 12–23-month-old children, these characteristics are very similar to those of our baseline sample (Rangarajan et al. 2013). In contrast, the median respondent in the 2007–2008 DLHS (an example of a survey sampling all women of reproductive age in Bihar) was 29 years old and about half of the women in that sample had given birth to three or more children.

Figure III.3. Age, birth parity, and gender of the midline sample



Source: Women with children 0–23 months old in the Ananya midline survey (2014).

Notes: All numbers are based on the weighted sample and are representative of all mothers of children 0–23 months old in Bihar. N = 14,143.

IV. EXPOSURE TO KEY PROGRAM ELEMENTS

As described extensively in Chapter I, the Ananya program included several interventions that aimed to increase coverage and service uptake and facilitate behavior change among beneficiaries. These approaches included interventions related to improving the skills and performance of FLWs, encouraging behavior change through a multifaceted communication strategy, and integrating health messages into community groups for marginalized women.[30] Examining the impact of Ananya on exposure to these interventions is an important first step in analyzing the impact of Ananya on health outcomes. We focus our analysis on three main measures of program exposure related to the Ananya theory of change: (1) FLW home visits and other FLW–beneficiary interactions, (2) media messages about key behaviors, and (3) participation in community groups by marginalized women.

A. Number of FLW home visits

By supporting a complete mapping of beneficiary households and through monthly subcenter meetings to improve the skills and confidence of FLWs, the Ananya program aimed to increase the number of FLW–household interactions. The program had a specific focus on encouraging home visits, during which FLWs were to provide important health-related information to households. The midline survey focused on capturing home visits by FLWs at several points in the continuum of care, including the last trimester of pregnancy and the postpartum period (with visits in the first 24 hours, first week, and first month after delivery), as well as home visits specifically related to complementary feeding, and family planning during pregnancy and after delivery. Our analysis of FLW visits is based on these beneficiaries' reports, because we did not conduct FLW surveys at midline (we did conduct these surveys at baseline,

Key findings from this chapter

- Ananya had a substantial impact on the number of FLW–beneficiary interactions during pregnancy, but impacts on postdelivery interactions were more modest.
- Ananya improved the quality of FLW–beneficiary interactions—in terms of the advice provided, duration of visits, and use of job-aid tools—across the continuum of care.
- Exposure to media-based interventions was limited, likely because much of Bihar is without access to media resources.
- Participation in community groups by marginalized women was also limited, likely because the community group interventions began full implementation only shortly before the midline and because they were implemented only in a subset of blocks in the focus districts, which had limited overlap with the evaluation sample.

[30] As discussed in Chapter I, the community mobilization grant awarded to PCI is unlikely to have substantially affected outcomes by midline, but we include it here for completeness.

but found that FLWs tended to give socially desirable responses when asked about their interactions with households).[31]

1. Home visits during pregnancy

Encouraging multiple FLW home visits during the final trimester was a specific focus of the Ananya program, to encourage birth preparedness and appropriate newborn care through repeated messaging. We found strong and statistically significant impacts on the proportion of beneficiaries reporting two or more home visits by FLWs in the final trimester of pregnancy (Figure IV.1).[32] The proportion of women reporting any home visit in the final trimester increased from 33 to 39 percent in the focus districts but decreased from 36 to 32 percent in the nonfocus districts. The difference in these changes (the difference-in-differences), which we interpret as the impact of Ananya, was a statistically significant 10 percentage points (about one-third of the baseline focus district mean) after we adjusted for differences in demographic characteristics.[33] The decrease in final-trimester home visits in the nonfocus districts is statistically significant at the 5 percent level, and further analysis showed that it was driven entirely by decreases in a handful of nonfocus districts.[34] Further discussions with government officials at the state and district levels could help determine the possible reasons for the decrease in these districts if stakeholders are interested in exploring this further.

We also examined the variation in impacts on final trimester home visits by key subgroups. Because of the IFHI grant's efforts in encouraging enumeration and mapping of beneficiaries by FLWs, Ananya might have resulted in larger impacts on home visits for marginalized women who might otherwise have not been enumerated. The estimated impact on two or more final trimester visits was indeed larger for most marginalized groups—for example, SC/ST women (14 versus 7 percentage points for non-SC/ST women), illiterate women (13 versus 5 percentage points for literate women), and Muslim women (13 versus 9 percentage points for non-Muslim women) (not shown). However, the only difference in impacts that was statistically significant was for women in the lowest SES quartile (17 percentage points, significant) versus the highest

[31] To capture relevant home visits, we intended to focus on home visits in which the FLW provided health-related information, not social visits or visits made purely to provide specific services such as weighing the child or accompanying the child for immunization. However, this instruction to interviewers was emphasized more stringently in the midline compared with the baseline, which might have dampened measured changes over time. Nevertheless, because this instruction was the same in the focus and nonfocus districts, our impact estimates should not be substantially affected.

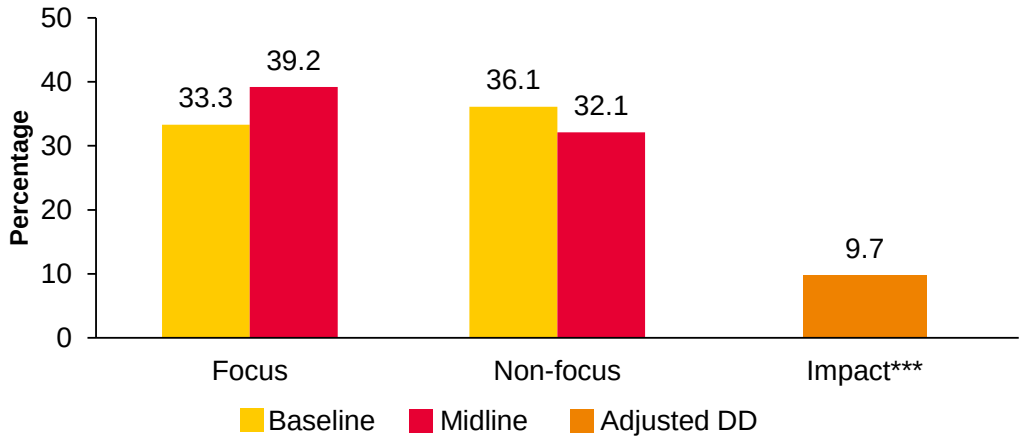
[32] For all questions on FLW home visits in the final trimester and postpartum periods, we explored whether recall error for women who gave birth several months before could affect the estimated means and impacts. However, the results were very similar when the sample was restricted to women who gave birth in the previous 2 or 6 months. Therefore, to maximize the sample size and statistical power, we focus on the results for the full sample of women who gave birth in the previous 12 months.

[33] Throughout this report, we focus on difference-in-differences (and simple difference) estimates that are regression-adjusted using control variables, as described in Appendix A (these controls are primarily demographic characteristics). The unadjusted differences were generally very similar in magnitude but less precisely estimated.

[34] The three nonfocus districts with the largest decreases were Sheikhpura, Araria, and Supaul. Although our estimates of district-level changes are imprecise due to small sample sizes, these districts showed statistically significant decreases. Omitting these districts from the analysis reduces the change in the nonfocus districts to almost zero.

quartile (3 percentage points, not significant). We also examined impacts by parity, because women who are more experienced in childbirth might not have the same needs in terms of FLW visits as those who are less experienced. However, the impacts were similar in magnitude (8 percentage points for first birth versus 11 percentage points for third or later birth), and not statistically different.

Figure IV.1. Received two or more home visits from an FLW in the final trimester of pregnancy



Source: Women with children ages 0–11 months in Ananya baseline and midline surveys.

N = 12,310 (baseline), 11,651 (midline).

*p < 0.10, **p < 0.05, ***p < 0.01 for adjusted difference-in-differences.

DD = difference-in-differences.

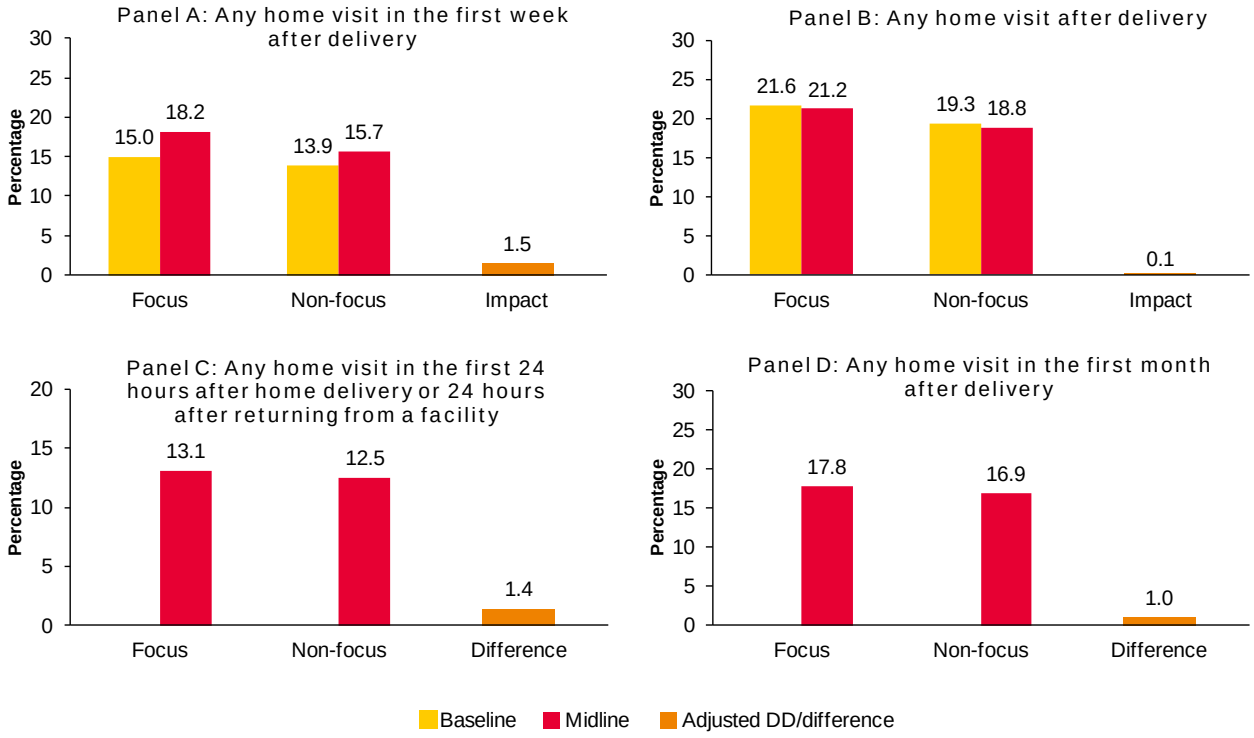
2. Home visits after delivery

In contrast, impacts on home visits after delivery were generally statistically insignificant (Figure IV.2). Specifically, there were no impacts on home visits in the first week after delivery (with similar increases over time in the focus and nonfocus districts, possibly reflecting other programs focused on newborn care in nonfocus districts) or any home visit since delivery (almost unchanged in the focus and nonfocus districts). Home visits in the first 24 hours after home delivery or within 24 hours after returning from a facility delivery, and within the first month of delivery—both of which we measured at midline only—were also similar in the focus and nonfocus districts.

More generally, and consistent with our results, PNC has been reported to be more neglected than ANC and delivery services in India (Kumar et al. 2014; Singh et al. 2012a). Even though postnatal indicators such as women receiving check-ups in the first 48 hours and within two weeks of delivery are expected to be tracked by the health management information system in India (Ministry of Health and Family Welfare 2014), this still remains a neglected area. It is possible that PNC might still not be adequately emphasized in the training and monitoring of FLWs, despite the efforts of Ananya. Another potential contributor could be that, although FLWs receive monetary incentives for taking women for institutional deliveries, there is no such incentive for PNC, which could lead to relative demotivation among FLWs to conduct these

visits. Overall, our findings indicate that the level of home visits after delivery was still relatively low at midline, and that this dimension of interactions offers much room for improvement.

Figure IV.2. Received home visits from an FLW after delivery



Source: Women with children ages 0–11 months in Ananya baseline and midline surveys.

N = 11,640–12,384 (baseline), 11,652–11,654 (midline).

*p < 0.10, **p < 0.05, ***p < 0.01 for adjusted difference-in-differences and differences.

3. Home visits related to complementary feeding and family planning

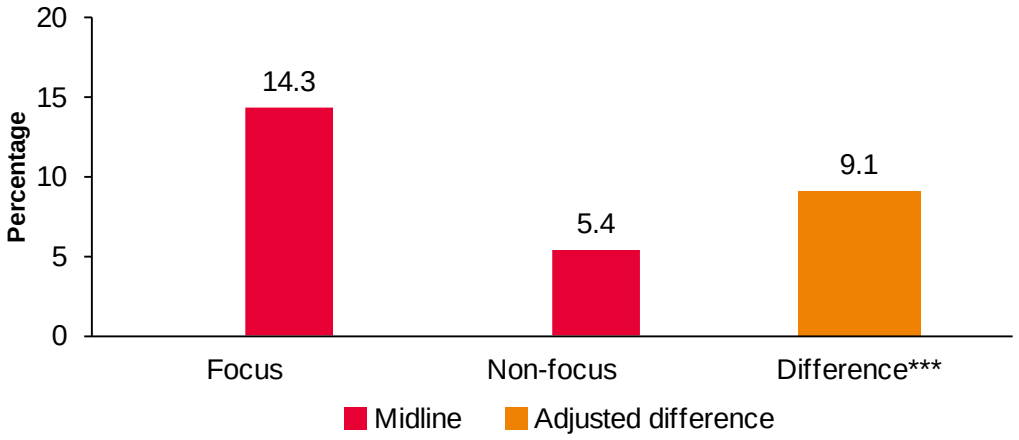
The Ananya program also encouraged FLWs to conduct home visits to promote appropriate complementary feeding and to discuss family planning with mothers. To explore the extent to which this interaction occurred, we captured FLW home visits specifically related to complementary feeding (for children 5 months or older, for whom these visits are most relevant, measured at midline only) and family planning (during pregnancy and after delivery, measured at baseline and midline).[35]

The differences in visits related to complementary feeding were significant, but those related to family planning were not. Specifically, beneficiaries in the focus districts were almost three times as likely to receive a visit related to complementary feeding than those in the nonfocus districts at midline, although only about 15 percent of beneficiaries in focus districts reported these visits (Figure IV.3). Increases in the proportion reporting visits specifically related to family planning during pregnancy and after delivery were larger in the focus districts compared

[35] The question on family planning during pregnancy might have captured some interactions outside of home visits, because it asked more broadly about "discussions with FLWs." In addition, some visits to discuss family planning could have overlapped with last trimester and postdelivery visits described earlier.

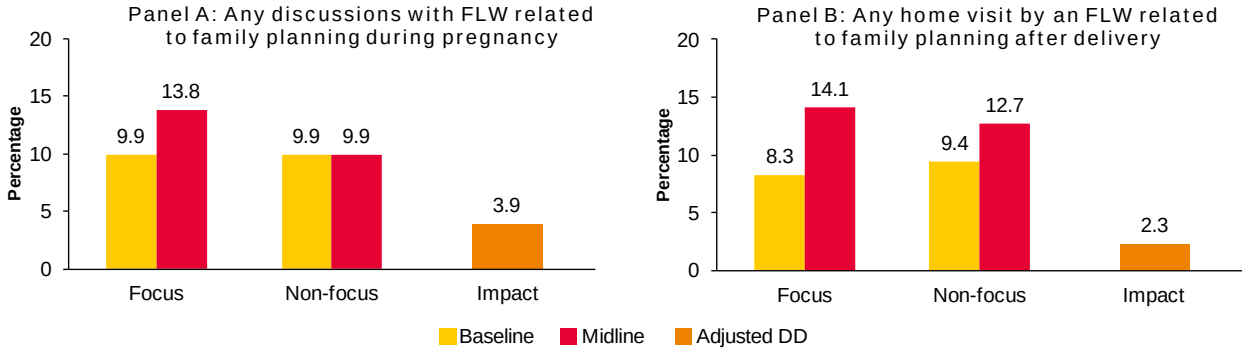
with the nonfocus districts, but the impacts were not statistically significant (Figure IV.4). At midline, about 15 percent of women in the focus districts reported each of these types of family planning visits.

Figure IV.3. Received any home visit from an FLW related to complementary feeding, mothers of children 5–11 months old



Source: Women with children ages 5–11 months in Ananya midline survey.
N = 6,229
*p < 0.10, **p < 0.05, ***p < 0.01 for adjusted differences.

Figure IV.4. Received visits by an FLW related to family planning



Source: Women with children ages 0–11 months in Ananya baseline and midline surveys.
N = 12,384 (baseline), 11,654 (midline).
*p < 0.10, **p < 0.05, ***p < 0.01 for adjusted difference-in-differences.

B. FLW interactions outside of home visits

Although Ananya focused on increasing FLW–beneficiary interactions through home visits (and gathering information on home visits was the primary focus of our surveys), interactions could have also taken place outside of home visits. For example, because FLWs generally belong to the local community, beneficiaries could be coming across FLWs informally in a variety of social settings and receive advice from them on such occasions. Better understanding the prevalence of these types of interactions could be informative about the value of expanding the focus on interactions beyond home visits. Although we did not directly measure interactions with

FLWs outside the home, we are able to provide some inference about such interactions. Specifically, we analyzed three domains—pregnancy and delivery preparation, complementary feeding, and family planning—in which we asked women whether they received information from FLWs more generally, not restricted to home visits. By comparing these reports with reports of information received in these domains during home visits, we can provide some suggestive evidence on the relative importance of interactions outside of home visits.

The importance of information outside of home visits varies by domain. For delivery preparation, reports of receiving general information from FLWs were similar to reports of last-trimester home visits (Table IV.1).[36] Therefore, home visits are likely to be the major forum for receiving information from FLWs during pregnancy.[37] However, the proportion of women who reported they received information on complementary feeding and family planning from FLWs in the previous year is substantially higher than the corresponding reports of home visits related to these domains, suggesting that discussions related to these topics are taking place outside of

Table IV.1. Interactions with FLWs in focus districts at midline (percentage of beneficiaries)

	Focus district mean	Nonfocus district mean	Adjusted midline difference
Pregnancy and delivery preparation			
Received any FLW visit in final trimester	45.7	42.3	3.4
Received any relevant information from an FLW in the previous year	41.3	34.9	7.8***
Complementary feeding (children 5–11 months old)			
Received any FLW visit related to complementary feeding	14.3	5.4	9.1***
Received any relevant information from an FLW in the previous year	29.2	19.2	11.4***
Family planning			
Had any discussions with an FLW about family planning during pregnancy	13.8	9.9	3.6***
Received any FLW visit related to family planning since delivery	14.1	12.7	0.4
Received any relevant information from an FLW in the previous year	27.5	22.4	3.6*

Source: Women with children ages 0–11 months in Ananya midline survey (pregnancy and family planning interactions), women with children ages 5–11 months in Ananya midline survey (complementary feeding interactions).

N = 1,640–1,641 for complementary feeding, otherwise N = 3,089–3,092.

*$p < 0.10$, **$p < 0.05$, ***$p < 0.01$ for adjusted differences.

[36] The slightly lower reports of any information received from FLWs compared with last-trimester home visits could reflect, for example, that some last-trimester home visits did not explicitly cover topics related to pregnancy and delivery preparation.

[37] Beneficiaries could be interacting with FLWs during pregnancy in a number of ways outside of home visits. For example, at midline, 81 percent of beneficiaries in the focus districts reported registering their pregnancies with an FLW, 61 percent reported receiving ANC from an FLW, and 37 percent reported that they were accompanied by an FLW for facility delivery. However, receipt of health-related information during these interactions might be limited, in which case they would not affect the reports in Table IV.1.

home visits. The corresponding numbers for general receipt of information were significantly lower in nonfocus districts compared with focus districts. From a programmatic perspective, it might be important to further understand the value and quality of interactions during home visits and interactions outside of home visits, and assess how to leverage the contacts outside of homes to drive behavior change.

C. Quality of FLW interactions

In addition to increasing the number of FLW–beneficiary interactions, the Ananya theory of change relies on improving the quality of these interactions. To improve quality, the program's subcenter meetings sought to improve FLWs' knowledge about appropriate health behaviors, emphasized which health-related messages to provide to households throughout the continuum of care, and taught FLWs how to improve their interpersonal communication skills. As we describe in Chapter I, FLWs were also provided with the mobile kunji and other tools to assist them in more effectively communicating with households.

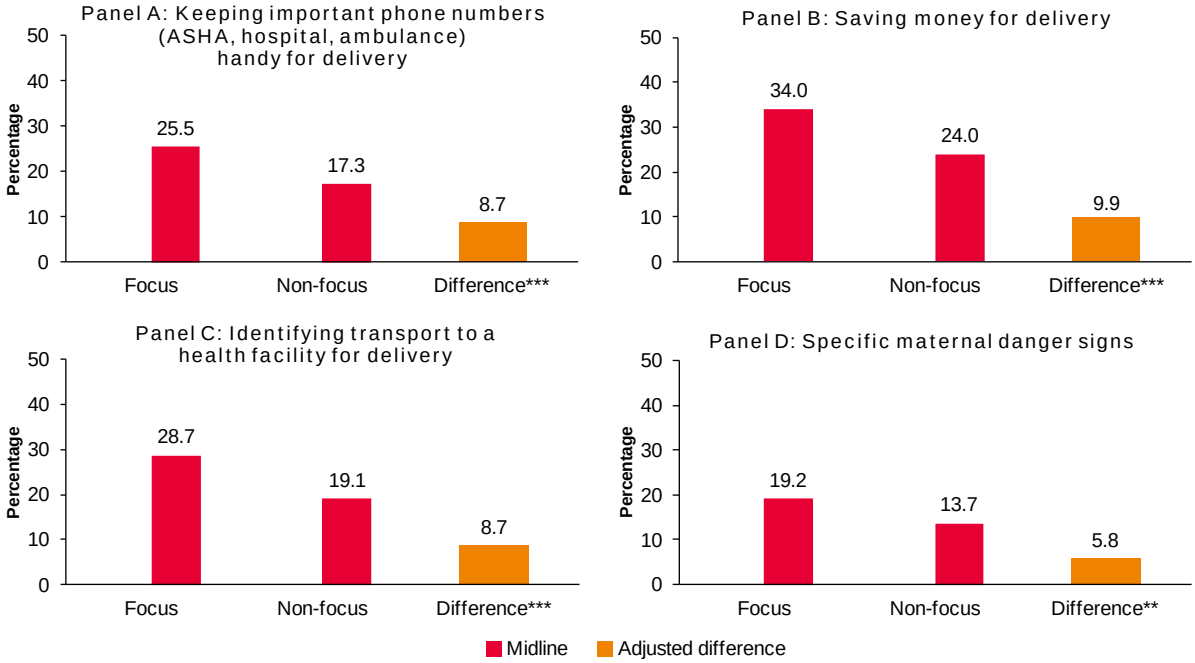
The ideal measures of the quality of FLW home visits would include a detailed assessment of the content of interaction between the FLW and the mother. Observation of these interactions, vignettes for FLWs, and interview of mothers soon after the interaction are other potential options for understanding the quality of FLW home visits. Although these approaches would enable a more detailed assessment and reduce recall error, the bias introduced by direct observation could be a significant limitation. In addition, these approaches would be substantially more resource-intensive. They were therefore not feasible for the midline evaluation, but could be considered as part of future Ananya evaluation efforts.

We therefore focus on three measures available in our midline survey that could reflect visit quality: (1) receipt of targeted advice from FLWs, especially during home visits; (2) duration of home visits; and (3) use of Ananya job tools in home visits. These measures are likely to be correlated with quality, although not perfectly so. For example, improved FLW knowledge and skills could eventually reduce the need for use of job tools, whereas longer home visits reflect quality only to the extent that they might relate to the amount or effectiveness of information provided. Therefore, these measures should be viewed as suggestive of improved quality.

Consistent with the higher proportion of women reporting receiving information from FLWs on pregnancy and delivery preparation in focus versus nonfocus districts, there was a significant difference in the proportion of women receiving targeted advice on topics related to pregnancy or delivery (Figure IV.5).[38] Specifically, reports of discussions of topics related to birth preparedness (such as keeping important telephone numbers available, identifying transportation to a facility, and saving money for delivery) and maternal danger signs were significantly higher in focus districts. Similarly, discussions of newborn care were also reported by a significantly higher proportion of women for topics such as clean cord care, skin-to-skin care, and immediate breastfeeding, though not for newborn danger signs (Figure IV.6).

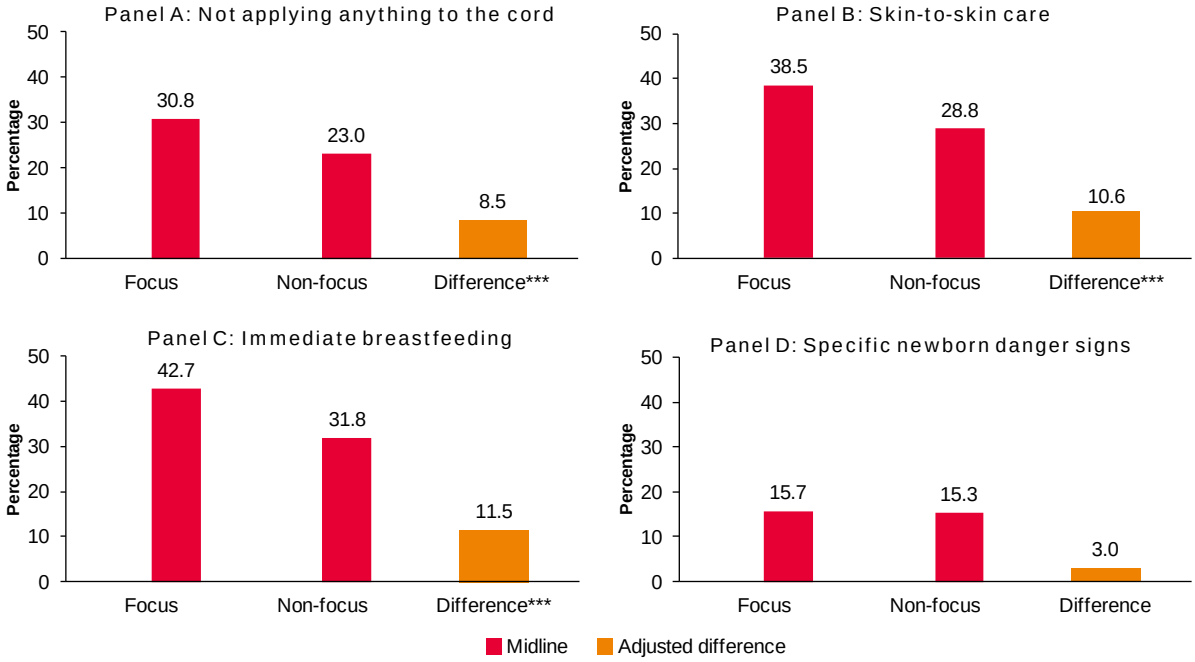
[38] The questions on advice during pregnancy were not restricted to home visit interactions.

Figure IV.5. Received advice from FLWs during pregnancy on pregnancy and delivery topics



Source: Women with children ages 0–11 months in Ananya midline survey.
N = 11,654.
*$p < 0.10$, **$p < 0.05$, ***$p < 0.01$ for adjusted differences.

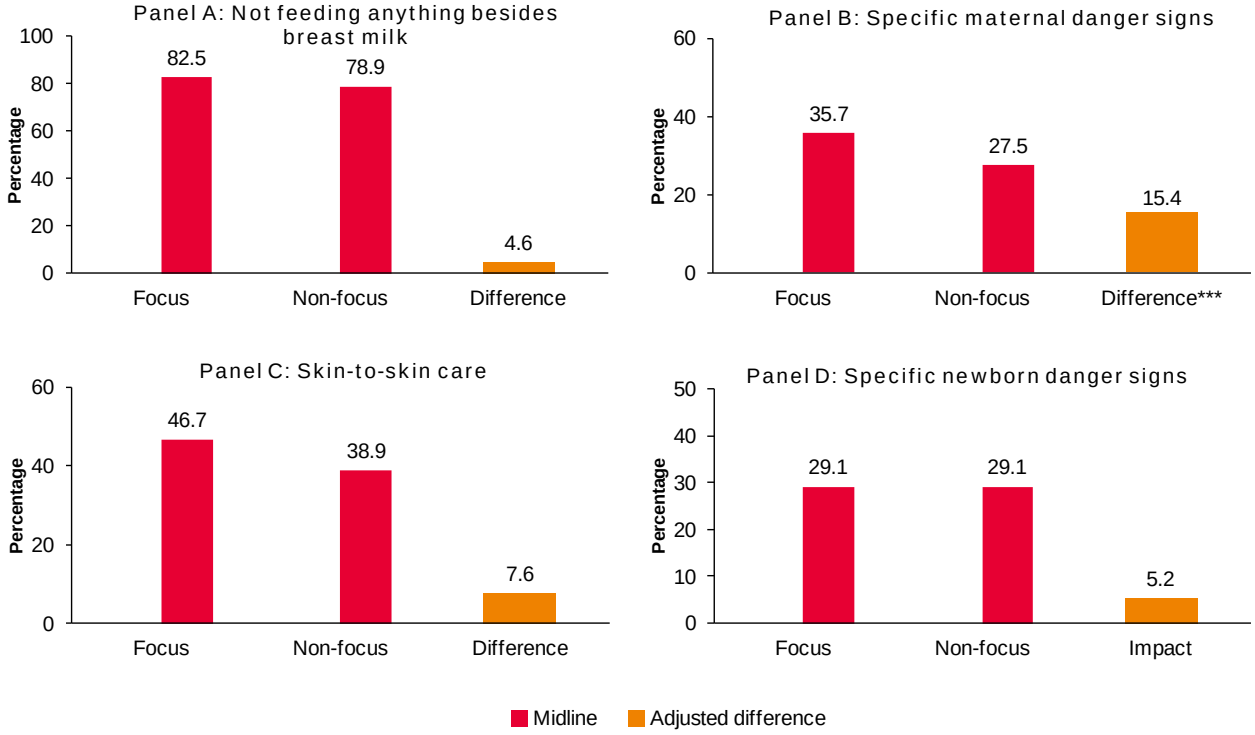
Figure IV.6. Received advice from FLWs during pregnancy on newborn care topics



Source: Women with children ages 0–11 months in Ananya midline survey
N = 11,654.
*$p < 0.10$, **$p < 0.05$, ***$p < 0.01$ for adjusted differences.

We also examined discussions of targeted topics in home visits after delivery, among women reporting such a visit. The percentage discussing topics such as exclusive breastfeeding, skin-to-skin care, and specific maternal and newborn danger signs during home visits within the first week of delivery were generally slightly higher in the focus districts compared with the nonfocus districts (Figure IV.7). However, because the sample receiving a visit within the first week was relatively small (less than one-fifth of the total), few of these differences were statistically significant and they were often sensitive to the inclusion of control variables in the regression adjustment used to estimate the differences (not shown).

Figure IV.7. Received advice from FLWs in the first week after delivery on targeted topics, among those with home visits



Source: Women with children ages 0–11 months in Ananya midline survey who received an FLW home visit in the first week after delivery.

N = 1,764.

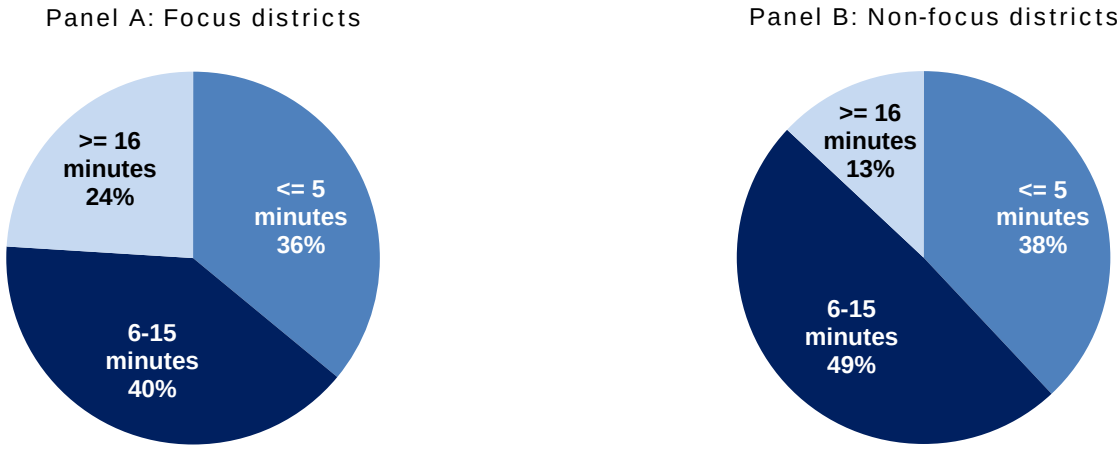
*p < 0.10, **p < 0.05, ***p < 0.01 for adjusted differences.

The duration of the most recent home visit in the previous six months, another measure that could be related to visit quality, was longer in the focus districts compared with the nonfocus districts at midline (Figure IV.8).[39] Although the proportion of home visits lasting 5 minutes or fewer was similar, the proportion lasting more than 15 minutes was almost twice as large in the focus districts (about one-quarter of home visits). Mean visit duration was 2 minutes longer in the focus districts (12 minutes compared with 10 minutes, statistically significant at the

[39] The potential for recall error suggests that visit duration might be an imprecise measure of quality. However, almost three-quarters of visits for which this measure was reported took place in the previous 30 days, reducing concerns about recall error.

10 percent level). The longer duration of visits could be related to increased use of the job tools that we describe later in this report; for example, visits in which mobile kunji was used were 15 minutes, on average, compared with 10 minutes for those in which it was not used (not shown).

Figure IV.8. Duration of the most recent FLW home visit, among those who received a home visit in the previous six months



Source: Women with children ages 0–11 months in Ananya midline survey who received an FLW home visit in the previous six months.

Note: Mean visit duration was 12 minutes in the focus districts and 10 minutes in the nonfocus districts. The difference of 2 minutes was statistically significant at the 10 percent level.

N = 1,989.

*$p < 0.10$, **$p < 0.05$, ***$p < 0.01$ for adjusted differences.

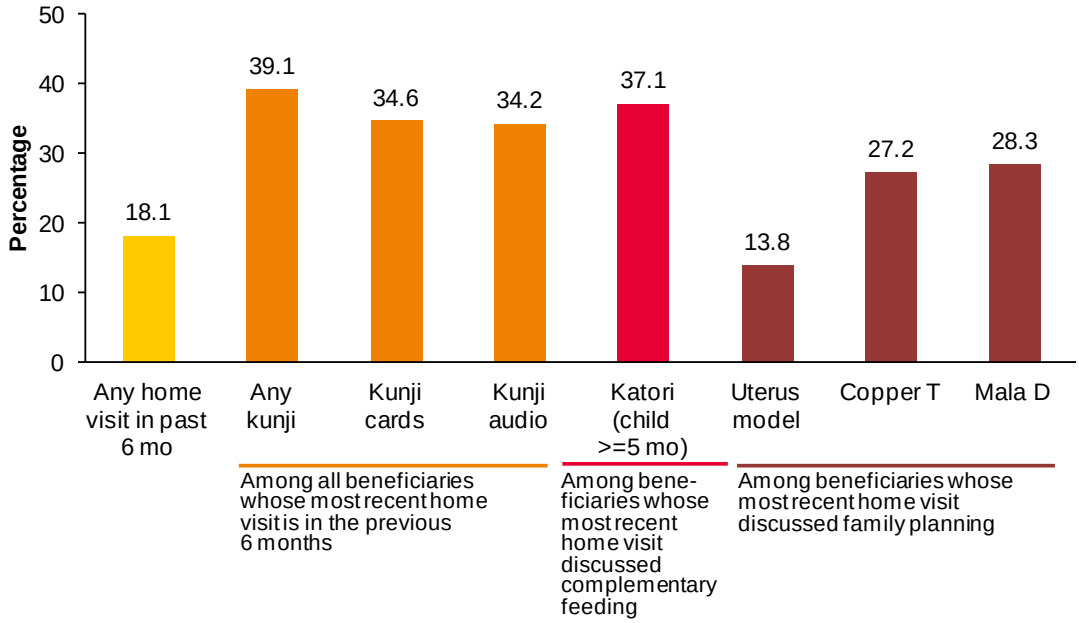
We also asked beneficiaries about whether the FLWs used job tools introduced by Ananya to improve communication on health-related issues. In particular, as we mentioned in Chapter I, the Ananya program introduced the mobile kunji tool, which includes picture cards with information on health topics and a short code that beneficiaries can dial to hear a recorded health message from the fictional character Dr. Anita. The program also introduced a job-aid kit for FLWs that included implements such as a bowl (katori) to demonstrate for mothers how and how much to feed the child, a uterus model and copper-T to demonstrate how an intrauterine device (IUD) can be effective, and so on.

Focusing on the most recent home visit, 35 percent of beneficiaries in focus districts at midline reported use of mobile kunji cards and 34 percent reported using mobile kunji audio (Dr. Anita); 39 percent reported using kunji cards *or* audio (Figure IV.9).[40] Use of the katori (bowl), a tool designed to promote complementary feeding, was reported by 37 percent of beneficiaries who discussed complementary feeding in the most recent home visit. Use of the tools related to family planning among those who discussed family planning in the most recent home visit was 14 percent for the uterus model, 27 percent for copper-T (an IUD device), and 28 percent for mala-D (contraceptive pills). Although the sample sizes for use of complementary

[40] We also asked about use of kunji and other tools in home visits in the previous six months, but these reports were very similar to those for the last visit that we report here.

feeding and family planning tools are low, the evidence suggests that many FLWs used these tools during home visits related to these topics.

Figure IV.9. Use of Ananya job tools by FLWs in the most recent FLW home visit, among those who received a home visit in the previous six months



Source: Women with children ages 0–11 months in focus districts in the Ananya midline survey.
N = 3,072 (yellow bar), 715 (orange bars), 118 (red bar), and 113 (maroon bars).

Additionally, the use of non-kunji tools in the most recent visit is closely related to use of kunji. Specifically, we compared the mean exposure to non-kunji tools in the most recent visit for beneficiaries who were and were not exposed to kunji in this visit (these means were regression-adjusted for demographic characteristics, using regression [4] in Appendix A). This analysis suggests that use of non-kunji tools was 7 to10 times more likely when kunji was used (not shown). Although these correlations could simply reflect underlying characteristics of FLWs or households (for example, some FLWs might be more motivated and eager to use tools of any type, or households might be more likely to recall tool use if multiple tools were used), they do provide suggestive evidence that kunji and other tools are complements helping FLWs promote behavior change among beneficiaries. That is, when these tools are used, FLWs appear to use multiple tools simultaneously to attempt to change the behavior of beneficiaries, rather than rely on a single tool.

D. Findings on FLW–beneficiary interactions from the process study

A qualitative process study, which we conducted in spring 2013 (about midway between the baseline and midline surveys), provided additional insights about the implementation of the Ananya interventions related to FLWs and how these affected FLW–beneficiary interactions (Sridharan et al. 2014). Qualitative data collected through in-depth interviews with program staff, FLWs, pregnant women, and new mothers informed the study, as did focus groups with

husbands and mothers-in-law of pregnant women and new mothers. These data were collected in five of the eight focus districts and in two nonfocus districts.

1. Findings on implementation of Ananya interventions related to FLWs

The process study provided several important findings regarding the trainings and tools FLWs received, and the extent to which FLWs applied what they had learned. We found that the subcenter platform, IFHI's core intervention, had been well received by FLWs, with many respondents noting that they felt they were receiving useful information. However, participation in subcenter meetings had fluctuated. Meetings were frequently postponed or canceled because the government scheduled last-minute meetings requiring FLWs' participation. Even when meetings were held at the appointed times, FLWs' attendance tended to vary. Respondents reported significant issues of access—subcenters are sometimes far from the villages they cover and transportation is limited. FLWs who belong to a higher class or influential families might take the meetings less seriously and skip them on occasion (according to program staff). Finally, FLWs could miss meetings because of work-related responsibilities, such as accompanying women to facilities for delivery.

As mentioned in Chapter I, the SDP grant also conducted an in-depth interpersonal communications training for FLWs during the subcenter platform meetings. As part of this training, it introduced the mobile kunji tool and coached participants on how to use the "Sales Cycle Approach", a five-step methodology for explaining health information to beneficiaries during home visits and persuading them to implement important practices. We found that, in general, IFHI and SDP were effectively coordinating to integrate their training content (on important MNCH practices and effective communication techniques respectively). IFHI invited SDP to attend its subcenter meetings and reinforce relevant messages from the interpersonal communications session. For example, if the theme of the subcenter meeting was family planning, the SDP staff member might demonstrate how to use mobile kunji through the family planning cards and audio messages.

2. Findings on FLW–beneficiary interactions

The process study findings suggested that the extent to which FLWs practiced what they learned in subcenter meetings varied considerably by the type of training or tool.

a. Planning and implementing a home visit schedule

As part of the subcenter platform, FLWs were offered training on how to plan and implement a home visit schedule to ensure that households received important MNCH information at all the relevant times. CARE specifies exactly when FLWs should visit households during pregnancy and after a child's birth and trains FLWs on how to use a home visit planner to build and follow a precise home visit schedule.

The training appears to have strengthened FLWs' understanding of the importance of home visits, and many have increased the overall regularity with which they visit households. However, there was less attention to the timeliness of visits. FLWs rarely used the home visit planner and did not closely follow IFHI's recommended schedule for home visits over the 1,000 day period covering the target woman's pregnancy and the first two years of her child's life. The infrequent use of the home visit planner could be linked to several contextual factors.

Low levels of FLW literacy pose one challenge, particularly among ASHAs, who typically have an 8th-grade education. The complexity of the register and the accompanying instructions—on how to identify names for inclusion in the register, calculate the expected date of delivery, build a home visit timeline based on that date and the recommended schedule for visits, update that schedule on the basis of the birth date after the child is born, and so on—can compound the effects of poor reading and writing abilities. Home visit planner use could also be limited because FLWs have so many other registers to fill out. AWWs reported that they have as many as 15 to 20 registers to maintain and update, and they generally choose a few registers based on the current focus of the particular meetings they are attending and update only those records.

In lieu of the home visit planner, a few FLWs used an immunization due list (which contains the birth dates of beneficiaries) or an informal notebook or diary to plan and track home visits. In general, however, few seem to draw on any written records to decide when to visit particular households.

b. Sharing health-related information with households

The subcenter platform provided training to FLWs on key health-related information to provide to households at relevant points across the continuum of care. According to qualitative reports by beneficiaries captured as part of the process study, there was variation in the amount of information shared by FLWs across different domains in the continuum of care. Specifically, FLWs seemed to share a substantial amount of information related to practices to follow during pregnancy and immunizations, but less information related to newborn care and complementary feeding.

c. Effectively communicating information to households

The SDP grant focused on improving the ability to FLWs to efficiently communicating the information they learned in subcenter meetings to households, primarily through the mobile kunji tool and the Sales Cycle Approach. SDP's electronic monitoring data show a steady increase in the use of mobile kunji over time, with the share of FLWs using the tool increasing from about 20 percent in November 2012 to about 45 percent in July 2013. However, illiteracy remained a key barrier to mobile kunji use. FLWs who had trouble reading and writing, particularly the more poorly educated ASHAs, were generally less likely to use mobile kunji to explain health information to households. Several program staff also noted that ASHAs and AWWs are always concerned about running out of phone plan minutes, and therefore postpone using mobile kunji extensively until the end of the month. Finally, a few respondents report network-related issues. In some cases, ASHAs and AWWs living close to the border with Uttar Pradesh have access to only roaming mobile phone coverage, in which case they are charged for the otherwise free mobile kunji minutes.

The other key aspect of effective communication on which FLWs are trained, the Sales Cycle Approach, does not appear to have gained much traction among the ASHAs and AWWs we interviewed. Most displayed limited recall of the methodology and appear (from a description of their most recent home visit) to be executing only step 1 (establish a relationship) and step 3 (formulate a solution). Not as many seemed to be implementing steps 2, 4, and 5 (identify a need, get the family to commit to a solution, and reinforce the solution).

3. Conclusion on process study findings

The process study findings are broadly consistent with the quantitative findings related to the FLW–beneficiary interactions described previously. For example, both sets of findings suggest there was an overall increase in the frequency of FLW–beneficiary interactions, though not necessarily in the critical periods when more exact timing of visits is important (in particular, immediately after delivery). Similarly, Ananya was associated with more information provided by FLWs to beneficiaries in certain domains (such as delivery preparation), but not in others (such as newborn care). In addition, the use of the mobile kunji tool also seems to have been widespread, but not universal—consistent with household reports.

The process study also provides valuable evidence on some of the implementation challenges that might have constrained the effectiveness of the FLW-related Ananya interventions and, hence, the degree of exposure by beneficiaries. The FLWs encountered three main challenges: (1) interruptions to the regular scheduling of subcenter meetings and difficulty in ensuring high attendance; (2) low levels of literacy among some FLWs, which limited their ability to take full advantage of the Ananya training and tools; and (3) the fact that FLWs were already overwhelmed with multiple registers to maintain and might not have been able to track home visits using the new tools. Creatively addressing some of these constraints as the Ananya interventions are scaled up under the TSU might lead to larger impacts on FLW interactions and, ultimately, on health behaviors.

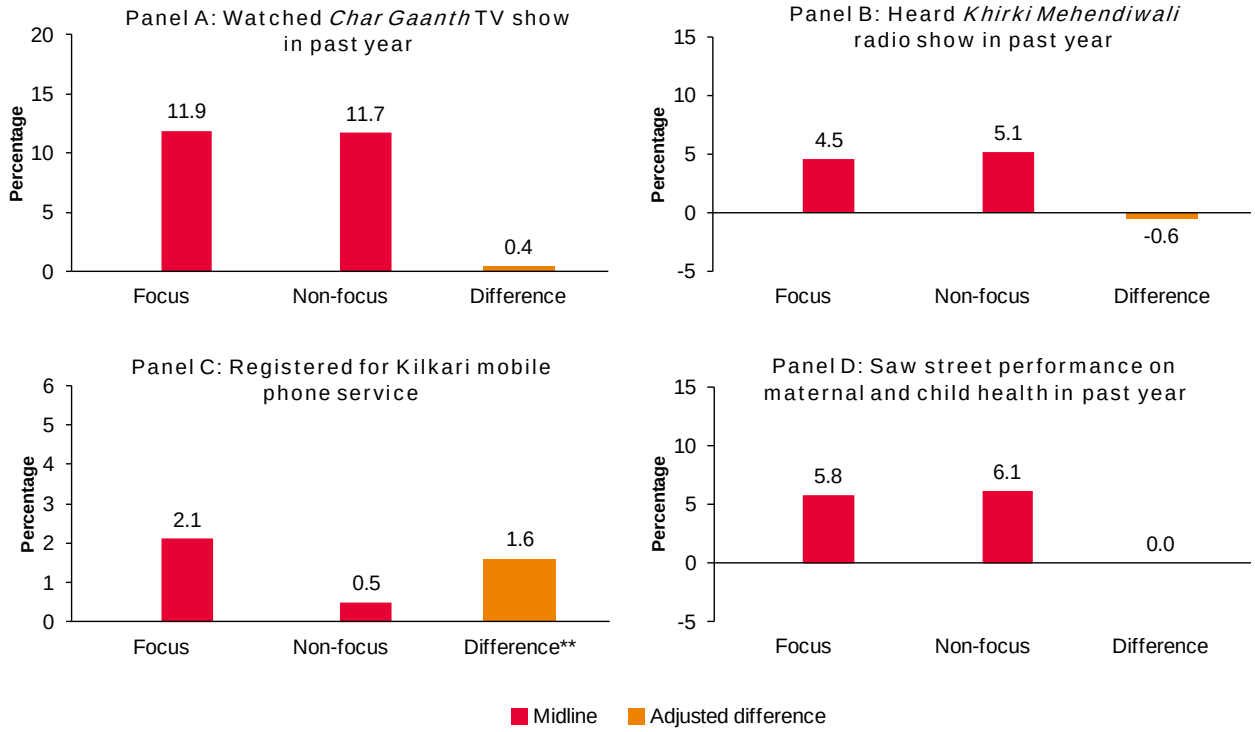
E. Exposure to media

Exposure to the media-based interventions introduced by the SDP grant as part of its communication strategy (described in Chapter I) to change health-related behaviors was relatively limited. Only about 12 percent of women in focus districts at midline reported having watched the *Char Gaanth* birth preparedness television program in the previous year, and only about 5 percent reported having heard the *Khirki Mehendiwali* radio program (we asked about these programs by name, and provided a brief description to the respondents) (Figure IV.10). Exposure rates were similar in the nonfocus districts, because these media-based interventions had a statewide reach. The overall low exposure rates of these interventions are driven in large part by the low penetration of media in Bihar—at midline only about one in three women in the focus districts reported watching any television in the previous three months, and only about 10 percent reported listening to the radio in the previous three months (not shown).[41]

Other interventions implemented by the SDP grant included the Kilkari mobile phone service and street plays. Registration for the Kilkari service, to which households could subscribe for time-specific health messages related to pregnancy, newborn care, and related health practices, was very low at midline (about 2 percent), likely because the service had just been introduced. Exposure to street plays introduced as part of SDP's 360 degree communication strategy was also low, reported by about 6 percent of households. The latter was similar in the nonfocus districts, possibly reflecting the promotion of street plays by other organizations in nonfocus districts.

[41] The rate of exposure to radio in the focus districts was very similar at baseline and midline (about 12 percent), but the rate of exposure to television did increase substantially (from 23 percent to 31 percent). If this trend continues, television could be an increasingly important medium for media-based health interventions.

Figure IV.10. Reported exposure to SDP grant interventions



Source: Women with children ages 0–11 months in Ananya midline survey.

N = 11,585–11,654.

*p < 0.10, **p < 0.05, ***p < 0.01 for adjusted differences.

To better understand the broader media context in Bihar, we also asked beneficiaries more generally about receipt in the previous year of health-related information from the media (radio, television, and billboards) on pregnancy and delivery preparation, complementary feeding, and family planning. These rates were substantially higher—about 30, 25, and 30 percent, respectively, in both focus and nonfocus districts at midline (not shown). This finding could suggest that beneficiaries were exposed to other non-Ananya media messages or that exposure to Ananya media interventions was higher than reported but beneficiaries were unable to recall the names of these interventions.

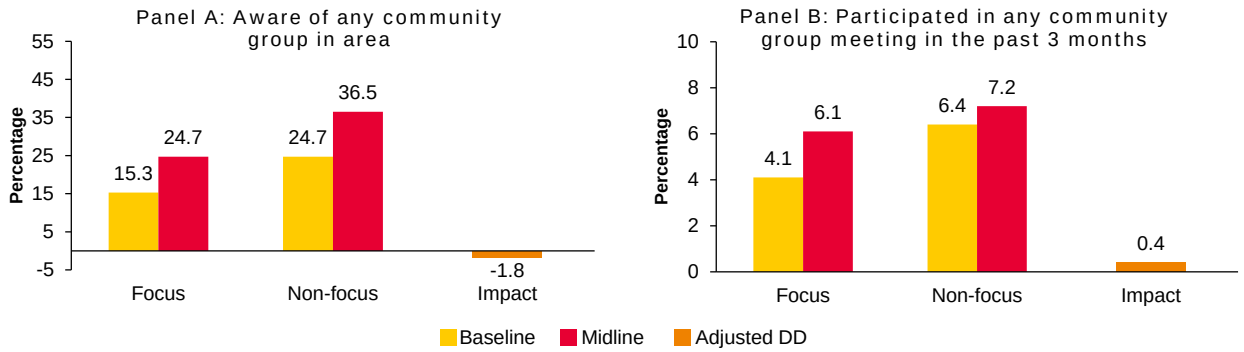
F. Participation in community groups

Finally, we examined membership of and participation in community groups by beneficiaries belonging to an SC/ST. Under the PCI grant, new community groups aimed at these marginalized women were being formed and messages related to maternal and child health were being integrated into their discussions and in other existing community groups.

Awareness of community groups among SC/ST women increased in focus districts from baseline to midline, but the increase was very similar in nonfocus districts; increases in participation in community groups in the three months before the survey were also similar (Figure IV.11). Community group participation at midline (only 6 percent of beneficiaries in focus districts participated) might have low levels and limited impact because the PCI activities began full implementation only a few months before the midline. In addition, these activities

were implemented in only a subset of blocks (55 of 137 blocks) that did not fully overlap with the blocks in our sample (only 40 percent of our sample blocks overlapped with PCI blocks).

Figure IV.11. Awareness of and participation in community groups, among SC/ST women



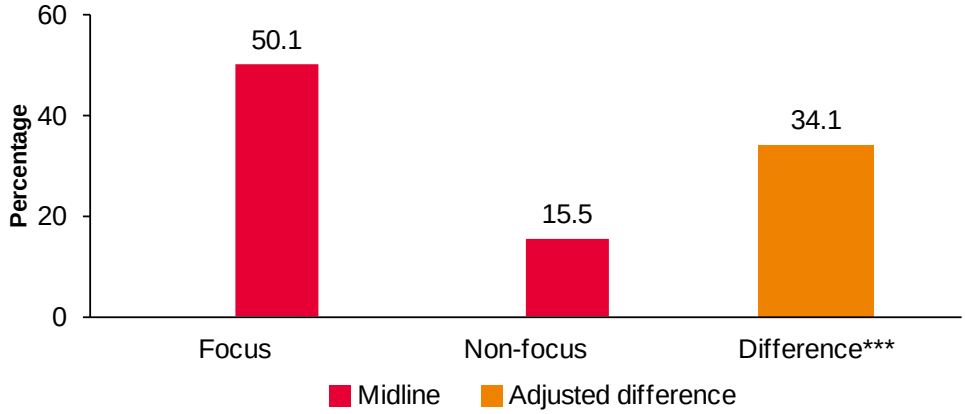
Source: SC/ST women with children ages 0–11 months in Ananya baseline and midline surveys.

N = 2,999 (baseline), N = 3,173 (midline).

*$p < 0.10$, **$p < 0.05$, ***$p < 0.01$ for adjusted difference-in-differences.

Nevertheless, reported discussion of maternal and child health topics among those participating in community groups in the previous three months was substantially higher in the focus districts at midline—almost triple that in nonfocus districts (Figure IV.12). This finding suggests increased integration of these topics into community groups, though the sample sizes were relatively small given the limited participation in these groups.

Figure IV.12. Discussion of maternal and child health topics in any of the past three community group meetings, among SC/ST women participating in a meeting in the past three months



Source: SC/ST women with children ages 0–11 months who participated in a community group meeting in the past three months in Ananya midline survey.

N = 121.

*$p < 0.10$, **$p < 0.05$, ***$p < 0.01$ for adjusted differences.

V. MATERNAL AND NEWBORN HEALTH

In Chapter IV, we examined measures of exposure to some of the key Ananya interventions and found that Ananya led to changes in several of these measures, especially in terms of the quantity and quality of FLW home visits. In this and subsequent chapters, we examine whether these changes were reflected in impacts on health behaviors, as suggested by the Ananya theory of change. This chapter focuses on estimating impacts related to maternal and newborn health.

Improving maternal and newborn health behaviors before, during, and after delivery was one of the primary goals of the Ananya interventions. To facilitate facility delivery and improve birth outcomes, Ananya messages emphasized better birth preparedness practices (for example, saving money and having a transportation plan for delivery). In addition, FLWs encouraged the use of newborn care practices that are important to newborns' survival and long-term child health, such as clean cord care, keeping the baby warm, and immediate breastfeeding.

The Ananya interventions occurred in a context in which many maternal and newborn health behaviors are incentivized through existing schemes. The largest incentive scheme is the Janani Suraksha Yojana, or JSY program, in which the health system provides incentives to FLWs to encourage ANC check-ups and facility deliveries and incentives to women for delivering in facilities. Other important incentive schemes include the Indira Gandhi Matritva Sahyog Yojana, which encourages safe delivery and improvements in infant feeding practices and the Home-Based Newborn Care program, which provides incentives to ASHAs to visit mothers after birth with a focus on improving newborn care. These programs are likely to have impacts of their own, potentially leading to changes in behavior in both focus and nonfocus districts. The JSY program has been shown to increase institutional delivery, childhood immunization rates, post-partum check-up rates, and healthy early breastfeeding practices (Lim et al. 2010; Gopalan and Varatharajan 2012; Carvalho et al. 2014). Similar impacts have been found for other health-related incentive programs implemented in different contexts, further suggesting that such schemes likely have impacts on behavior (Bellows et al. 2011; Bellows et al. 2012; DeCosta et al. 2014).

In this chapter, we examine the impacts of Ananya, over and above these existing interventions, on beneficiaries' practices during the antenatal, natal, and postnatal periods by

Key findings from this chapter

- Ananya is associated with improvements in some demand-side health behaviors, such as preparation for delivery and clean cord care. Other demand-side behaviors changed little with Ananya, including facility delivery, delayed bathing, and immediate breastfeeding.
- Likewise, many, but not all, outcomes potentially associated with supply-side constraints improved under Ananya. The program was associated with increases in the quality of delivery care at facilities but no significant change in ANC or receipt of IFA tablets.
- Despite the improvements we observed as a result of Ananya, overall coverage levels are low for many maternal and newborn health indicators, and substantial room for improvement remains.

comparing changes in practices among households in the focus and nonfocus districts between baseline and midline. The literature suggests that these practices are associated with improvements in infant and maternal mortality. Kumar et al. (2014) provides the most direct evidence on these relationships. In this work, the authors analyzed the Ananya baseline household survey (conducted in early 2012 across all districts of Bihar) and revealed that measures of PNC were significantly associated with neonatal deaths, with particularly strong relationships between neonatal mortality and thermal care measures. The authors also showed a strong relationship between delivery location and neonatal death, and a weaker—but still substantively important—link between mortality and mother's consumption of IFA tablets.

Other studies have also reported a variety of favorable associations between use of maternal and child health care services and mortality outcomes. A recent paper using DLHS-3 data from India reported that the risk of neonatal mortality was negatively related to mothers' ANC (Singh et al. 2013a). Mothers' consumption of IFA tablets has further been reported to reduce preterm delivery, birth asphyxia, low birth weight, and neonatal death in a range of contexts (Siega-Riz et al. 2006; Zeng et al. 2008; Titaley et al. 2010). The beneficial effect of PNC interventions on newborns' health has also increasingly been documented in the literature (see Kumar et al. 2008; Lawn et al. 2010; Bhandari et al. 2012; and Singh et al. 2012b). Finally, a recent systematic review has reported that early initiation of breastfeeding can reduce neonatal mortality (Debes et al. 2013). Thus, there is evidence of strong linkages between the proximal health outcomes discussed in this chapter and the mortality-related outcomes that are the ultimate focus of the Ananya program.

All analyses of these outcomes presented here account for the characteristics of households, including controls for mother's religion, caste, age, parity, education, and literacy; husband's education; and household's wealth index quartile and location (district and rural location).[42] We use a similar approach to estimate impacts in subsequent chapters. Overall, our results suggest that Ananya was associated with gains in many maternal and newborn care practices, although levels of some of these practices remain low.[43]

A. Antenatal care

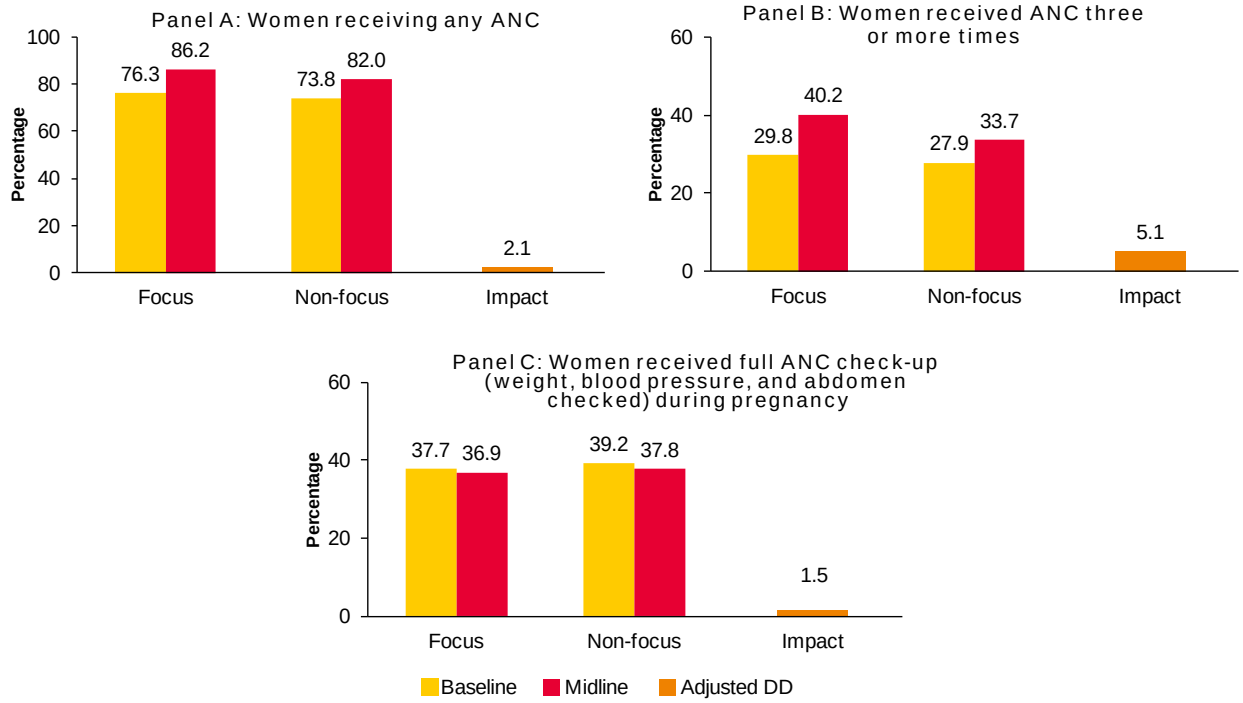
The level and quality of ANC and preventive practices can have important implications for birth and the subsequent health outcomes of both a mother and her child. As mentioned earlier, the Ananya program focused on improving ANC and preventative practices through enhancements to the quantity and quality of FLW interactions with pregnant women.

[42] See Appendix A for details.

[43] All results reported in this chapter pertain to our sample of women who gave birth in the past year. To mitigate issues related to recall, we also examined outcomes for a sample of women who had given birth more recently—in the three months before our survey—and found largely similar results. Therefore, to maximize the sample size and statistical power, we focus on the results for the full sample who gave birth in the previous year.

Reported ANC increased in both focus and nonfocus districts between baseline and midline, perhaps reflecting an increased trend in ANC visits as a result of the JSY program (Figure V.1). The share of women receiving any ANC check-up increased from 76 to 86 percent in focus districts but increased by a similar magnitude in nonfocus districts. The share of women receiving three or more ANC visits increased by a larger amount in the focus districts compared with the nonfocus districts, but the estimated impact of 5 percentage points (17 percent of the focus district baseline mean) was not statistically significant. Despite the high levels of any reported ANC visits, the share of mothers who had their blood pressure, weight, and abdomen checked during pregnancy—a measure of the quality of ANC visits—was fewer than 40 percent and very similar between baseline and midline, as well as across focus and nonfocus districts.

Figure V.1. ANC check-ups



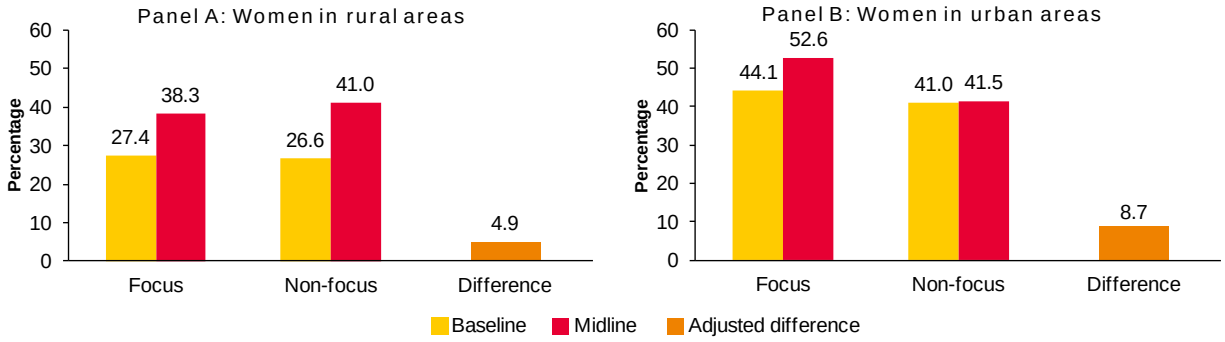
Sources: Ananya baseline and midline surveys conducted by Sambodhi in collaboration with Mathematica and PHFI in spring 2012 and spring 2014, respectively.

N = 12,376–12,384 (baseline), 11,653–11,654 (midline) women with children ages 0–11 months.

**p* < 0.10, ***p* < 0.05, ****p* < 0.01 for adjusted difference-in-differences.

The lack of significant impacts on ANC might mask substantial variation in effects across different groups of women. In particular, the literature suggests that mothers in rural areas are relatively less likely to receive adequate preventative care, including ANC (see Balarajan et al. 2011). We thus explored differences in Ananya's impact on ANC by location (see Figure V.2). Our data confirm the patterns in the literature (that is, women in urban areas are more likely than those in rural areas to receive sufficient ANC) but do not demonstrate significant differential impacts of Ananya across groups. For women in both urban and rural areas, Ananya is associated with a statistically insignificant increase in ANC.

Figure V.2. Women receiving ANC three or more times, by location



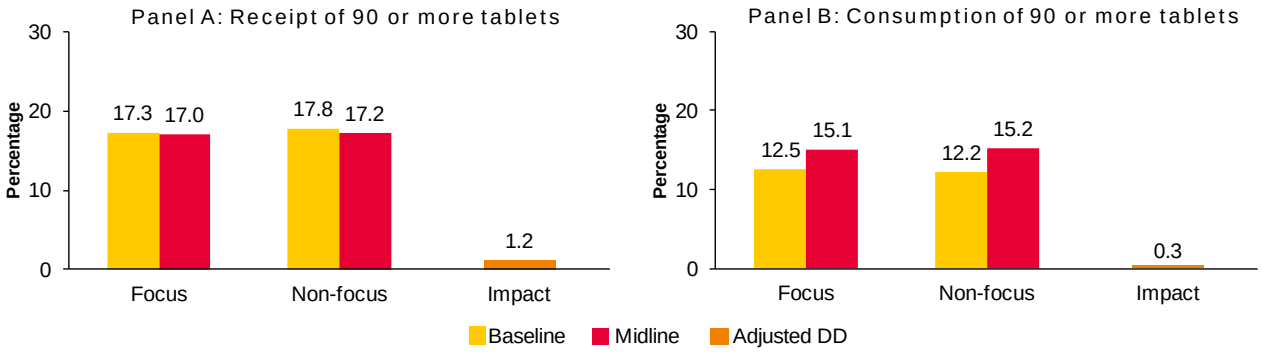
Sources: Ananya baseline and midline surveys conducted by Sambodhi in collaboration with Mathematica and PHFI in spring 2012 and spring 2014, respectively.

Panel A: N = 10,178 (baseline), 9,502 (midline) women with children ages 0–11 months. Panel B: N = 2,198 (baseline), 2,151 (midline) women with children ages 0–11 months.

*$p < 0.10$, **$p < 0.05$, ***$p < 0.01$ for adjusted difference-in-differences.

We also examined changes in the receipt and consumption of 90 or more IFA tablets, which are recommended to prevent anemia during pregnancy and can be supplied by FLWs. There were few differences between focus and nonfocus districts and little change over time in the receipt of 90 or more IFA tablets (Figure V.3). Consumption of 90 or more IFA tablets increased slightly in the focus and nonfocus districts, but the magnitude of the increases was similar. Therefore, the estimated impacts of Ananya on IFA receipt and consumption were statistically insignificant. These limited impacts are consistent with anecdotal evidence of IFA supply shortages in Bihar over this period. The low estimated levels of IFA consumption are also consistent with other data sources; for example, the AHS-3 finds that only 13 percent of mothers across Bihar consumed IFA for 100 days or more during their pregnancy in 2009-2011.

Figure V.3. Receipt and consumption of 90 or more IFA tablets



Sources: Ananya baseline and midline surveys conducted by Sambodhi in collaboration with Mathematica and PHFI in spring 2012 and spring 2014, respectively.

N = 12,384 (baseline), 11,588 (midline) women with children ages 0–11 months.

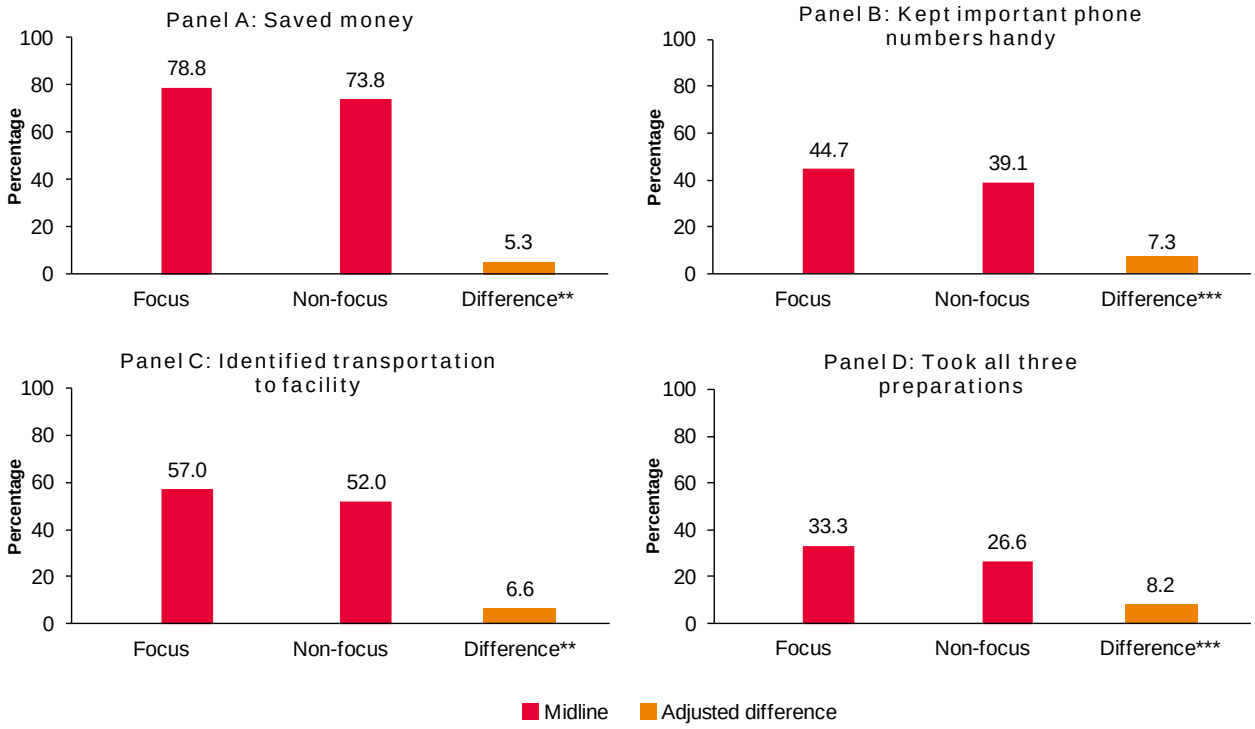
*$p < 0.10$, **$p < 0.05$, ***$p < 0.01$ for adjusted difference-in-differences.

B. Delivery in facilities

The Ananya interventions support improvements in several aspects of delivery care. In particular, FLWs focused messaging on encouraging women to prepare for deliveries, including making plans to travel to a facility for delivery. Ananya also seeks to improve the quality of delivery care provided at facilities, which could directly influence health outcomes but could also lead more women to choose to have a facility delivery.

Safe delivery begins with the pregnant woman making proper preparations. Therefore, we first examined the relationship between Ananya and actions taken by women to prepare for delivery. In particular, Ananya emphasizes that women preparing for childbirth should save money; keep handy important telephone numbers (for the ASHA, hospital, and ambulance); and identify transportation to a health facility (for delivery or in an emergency, if a home delivery was planned). The four panels of Figure V.4 explore these behaviors at midline (comparable measures were not available at baseline).[44] At midline, the percentage of beneficiaries who took all three preparatory actions was 8 percentage points (31 percent) higher in focus than nonfocus districts, with about one in three women in focus districts making these preparations. There were also similar differences in the individual behaviors, with focus districts having higher proportions of women saving money, identifying transportation to a facility, and keeping handy relevant telephone numbers.

Figure V.4. Delivery preparation

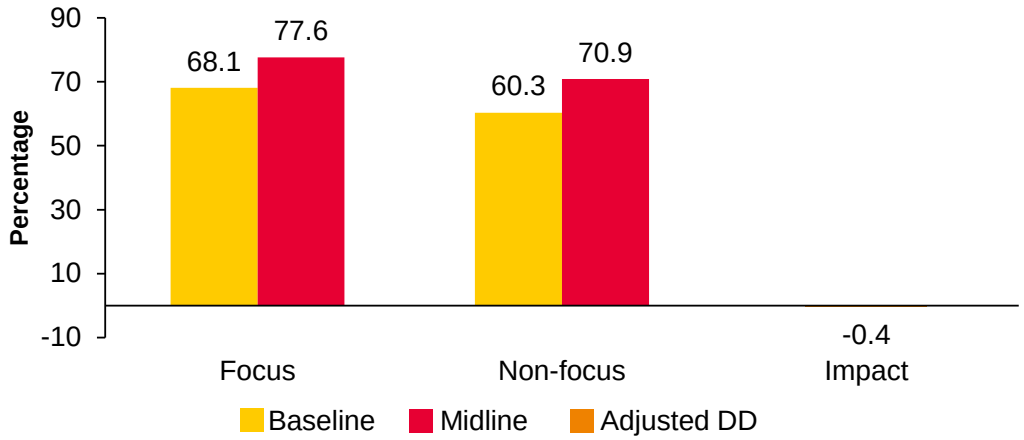


[44] These figures reflect mothers' reports of preparation activities when directly asked about whether they took each actions. We also examined Ananya's impact on preparations based on the responses of a broader question asking women to list the actions they took to prepare for delivery. This outcome showed similar results. Results are also similar when we restrict our sample to mothers of younger children, to reduce issues related to recall.

Source: Ananya midline survey conducted by Sambodhi in collaboration with Mathematica and PHFI in spring 2014.
N = 10,422–11,654 women with children ages 0–11 months.
*p < 0.10, **p < 0.05, ***p < 0.01 for adjusted differences.

Despite differences in delivery preparation, Ananya had little impact on the percentage of women giving birth at a facility, with similar increases in the focus and nonfocus districts over time (Figure V.5). Facility delivery was more common in focus districts at midline (78 percent compared with 71 percent in nonfocus districts), but this finding seems to reflect an underlying baseline difference rather than the impact of Ananya. The insignificant impacts of Ananya on facility delivery might be the result of other programs driving increases in the share of women delivering at a facility equally in focus and nonfocus districts. In particular, the JSY incentive program discussed earlier might be driving some of these increases (Lim et al. 2010 show that the scheme led to a substantial increase in facility births when it was introduced). Similarly, we found no significant impacts of Ananya on the percentage of women giving birth in a public facility (where Ananya facility-based interventions are being implemented) or the proportion of women seeking assistance in public facilities for complications related to pregnancy and delivery (both not shown).

Figure V.5. Delivery at a facility

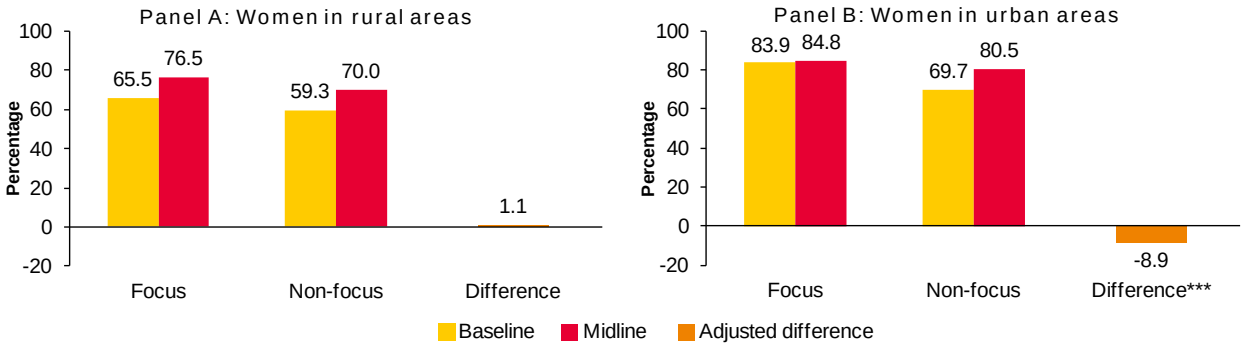


Sources: Ananya baseline and midline surveys conducted by Sambodhi in collaboration with Mathematica and PHFI in spring 2012 and spring 2014, respectively.
N = 12,355 (baseline), 11,625 (midline) women with children ages 0–11 months.
*p < 0.10, **p < 0.05, ***p < 0.01 for adjusted difference-in-differences.

We also explored whether the impact of Ananya on facility deliveries differed for rural and urban mothers. Women in rural areas can have greater difficulty accessing a facility at which they can deliver. Moreover, the literature demonstrates large gaps in the rate of facility delivery based on rural location (Thind et al. 2008). Therefore, we analyzed the impact of Ananya on facility deliveries by mothers' location (Figure V.6). The results for rural areas are similar to those for the full sample: facility deliveries increased similarly in both focus and nonfocus districts, resulting in Ananya having a statistically insignificant impact on this outcome. In urban areas, Ananya has a statistically significant *negative* impact on facility deliveries, driven by a stable rate in focus districts and an increase in nonfocus districts (suggesting that there would have been an increase in the focus districts in the absence of Ananya). However, the urban areas

in focus and nonfocus districts may not be comparable because the former includes Patna—the state capital, and by far Bihar's largest urban area. Therefore, the negative "impact" for urban areas might not have a causal interpretation, and should be viewed with caution.

Figure V.6. Delivery at a facility, by location



Sources: Ananya baseline and midline surveys conducted by Sambodhi in collaboration with Mathematica and PHFI in spring 2012 and spring 2014, respectively.

Panel A: N = 10,162 (baseline), 9,477 (midline) women with children ages 0–11 months. Panel B: N = 2,193 (baseline), 2,148 (midline) women with children ages 0–11 months.

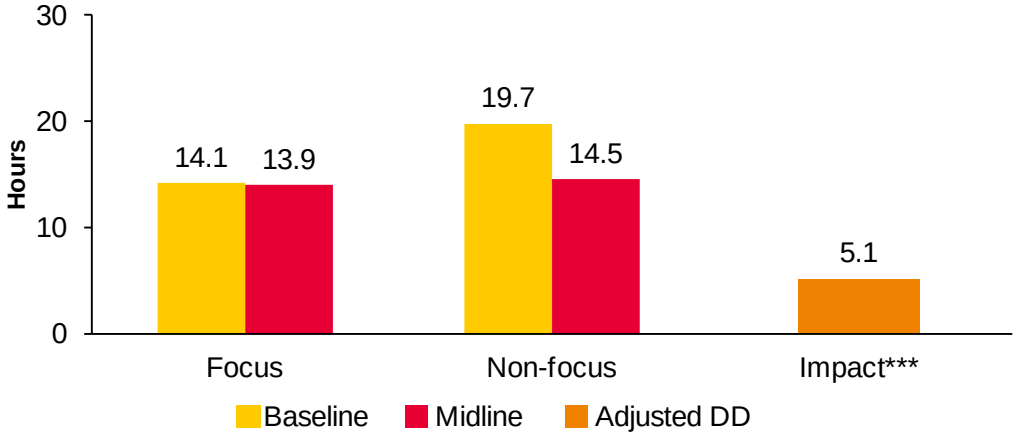
**p* < 0.10, ***p* < 0.05, ****p* < 0.01 for adjusted difference-in-differences.

Although the proportion of women giving birth at a facility did not increase as a result of Ananya, we also examined whether the program had impacts on some measures of quality of delivery services at public facilities.[45] Specifically, we examine impacts on the amount of time spent at a facility after delivery and on whether the mother and child were examined after delivery. We use time as a proxy for quality of care at facilities because women are more likely to leave facilities quickly if the infrastructure is poor or capacity is low. Additionally, it is important for mother and child to be observed for several hours after birth, so that complications can be identified. Such observations cannot be made if a woman leaves after a very short time. Our other measure of quality of care is a direct report from the mother on whether she and her child were examined before discharge.

Focus districts saw little change in the average time women spent in public facilities after delivery, but this measure decreased in nonfocus districts (Figure V.7). The decreases in the focus district could reflect the increased pressure on facilities to accommodate additional facility deliveries, which Ananya could help mitigate by emphasizing the importance of keeping women for a longer period after delivery. Together, the changes imply that Ananya had a statistically significant impact of five hours on the time spent at a public facility after birth (36 percent of the focus district baseline mean). Despite this increase, there was no significant change in the share of mothers or babies examined before leaving the facility (Figures V.8 and V.9).

[45] As mentioned earlier, we have not yet conducted facility surveys to directly capture the effects of the IFHI grant's facility-based interventions. However, measuring some aspects of facility-based care from the perspective of the beneficiaries in our household surveys may provide some evidence of these effects.

Figure V.7. Average time spent at facility after delivery, public facilities



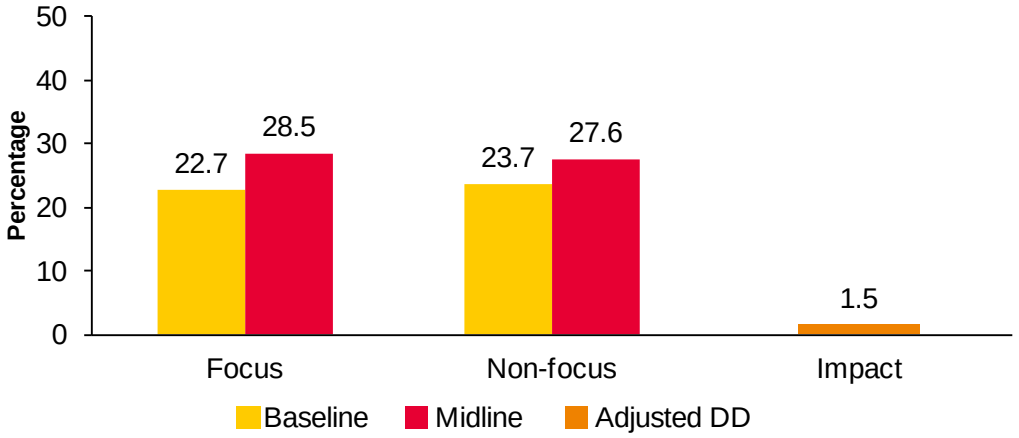
Sources: Ananya baseline and midline surveys conducted by Sambodhi in collaboration with Mathematica and PHFI in spring 2012 and spring 2014, respectively.

Notes: Values trimmed so that any time that is three standard deviations above the mean time is set to three standard deviations above the mean.

N = 5,655 (baseline), 6,401 (midline) women with children ages 0–11 months and who delivered in a public facility.

*p < 0.10, **p < 0.05, ***p < 0.01 for adjusted difference-in-differences.

Figure V.8. Deliveries in which mother was examined before leaving facility, public facilities

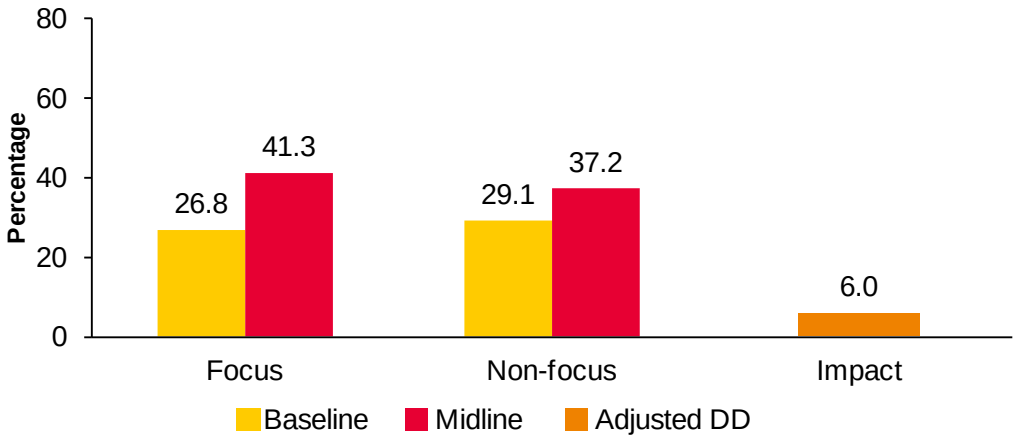


Sources: Ananya baseline and midline surveys conducted by Sambodhi in collaboration with Mathematica and PHFI in spring 2012 and spring 2014, respectively.

N = 5,665 (baseline) 6,401 (midline) women with children ages 0–11 months and who delivered in a public facility.

*p < 0.10, **p < 0.05, ***p < 0.01 for adjusted difference-in-differences.

Figure V.9. Deliveries in which child was examined before leaving facility, public facilities



Sources: Ananya baseline and midline surveys conducted by Sambodhi in collaboration with Mathematica and PHFI in spring 2012 and spring 2014, respectively.

N = 5,665 (baseline), 6,401 (midline) women with children ages 0–11 months and who delivered in a public facility.

*$p < 0.10$, **$p < 0.05$, ***$p < 0.01$ for adjusted difference-in-differences.

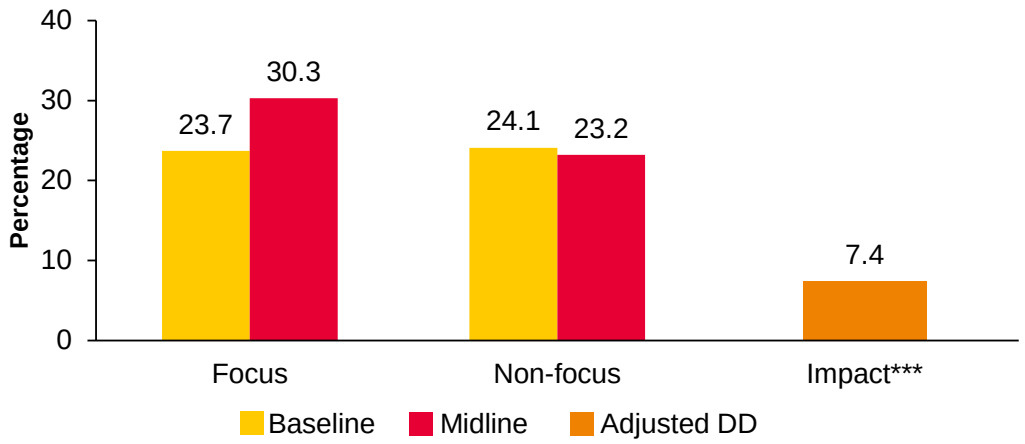
C. Newborn care practices

Newborn care practices can have important implications for children's health and well-being. In the short term, the quality of immediate newborn care, such as appropriate cord care and immediate breastfeeding, could be especially important given that most infant deaths in Bihar (90 percent of those in the baseline sample) occur within the first month of life. In addition, newborn care practices can have longer-term effects on children's health—for example, immediate breastfeeding can affect subsequent breastfeeding behavior, help mothers recover from childbirth, and reduce the incidence of illness and infection in infants (Tinker and Ransom 2002). We considered the relationship between Ananya and four key immediate newborn practices: (1) applying nothing to the cord and umbilicus, (2) practicing skin-to-skin (kangaroo-mother) care, (3) delaying bathing the baby for two days, and (4) initiating breastfeeding within an hour of birth.

Clean cord care is important for ensuring that neonates do not develop dangerous infections. We examined the share of women who practiced clean cord care by ensuring nothing was applied to their children's umbilical cords or umbilicus.[46] The share of women practicing clean cord care increased from baseline to midline in focus districts but was almost unchanged in nonfocus districts (Figure V.10). The estimated impact was a statistically significant 7 percentage points (31 percent of the focus district baseline mean).

[46] Although the application of some materials (for example, antiseptic ointment or iodine) to the umbilical cord or umbilicus can have protective effects, we focus on this measure of clean cord care because it was advocated by CARE in training FLWs.

Figure V.10. Nothing applied to cord or umbilicus



Sources: Ananya baseline and midline surveys conducted by Sambodhi in collaboration with Mathematica and PHFI in spring 2012 and spring 2014, respectively.

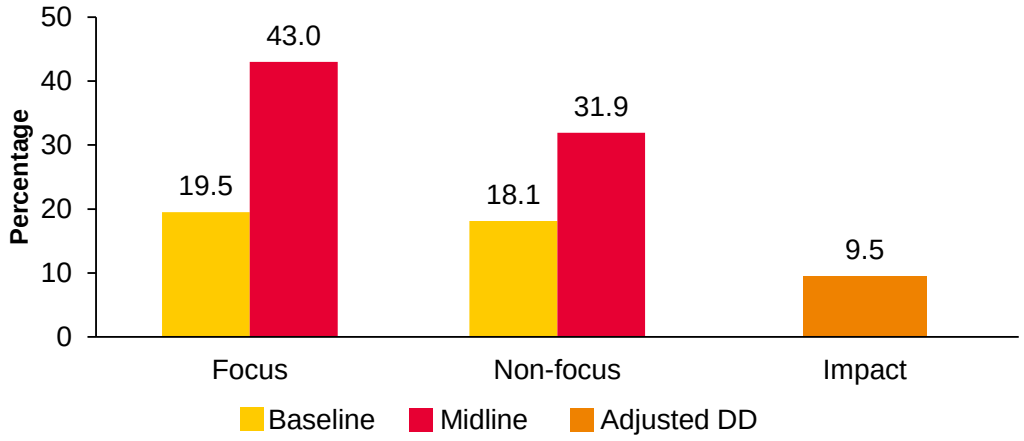
N = 12,297 (baseline), 11,057 (midline) women with children ages 0–11 months.

*p < 0.10, **p < 0.05, ***p < 0.01 for adjusted difference-in-differences.

Another key newborn care practice is skin-to-skin care (also sometimes referred to colloquially as kangaroo-mother care), which is especially important for small or weak babies. In this care practice, a child is placed unclothed on a woman's chest or abdomen and they are wrapped together in a cloth. This practice helps to stabilize the infant's vital signs, keeps the infant warm, and encourages other important newborn care practices, such as immediate breastfeeding. Both UNICEF and the World Health Organization advocate the use of skin-to-skin care, particularly for low-weight infants in developing countries. Moreover, the Kangaroo Mother Care Initiative aims to increase the practice among Indian women. Thus, we could see changes in this variable unrelated to the Ananya program, though such differences would be similar in focus and nonfocus districts. Skin-to-skin care did increase in both focus and nonfocus districts from baseline to midline (Figure V.11). However, the increase was substantially larger in focus districts, resulting in an estimated impact of 10 percentage points. Although this finding was not statistically significant, it is substantively important at 49 percent of the focus district baseline mean.

Finally, we found little impact of Ananya on the share of women delaying their child's first baths for two or more days (Figure V.12) or the share of women breastfeeding their child within one hour of birth (Figure V.13). The former practice helps prevent hypothermia in neonates and the latter can improve the health of both mother and child, as well as improve longer-term nursing practices. Additionally, NIPI's Home-Based Newborn Care and Mamta programs have targeted these outcomes; thus, some changes in the measures would be likely in both focus and nonfocus districts over the period we consider. Indeed, both measures increased between baseline and midline by a similar amount in focus and nonfocus districts, leading to insignificant estimated impacts.

Figure V.11. Health worker placed child unclothed on mother's chest/abdomen in skin-to-skin contact

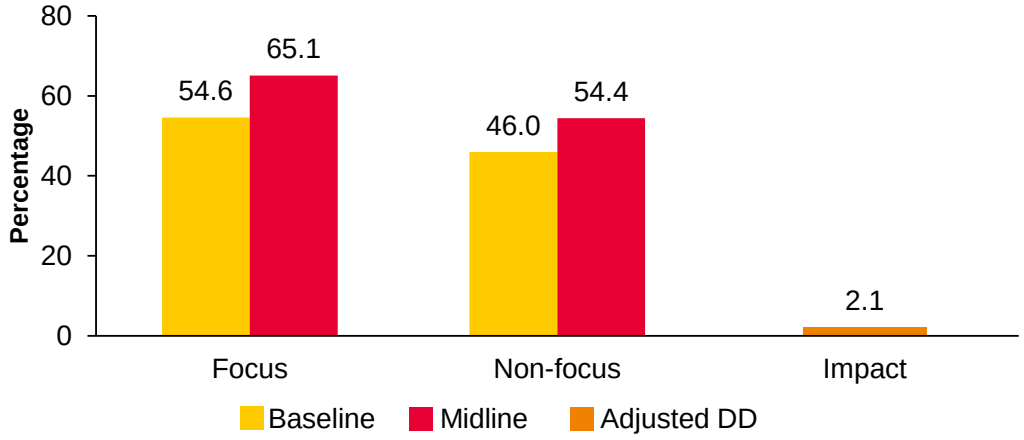


Sources: Ananya baseline and midline surveys conducted by Sambodhi in collaboration with Mathematica and PHFI in spring 2012 and spring 2014, respectively.

N = 12,360 (baseline), 11,612 (midline) women with children ages 0–11 months.

*$p < 0.10$, **$p < 0.05$, ***$p < 0.01$ for adjusted difference-in-differences.

Figure V.12. First bath delayed by two or more days

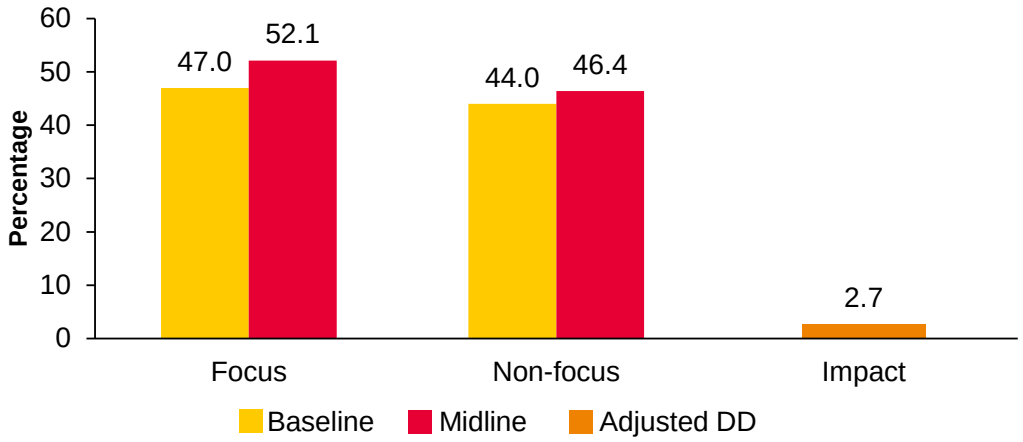


Sources: Ananya baseline and midline surveys conducted by Sambodhi in collaboration with Mathematica and PHFI in spring 2012 and spring 2014, respectively.

N = 12,384 (baseline), 11,569 (midline) women with children ages 0–11 months.

*$p < 0.10$, **$p < 0.05$, ***$p < 0.01$ for adjusted difference-in-differences.

Figure V.13. Breastfed child within one hour of birth



Sources: Ananya baseline and midline surveys conducted by Sambodhi in collaboration with Mathematica and PHFI in spring 2012 and spring 2014, respectively.

N = 12,325 (baseline), 11,575 (midline) women with children ages 0–11 months.

*p < 0.10, **p < 0.05, ***p < 0.01 for adjusted difference-in-differences.

In sum, our results suggest that Ananya was associated with improvements in several maternal and newborn health outcomes targeted by the program. This includes outcomes for which demand-side constraints are likely to be important (such as delivery preparation) and those for which supply-side factors may limit coverage (such as quality of delivery care). However, Ananya was not associated with improvements in all outcomes, suggesting the program does not necessarily lead to universal improvements in care. Nevertheless, many of the indicators on which Ananya did not have significant impacts exhibited gains between baseline and midline, particularly in the newborn care domain. Thus, it appears that, although coverage remains low for some maternal and newborn health outcomes, progress is being made in Bihar on many of these outcomes—with Ananya making a contribution for some outcomes.

VI. CHILD NUTRITION

In India, the prevalence of undernutrition in children younger than 5 is among the highest in the world. The number of stunted children (those who are too short for their age) in India comprises more than one-third of the global burden (UNICEF 2013), and the number of wasted children (those who weigh too little for their height) exceeds the combined burden of the next nine high-burden countries (Subramanyam et al. 2010).[47] The prevalence of these undernutrition indicators varies across states in India, with Bihar one of the worst performers. In the 2005–2006 NFHS, 56 percent of children younger than 5 in Bihar were stunted, 27 percent were wasted, and 56 percent were underweight (weighed too little for their age). The hunger index for states across India, which considers child mortality and calorie consumption in addition to underweight children, shows a similar pattern, with Bihar among the worst-performing states (Menon et al. 2008).

The ICDS program is currently the most significant government intervention for reducing maternal and childhood malnutrition. According to an evaluation report of ICDS in 2011, it covered 7.6 million expectant and nursing mothers and more than 36 million children younger than 6 (Government of India 2011). Although some studies suggested a positive impact of ICDS on child malnutrition, the findings are not conclusive because of the limited sample sizes (Government of India 2011; Desai et al. 2013). Some recent studies have highlighted the role of community health workers in improving the child health and nutrition outcomes among difficult-to-reach populations, which has been a focus of ICDS (Bhutta et al. 2013; Bhagwat 2014).

There is an increasing recognition of the need to focus nutrition-improvement efforts on the crucial period of 1,000 days from conception to a child's second birthday (Danzon et al. 2000; Victora et al. 2010; Menon and Aguayo 2011). The WHO recommends initiation of breastfeeding within one hour of birth, exclusive breastfeeding of infants until 6 months of age, followed by continued breastfeeding with adequate complementary feeding (adequate in terms of

Key findings from this chapter

- Ananya did not have a significant impact on exclusive breastfeeding using the standard 24-hour recall measure recommended by the WHO, with similar increases between baseline and midline in the focus and nonfocus districts.
- Ananya had large and significant impacts on the prevalence of complementary feeding, driven in part by declines in the nonfocus districts.
- There were few significant differences between focus and nonfocus districts in measures of the frequency, diversity, and quantity of feeding. Many of these measures were still at low levels in the focus districts at midline.
- The proportion of underweight children (low weight for height) ages 0–23 months was significantly lower in focus districts at midline, but the extent to which this finding can be attributed to Ananya is unclear.

[47] These indicators of undernutrition are defined more precisely in Section C of this chapter.

quantity, frequency, and diversity of foods) until 2 years or older (Bhutta et al. 2013; Moore et al. 2009; Kramer and Kakuma 2009). The Ananya program's messages to households emphasized these nutrition practices for infants and young children.[48] In combination, these practices are important to provide sufficient nutrients for cognitive and physical development and to reduce undernutrition (Bhutta et al. 2008; Black et al. 2013).

Interventions that use community health workers to promote appropriate nutrition have been found to be effective in the Indian context. For example, a study in Uttar Pradesh showed significant improvement in practices of early initiation of breastfeeding, feeding colostrum, and timely introduction of complementary feeding through community health workers (Vir 2013). Another study in rural Karnataka revealed that nutrition education and counseling was significantly associated with increased weight among girls and improved feeding behavior among boys and girls (Ghosh et al. 2002; Kilaru et al. 2005).

Next, we examine impacts of Ananya on exclusive breastfeeding, complementary feeding, and standard anthropometric indicators of undernutrition. We find mixed evidence of impacts on exclusive breastfeeding but positive and significant impacts on several complementary feeding indicators. However, despite these positive impacts, most young children still do not receive the recommended diversity, frequency, and quantity of complementary feeding; rates of undernutrition are still very high.

A. Exclusive breastfeeding

Exclusive breastfeeding for six months is an important practice to reduce child morbidity and mortality (especially by reducing diarrhea associated with the intake of contaminated liquids and foods; Kramer and Kakuma 2002) and to help ensure adequate growth. The Ananya program encouraged FLWs to emphasize the importance of exclusive breastfeeding for the full six-month period in their interactions with pregnant women and new mothers.

We measured impacts of Ananya on exclusive breastfeeding in two ways. First, we asked women directly to self-report the duration of exclusive breastfeeding and whether they gave water during this period (exclusive breastfeeding should exclude water, but we asked this follow-up question to confirm that respondents reported exclusive breastfeeding correctly). To allow for full exposure to the ideal exclusive breastfeeding period of six months, our analysis using this measure focused on children older than 6 months. Second, we asked mothers to report liquids or solids they had fed their children in the previous day. This approach enabled us to compute a measure of exclusive breastfeeding recommended by the WHO (World Health Organization 2010), namely the percentage of children younger than 6 months who received no liquids other than breast milk during the previous day.[49] The two measures are not directly comparable,

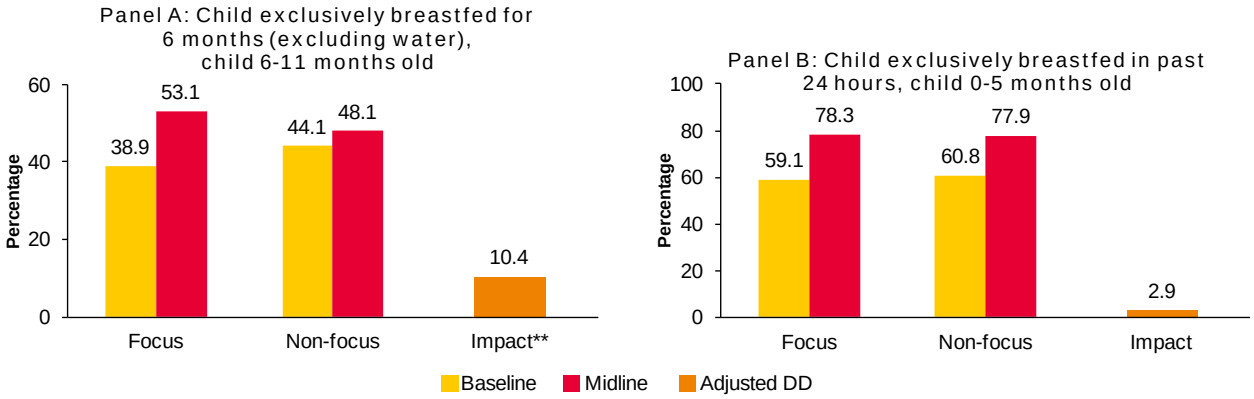
[48] The program does not focus on maternal nutrition or supplementation other than IFA, which was discussed in Chapter V.

[49] The first measure, which relies on self-reports of the duration of exclusive breastfeeding, might be subject to error from multiple sources. In addition to the potential for recall error, mothers can struggle to understand the concept of exclusive breastfeeding. Indeed, about 12 percent of mothers in our sample who reported that they were *currently* exclusively breastfeeding (without water) also reported that they gave their children some other liquid the previous day—an inconsistent response. The second measure, which relies only on 24-hour recall, is likely easier and more

although they begin to converge for a more similar age group, because children still exclusively breastfed at close to age 6 months are more likely to experience the requisite six-month period of exclusive breastfeeding.[50]

Both measures suggest an increase in exclusive breastfeeding over time in the focus and nonfocus districts (Figure VI.1). However, the relative magnitudes of the changes over time for each measure differ between focus and nonfocus districts, as do the estimated impacts. For the duration measure (excluding water), the increases over time in the focus districts were larger than the increases in the nonfocus districts, resulting in a statistically significant impact of 10 percentage points (26 percent of the focus district baseline mean). However, for the WHO measure, increases were similar in the focus and nonfocus districts, resulting in statistically insignificant impacts.[51] Because the WHO measure is accepted as the standard measure of exclusive breastfeeding, we view it as our primary measure.

Figure VI.1. Exclusive breastfeeding



Sources: Panel A: Women with children ages 6–11 months in Ananya baseline and midline surveys. Panel B: Women with children ages 0–5 months in Ananya baseline and midline surveys.

N = 4,900 (Panel A baseline), 4,902 (Panel A midline), 6,750 (Panel B baseline), 7,455 (Panel B midline).

*$p < 0.10$, **$p < 0.05$, ***$p < 0.01$ for adjusted difference-in-differences.

(continued)

accurate for mothers to report, although it reflects only the current exclusive breastfeeding status of young children and not the duration of exclusive breastfeeding.

[50] Specifically, the WHO indicator of exclusive breastfeeding in the focus districts at midline decreases from 78 percent (for children up to age 5 months) to 71 percent (for children ages 4 or 5 months), which is closer to the duration indicator for exclusive breastfeeding for six months (53 percent).

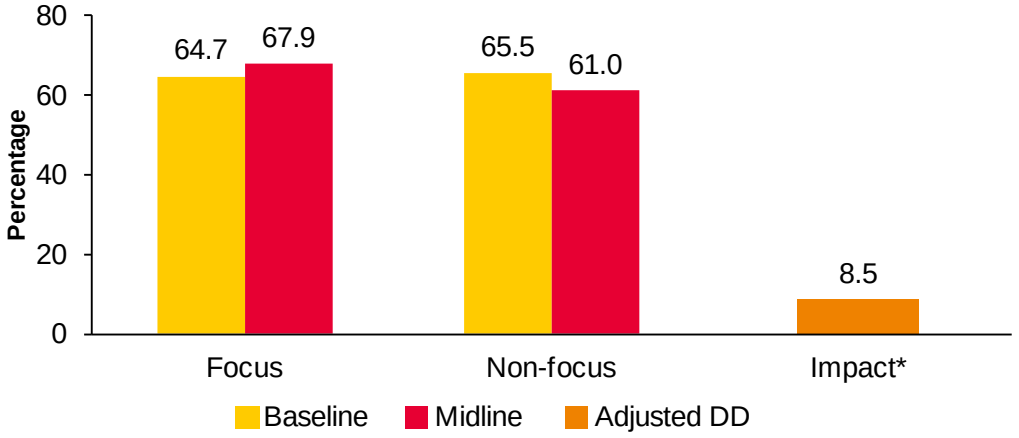
[51] Larger impacts on the duration measure might reflect desirable response bias, particularly in the focus districts. Specifically, if Ananya improved knowledge of the appropriate duration of exclusive breastfeeding, beneficiaries in focus districts might be more likely to report this behavior even if they did not practice it. However, we examined beneficiaries' knowledge of exclusive breastfeeding and found no differences between beneficiaries in focus versus nonfocus districts, which argues against this explanation.

B. Complementary feeding

The WHO and UNICEF recommend initiating semisolid food at age 6 months (along with continued breastfeeding), because after that age breast milk alone cannot meet a child's energy and nutrient requirements (World Health Organization 2014). However, lack of knowledge about the importance of complementary feeding, economic constraints, and other factors might limit infants from receiving appropriate feeding. The Ananya program therefore included specific messages on the importance and nature of appropriate complementary feeding for mothers whose children were old enough to begin receiving these foods. FLWs were also provided with a specific job tool, the katori (bowl) and spoon, to demonstrate complementary feeding. As part of our surveys, we collected data on the prevalence of complementary feeding and the diversity, frequency, and quantity of feeding. We focus our analysis primarily on children ages 6–11 months, for whom we have analogous complementary feeding measures at midline.

We found statistically significant impacts of Ananya on whether children ages 6–11 months received complementary feeding, as reported by their mothers. The impact on feeding of any solid or semisolid food was 9 percentage points (13 percent of the focus district baseline mean), driven both by an increase in focus districts and a decrease in nonfocus districts (Figure VI.2). The decline in the nonfocus districts, which is statistically significant at the 1 percent level, suggests that Ananya slowed and reversed a potential decrease that would have occurred in the absence of the program. Because the decrease in nonfocus districts was unexpected, we conducted additional analyses to explore this decrease in more detail.

Figure VI.2. Children ages 6–11 months who are currently receiving any solid or semisolid food



Source: Women with children ages 6–11 months in Ananya baseline and midline surveys.
N = 4,904 (baseline), 4,923 (midline).
*$p < 0.10$, **$p < 0.05$, ***$p < 0.01$ for adjusted difference-in-differences.

This further analysis showed that the decreases in the nonfocus districts were widespread across districts. Specifically, half of the nonfocus districts showed decreases of 5 percentage points or more in complementary feeding for children ages 6–11 months, although these district-level decreases were imprecisely estimated. In addition, our estimated levels of complementary feeding across the state are also lower than estimates from external pre-Ananya data sources (the estimated Bihar mean was 63 percent in the Ananya midline, compared with 68 percent in the 2005–2006 NFHS and 71 percent in the 2007–2008 DLHS). These estimates are also lower than reports from CARE's lots quality assurance sampling (LQAS) monitoring data. We conjectured that the differences between the focus and nonfocus districts could be due to differences in food security or availability, but found no evidence to support this theory.[52]

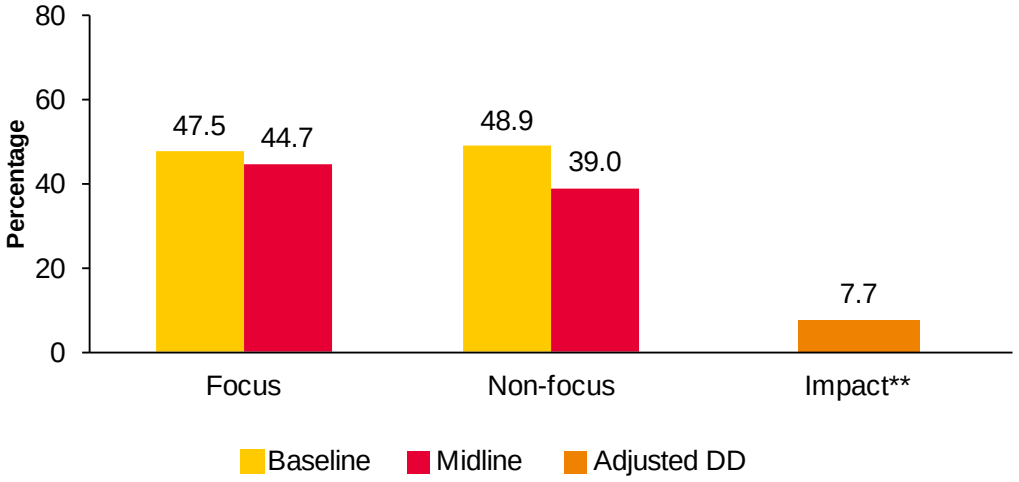
The reasons for the lower levels in the Ananya data and the decreases in the nonfocus districts between baseline and midline are unclear from our data and require further investigation. To better understand these issues, we recommend (1) further consulting with nutrition experts and local government officials to explore possible reasons for these decreases and issues related to measurement of complementary feeding and (2) sending an independent third party to the field to measure and/or observe the measurement of complementary feeding outcomes.[53]

Subgroup analysis by child's age suggests that the impact on feeding of solid and semisolid foods was driven almost entirely by impacts on children ages 6–8 months; impacts on children ages 9–11 months were close to zero, with little change in the focus or nonfocus districts (not shown). There was also an impact of 8 percentage points (16 percent of the focus district baseline mean) on self-reported timely initiation of complementary feeding by age 6 months (Figure VI.3). This is consistent with the Ananya behavior change messages, which focused on timely initiation of complementary feeding. We also examined differences in impacts by gender and found that the impact on feeding of solid and semisolid foods was higher for females than males (13 versus 5 percentage points; not shown). However, neither of these individual estimates nor the difference was statistically significant, so this finding is only suggestive of gender differences. Finally, we found no statistically significant differences in the impacts of Ananya on complementary feeding by subgroups defined by marginalization status (not shown).

[52] Specifically, there were very few differences at midline in a food insecurity index, computed as the sum of four food insecurity questions based on experiences in the previous four weeks (whether the household ran out of money for food, limited the types of food fed to the child because of lack of money, cut the size of or skipped meals, or had anyone go to bed hungry). Overall, food insecurity was relatively low, with a mean index of 0.7 in focus districts and 0.9 in nonfocus districts (of a possible 4 points). In addition, there were few differences between focus and nonfocus districts in an index of diversity of foods available in the household in the previous week, frequency of preparation of specific food groups such as cereals in the previous week, or receipt of food for the mother or child from AWWs in the previous three months. Further, the regression-adjusted correlations between these measures and complementary feeding outcomes were not statistically significant. Overall, these findings suggest that food security or availability does not explain the differences in trends in focus and nonfocus districts related to complementary feeding.

[53] This field exercise could focus on the nonfocus districts in which the declines in complementary feeding between baseline and midline were the largest and statistically significant—Madhepura, Jamui, and Lakhisarai.

Figure VI.3. Children ages 6–11 months who began receiving solid or semisolid foods by age 6 months



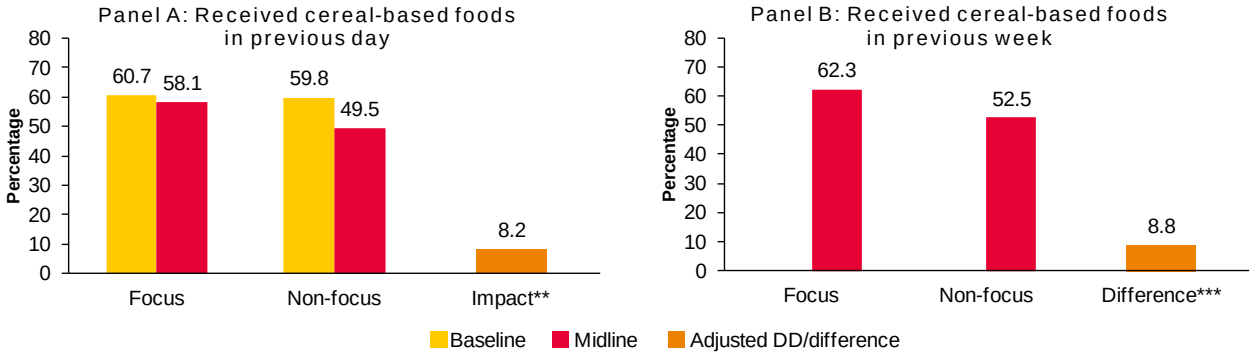
Source: Women with children age 6–11 months in Ananya baseline and midline surveys.

N = 4,895 (baseline), 4,923 (midline).

*p < 0.10, **p < 0.05, ***p < 0.01 for adjusted difference-in-differences.

Because the IFHI grant's messaging related to complementary feeding focused specifically on FLWs encouraging cereal-based feeding, we measured the impact for children ages 6–11 months on being fed any cereal-based food (rice, khichdi, or bread) in the previous day based on mothers' reports. This finding was a statistically significant 8 percentage points (14 percent of the baseline focus district mean), again driven by smaller declines between baseline and midline in the focus compared with nonfocus districts (Figure VI.4). The decline in the nonfocus districts was statistically significant at the 1 percent level, and could be explored as part of the additional consultations and field exercise recommended earlier. A broader measure of cereal-based feeding—whether the child was fed cereal-based foods in the previous week—was also significantly higher in focus districts at midline (this measure was not available at baseline).

Figure VI.4. Children ages 6–11 months receiving cereal-based foods



Source: Panel A: Women with children ages 6–11 months in Ananya baseline and midline surveys. Panel B: Women with children ages 6–11 months in Ananya midline survey.

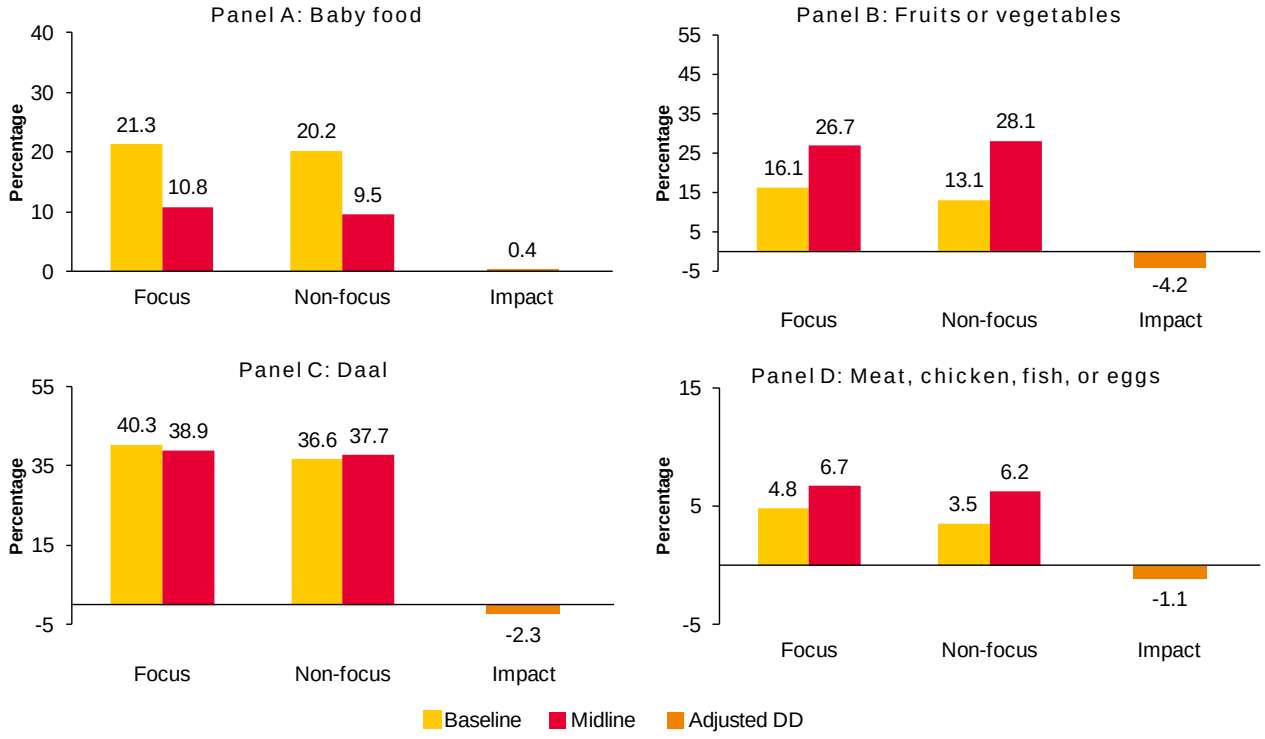
N = 4,904 (baseline), 4,923 (midline)

*p < 0.10, **p < 0.05, ***p < 0.01 for adjusted difference-in-differences/differences.

We also examined impacts on complementary feeding of other food types. Despite the IFHI grant's focus on cereal-based feeding, there might have been spillover effects to feeding of other foods; for instance, the SDP grant's messaging focused on feeding the child any foods available in the household. There were increases in the focus districts over time in the feeding of fruits and vegetables and meats or eggs, decreases in feeding of baby food, and little change in the feeding of daal (Figure VI.5).[54] All of the changes in feeding of these various food types were similar in the nonfocus districts, leading to statistically insignificant program impacts.

Additional analysis (not shown) suggested that, although cereals are generally available in the household, certain types of fruits, vegetables, meats, and eggs were often not available in the household (for example, nearly 90 percent of households reported that yellow or orange fruits were not available in the previous week; about 70 percent reported that eggs were not available). Limited availability of some noncereal foods could therefore be limiting impacts on these food types and on food diversity, which are described later.

Figure VI.5. Children ages 6–11 months receiving various food types in the previous day



Source: Women with children ages 6–11 months in Ananya baseline and midline surveys.

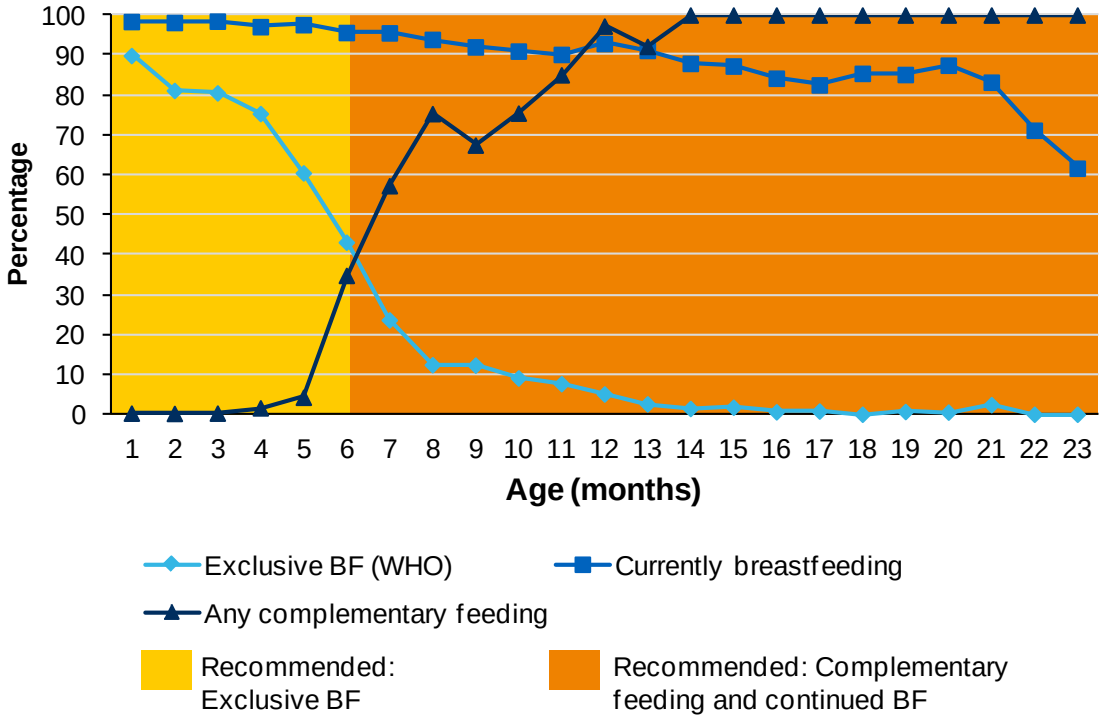
N = 4,904 (baseline), 4,923 (midline).

*p < 0.10, **p < 0.05, ***p < 0.01 for adjusted difference-in-differences.

[54] The food types included in the household survey were similar at baseline and midline, except that fruits and vegetables were disaggregated into more precise categories at midline (yellow or orange vegetables, green leafy vegetables, yellow or orange fruits, and other fruits and vegetables). These foods were collapsed into a broader fruits and vegetables category for this analysis.

To get a sense of overall compliance with the nutrition practices that Ananya is attempting to encourage, we examined the overall pattern of breastfeeding and complementary feeding from birth through 23 months in focus districts at midline (Figure VI.6). Continued breastfeeding over this age range is high (almost 90 percent for most of the range), with a decline only beginning after age 20 months. However, *exclusive* breastfeeding using the WHO measure starts at high levels (more than 80 percent) but declines sharply after age 4 months, as feeding of other liquids such as animal milk (not shown in the figure) increases, and some complementary feeding begins. The pattern for complementary feeding suggests that it is often delayed beyond 6 months, only reaching high levels (close to 80 percent) by age 8 months. Overall, these patterns suggest that despite providing messaging related to these topics, it remains challenging to change behaviors regarding exclusive breastfeeding through age 6 months and on-time initiation of complementary feeding.

Figure VI.6. Pattern of feeding, by age in focus districts at midline



Source: Children ages 0–23 months in focus districts in Ananya midline survey.

Notes: Shaded areas show ages at which exclusive breastfeeding (yellow shading, ages <6 months) and complementary feeding with continued breastfeeding (orange shading, ages 6-24 months) are recommended.

N = 3,706.

BF = breastfeeding.

In addition to encouraging complementary feeding in general, Ananya focused on ensuring age-appropriate diversity, frequency, and quantity of complementary feeding. To measure these areas, we constructed the following measures:

- **Food diversity.** We constructed a food diversity index based on the specific food groups fed to the child in the previous day (a modified version of the index in Garg and Chadha [2009]).
- **Frequency of feeding.** We constructed two measures of frequency: (1) an index based on the number of times specific food groups were fed to the child in the previous week (a modified version of the index in Garg and Chadha [2009]); and (2) a broader measure of whether the child was fed the recommended number of times in the previous day, regardless of food group (twice for children ages 6–8 months and three times for children ages 9–11 months).
- **Quantity of feeding.** We measured the quantity of feeding in all meals the child was fed in the previous day (in milliliters) by asking the mother to show the relevant quantities using water in a bowl that the survey team then transferred to a measuring cylinder. We report the percentage of children receiving the recommended quantity of feeding (100 ml for children ages 6–8 months and 200 ml for children ages 9–11 months). For consistency with the methodology in CARE's LQAS monitoring data, we measured quantity only for meals that included cereals and that an adult fed to the child out of a separate bowl (the restriction to cereals was based on the program's focus, whereas the other restriction was a practical one required to accurately measure the quantity of feeding).

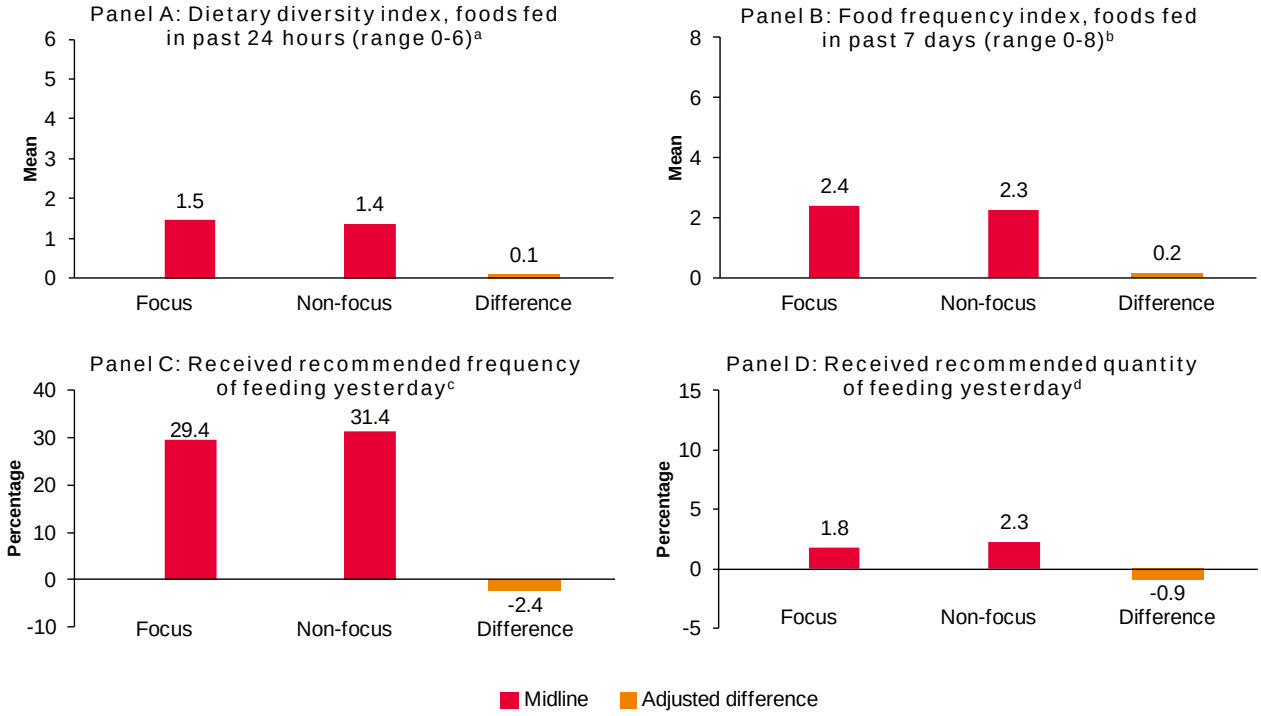
The differences in our measures of appropriate diversity, frequency, and quantity of complementary feeding between focus and nonfocus districts at midline were close to zero (Figure VI.7).[55] In addition, the levels of some these measures were relatively low—for example, only 2 percent of children received the recommended quantity of food. This finding suggests that, despite the efforts of Ananya or other development partners to date, many children in Bihar are not receiving appropriate nutrition.

C. Undernutrition

Anthropometric measurements for children ages 0–23 months enable us to compare rates of undernutrition in focus and nonfocus districts using standard indicators of undernutrition. These indicators are based on anthropometric measures of height and weight and offer the most accurate and informative assessment of undernutrition (Svedberg 2011). The three key indicators of anthropometric failure most often cited in the study of child undernutrition are stunting, wasting, and underweight. The World Health Organization's 2006 guidelines define stunting as a height-for-age z-score below 2 standard deviations (SDs) from the median height for age of the international reference population (which was drawn from six diverse countries); wasting is a weight-for-height *z*-score below 2 SDs of the reference population median; and underweight is

[55] These measures were also similar between focus and nonfocus districts for children ages 12–23 months (not shown).

Figure VI.7. Diversity, frequency, and quantity of feeding among children ages 6–11 months



Source: Women with children ages 6–11 months in Ananya midline survey.

[a]Recommended frequency of feeding is twice a day (children ages 6–8 months) or three times a day (children ages 9–11 months).

[b]Recommended quantity of feeding is 100 ml a day (children ages 6–8 months) or 200 ml a day (child ages 9–11 months).

[c]Index assigns one point for each of the following types of food eaten in the past 24 hours: rice, khichdi, or bread; daal; fruits and vegetables rich in vitamin A, or dark green leafy vegetables; other fruits and vegetables; meat, fish, or eggs; and oil or ghee added to food.

[d]Index assigns one point for each of the following types of food fed one to three times in the previous seven days, and two points for each type of food fed four or more times in the previous seven days: rice, khichdi, or bread; daal; fruits rich in vitamin A, or dark green leafy vegetables; other fruits and vegetables; and meat, fish, or eggs.

N = 4,904.

*$p < 0.10$, **$p < 0.05$, ***$p < 0.01$ for adjusted differences.

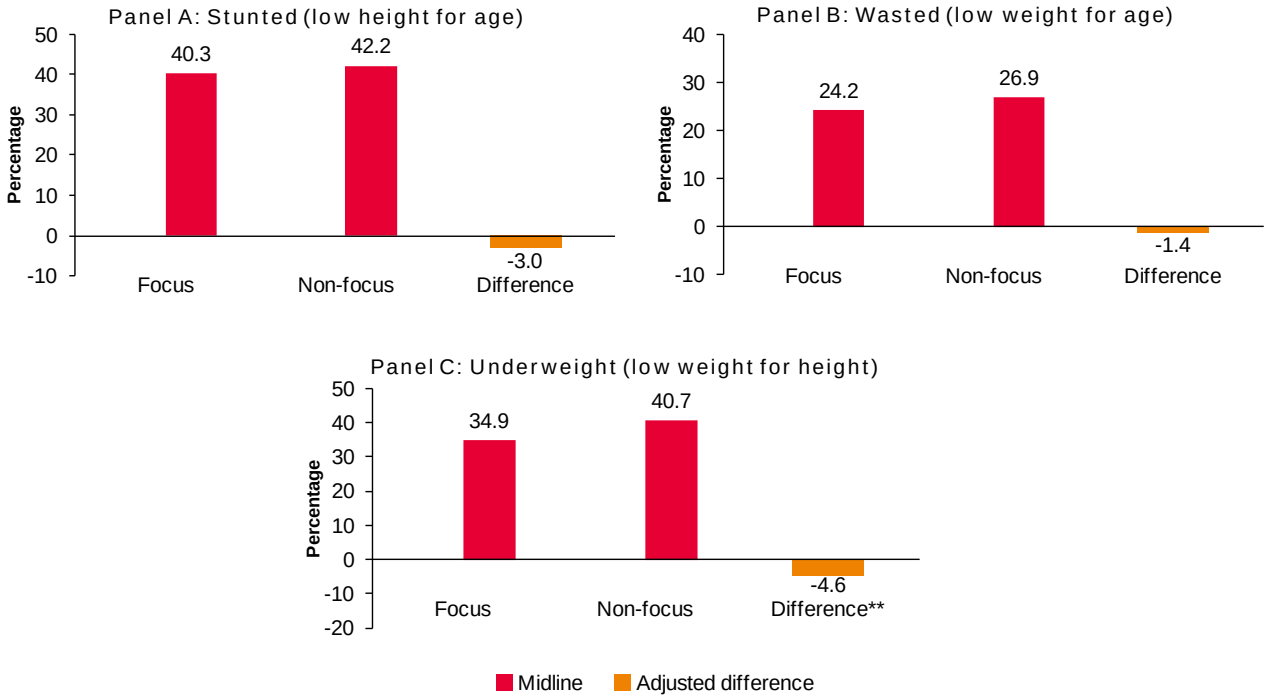
weight-for-age *z*-score below 2 SDs of the reference population median. Among the key indicators of child undernutrition, stunting can be particularly important, as it reflects early-life *net* nutrition (Spears 2013) and is an indicator of *long-term* nutritional deprivation (Reinhard and Wijayaratne 2000; de Onis et al. 2013; Svedberg 2011).

Our findings suggest that the proportion of children who were stunted or wasted was similar in focus and nonfocus districts, with about 40 percent of children in focus districts stunted and about 24 percent wasted (Figure VI.8). The limited difference in stunting rates is not surprising given that Ananya's impacts on some of the factors that might predict stunting were limited (for example, exclusive breastfeeding).[56] In addition, Ananya did not explicitly target areas such as

[56] The evidence on the link between some of these factors and undernutrition is also mixed. For example, a study from India using 2005-2006 NFHS data reported that complementary feeding from ages 6–8 months was

maternal nutrition (aside from IFA tablets, on which it has little impact); childhood diseases and infections (for example, worms); or sanitation (specifically, open defecation), which have the potential to reduce stunting (Bhutta et al. 2008; Spears 2013). In contrast, the proportion of children who were underweight was significantly lower, by about 5 percentage points in the focus districts. Without baseline data, the difference in underweight children should be interpreted with caution; given the limited differences in diversity, frequency, and quantity of feeding, and the absence of baseline data for this age group, we cannot rule out that they reflect underlying differences that are unrelated to Ananya.

Figure VI.8. Indicators of undernutrition for children ages 0–23 months



Source: Women with children ages 0–23 months in Ananya midline survey.

N = 11,956–12,435.

*p < 0.10, **p < 0.05, ***p < 0.01 for adjusted differences.

(continued)

associated with a reduced likelihood of being underweight, but did not find a significant association between early and exclusive breastfeeding with favorable nutritional outcomes (Menon et al. 2013). In contrast, two recent studies from Sub-Saharan Africa, one from Ethiopia and the other from Malawi, have reported a significant association between exclusive breastfeeding for six months and reduced stunting in children (Fikadu et al. 2014; Kuchenbecker et al. 2014).

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VII. IMMUNIZATIONS

In this chapter, we examine the impact of Ananya on routine child immunizations. These immunizations are supposed to be administered from 0–9 months to protect children against diseases that can cause severe illness, disability, or even death. Immunizations are especially important in environments such as Bihar, where undernutrition and poor sanitation increase vulnerability to these diseases. In Bihar, ANMs typically provide these immunizations at regularly scheduled immunization sessions.

Child immunization has been a major policy focus in Bihar in recent years. The year 2006 was designated as the "Year of Immunization" by the state, and a year-long campaign was launched by the GoB in 2007 called "Muskaan ek Abhiyaan". An evaluation of this campaign suggested that Muskaan interventions involving community volunteers contributed to improvements in age-appropriate immunization (Goel et al. 2012). Similar findings have been reported from Haryana state in India (Prinja et al. 2010). To further encourage immunizations, the government provides financial incentives for FLWs to meet immunization targets.

However, full immunization is still far from universal in Bihar, with dropout an important concern in the immunization coverage. According to AHS data, 95 percent of children ages 12–23 months received the BCGvaccine (given at birth) but only 80 percent were vaccinated against measles (given at age 9 months) in 2009–2011. As a result, the rate of full immunization was only 70 percent. A study from Assam reported that lack of information among parents was one of the major causes of dropout of vaccinations (Phukan et al. 2009). In a study in Gujarat, the reasons for missed vaccinations were that a prior reminder was not given, mother's forgetfulness, unavailability of vaccine, higher birth order, and mother's current residence at her father's home (Patel and Pandit 2011). Uneven distribution of health centers, many lacking basic facilities, has been linked with poor immunization outcomes, whereas better access to health services has been found to be associated with better vaccination coverage of infants (Phukan et al. 2009; Ghei et al. 2010; Kruk et al. 2009). A study in Haryana reported that the main reasons for delayed immunization were staff shortages, nonadherence to plans, and vaccine being out of stock (Prinja et al. 2010).

The continuing socioeconomic differentials and inequities in immunization coverage are of concern, with studies reporting lower vaccination in girls, rural areas, lower wealth index, lower parental education, higher birth order, and in Muslim communities (Mathew 2012; Manjunath and Pareek 2003; Vikram et al. 2012). A study of unvaccinated children using the 2007-2008

Key findings from this chapter

- Ananya had little impact on immunization rates for children ages 6–11 months; immunizations rates were generally flat in focus and nonfocus districts between baseline and midline.
- Rates of on-time immunizations are still very low at midline, with only about 10 percent of children receiving DPT3 by age 4 months, as recommended.
- There is some evidence that Ananya affected immunization rates for children ages 12–23 months.

DLHS data, including 65,617 children ages 12–23 months from across India, revealed that nonvaccination was associated with nonreceipt of tetanus immunizations for mothers during pregnancy, lower household wealth index, and no maternal or paternal schooling (Sissoko et al. 2014).

Examining the trend of immunization rates in Bihar suggests that immunization rates were fairly stagnant in the immediate pre-Ananya period. For example, the rate of DPT3 for children ages 12–23 months increased from 46 percent in 2005–2006 (NFHS-3) to 79 percent in 2008-2009 (AHS-1), but then remained similar at 80 percent in 2008–2010 (AHS-2), and 82 percent in 2009–2011 (AHS-3). Further increasing immunization rates therefore remains a priority, and Ananya's messages to households included a strong focus on ensuring that children received the full set of immunizations in a timely manner.[57]

We begin by discussing some measurement issues related to the collection of accurate immunization data, and then analyze the impacts of Ananya on receipt of immunizations for different age groups. We focus on children ages 6–11 months, for whom we have data on a baseline and midline cohort, and children ages 12–23 months, for whom we have data on a midline cohort only (this age group is typically used to report immunization rates in other data sources).[58] For children ages 6–11 months, we examine changes over time and present impact estimates using our difference-in-differences approach. For children ages 12–23 months, we have available only midline data, but we attempt to use external data sources to estimate possible impacts using difference-in-differences.

Overall, we find little evidence that Ananya had an impact on immunization rates for children ages 6–11 months, but some evidence of impacts for children ages 12–23 months.

A. Measurement issues

Following the approach of the AHS, as described in the AHS manual, we collected data from immunization cards or from self-reports when women did not have cards; the estimates presented here are based on the combined numbers.[59] Because measured immunization rates rely on both card data and self-reports, some caution is necessary in interpreting the estimated impacts. Specifically, if self-reported rates tend to systematically overstate or understate

[57] The full set of routine immunizations includes BCG and Polio 0 at birth, Polio 1 and DPT1 at 6 weeks, Polio 2 and DPT2 at 10 weeks, Polio 3 and DPT3 at 14 weeks, and measles at 9 months.

[58] The schedule of routine immunizations suggests that all immunizations except for measles should be completed by age 4 months. However, to account for possible delays in immunization, we focus our impact estimates on immunization rates for children 6 months and older.

[59] Our approach assumes that, for women with immunization cards, the child did not receive any immunizations not recorded on the card. This approach is unlike CARE's LQAS monitoring system, which asks women with a card specifically about each immunization not recorded in the card and uses these self-reports in the analysis. Our approach is more conservative because we assume that if a child receives the vaccine, it will be recorded on the card. As a result of the difference in approaches, the rates for children ages 6–11 months that we report here are lower than the reported LQAS rates. For example, the reported rate of DPT3 for children ages 6–11 months in focus districts at midline is about 70 percent in the LQAS data, whereas our data suggest 63 percent. However, when a similar restriction is applied to the LQAS data (ignoring self-reports for women with cards) the midline numbers for children ages 6–11 months are similar.

immunizations relative to card reports, then increased card prevalence over time could change reported immunization rates even if there is no real change in immunization. For example, if self-reports systematically over-report immunizations (because of desirable response bias), increased card prevalence would mechanically lower immunization rates.[60]

Card prevalence for children ages 6–11 months in our sample increased by about 4 percentage points (from 52 to 56 percent) in focus districts and by about 7 percentage points in nonfocus districts (from 52 to 59 percent), suggesting more households were getting or retaining cards during this period. However, the changes in card prevalence for children ages 6–11 months were not significantly different in focus and nonfocus districts, suggesting that the impact estimates are likely to be broadly valid. Further, our estimated immunization rates are consistent with trends in other external data sources, providing an additional source of validation. For example, as mentioned earlier, the rate of DPT3 for children ages 12–23 months in Bihar was 79 percent in 2007–2009 (AHS-1); 80 percent in 2008–2010 (AHS-2); and 82 percent in 2009–2011 (AHS-3). This relatively flat trend is consistent with our finding of 82 percent in the Ananya midline data.

B. Estimated impacts

1. Children ages 6–11 months

The estimated impacts of Ananya on immunizations for children ages 6–11 months were close to zero and statistically insignificant. Specifically, the percentage of children ages 6–11 months with DPT1 increased similarly in the focus and nonfocus districts, wherase for DPT3 and full immunization, the immunization rates were almost unchanged (Figure VII.1).[61]

We also examined impacts on immunizations for various subgroups, given some of the known disparities in immunization coverage discussed previously. Although it has been reported that wealthier households in India have benefited most from the average rise in full immunization in children ages 12–23 months (Arokiasamy and Pradhan 2010), we found little change over time in immunization rates for subgroups defined by socioeconomic quartile, and hence no significant impacts (not shown). The same was true for other marginalized subgroups, including SC/ST and Muslim women. Gender disparity in full immunization has been reported in India (Prusty and Kumar 2014; Kumar and Mohanty 2011; Corsi et al. 2009), but we also found no impact for subgroups defined by the child's gender. Finally, the impact for women with three or more children was higher than that for women with one child (8 versus 1 percentage point), though neither was statistically significant. This could reflect that women with more children are more familiar and comfortable with immunizations and are more open to behavioral change.

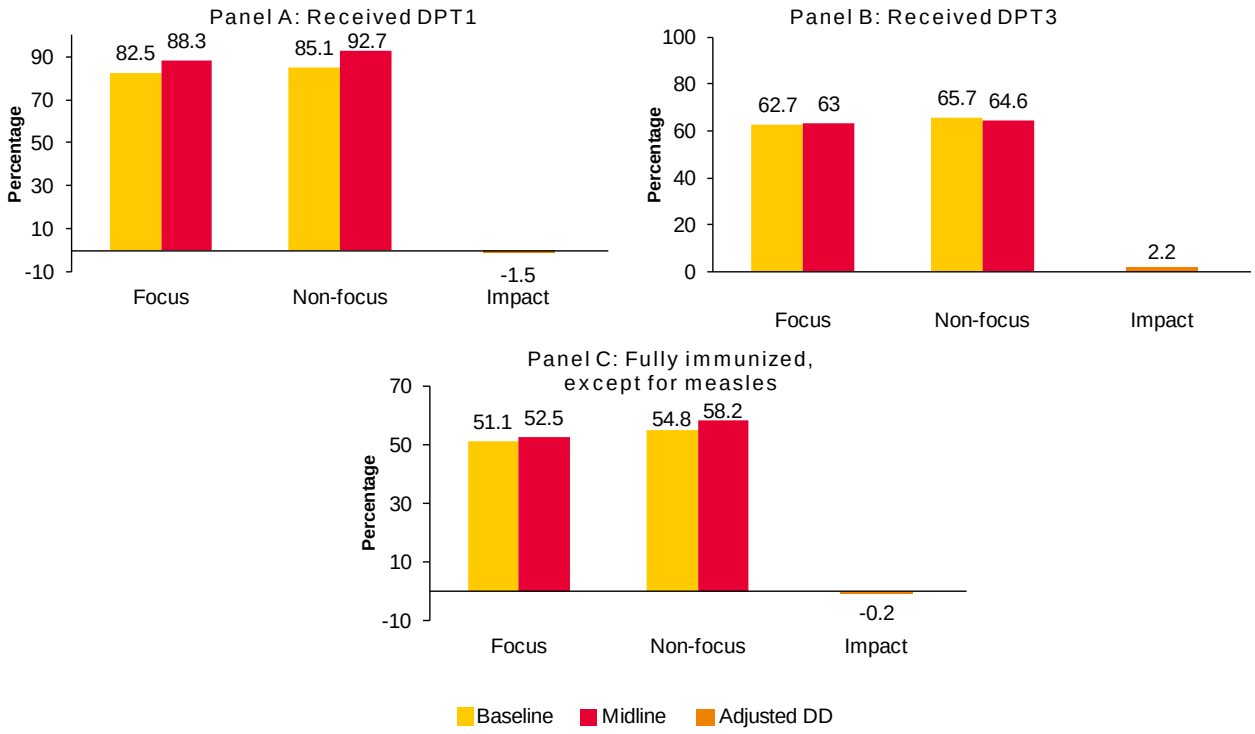
To better understand immunization dropout and remaining barriers to immunizations, we also asked about reasons for not receiving DPT3. The main reasons reported (not shown) were lack of time (47 percent), children being absent from the household at the time of immunization

[60] Focusing on card reports alone would not address these issues, because the characteristics of cardholders could change over time—especially if card prevalence changes.

[61] We exclude measles from the full immunization rate calculations for children ages 6–11 months, because this vaccine is meant to be administered only at age 9 months, and can be even further delayed.

sessions (12 percent), and the immunization session being held at an inconvenient time (10 percent). Supply-side interventions to make the delivery of immunizations more regular, more convenient, and less time-consuming could therefore be one approach to increasing immunization rates in the future.[62]

Figure VII.1. Children ages 6–11 months who were immunized, combining card data and self-reports



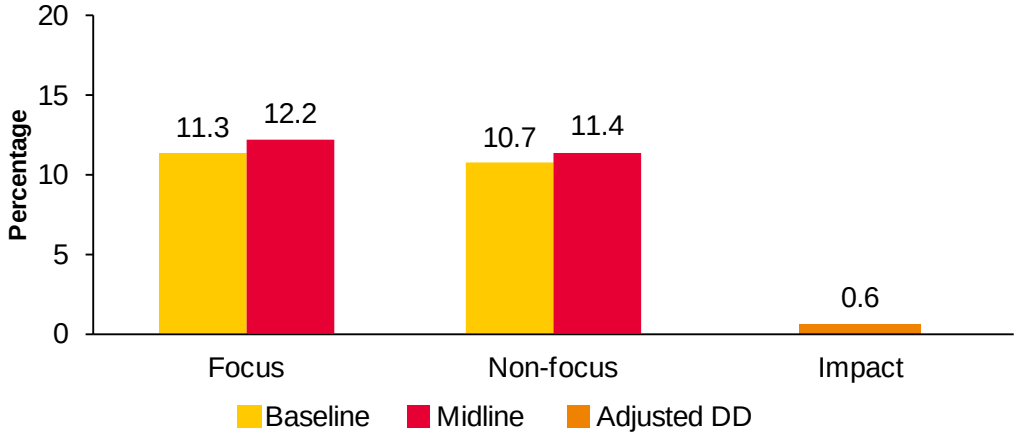
Source: Children ages 6–11 months in Ananya baseline and midline surveys.
N = 4,825 (baseline), 4,897 (midline).
**p* < 0.10, ***p* < 0.05, ****p* < 0.01 for adjusted difference-in-differences.

We also examined Ananya impacts on timely immunizations (recorded from cards only), because delays in immunizations could leave children exposed to infection even if they are eventually immunized. The importance of receiving immunizations on time was emphasized by many of the Ananya program's messages to households, especially through FLW interactions. The percentage of children ages 6–11 months receiving DPT3 by age 4 months (the recommended age is 3.5 months) was little changed in focus or nonfocus districts between baseline and midline, leading to a statistically insignificant estimated impact (Figure VII.2).[63] The midline rate of on-time DPT3 receipt in the focus districts remained very low, at slightly more than 10 percent.

[62] As noted earlier, other supply-side factors such as the uneven distribution of health centers, staff shortages, nonadherence to plans and vaccines being unavailable have been linked with poor immunization outcomes (Phukan et al. 2009; Prinja et al. 2010), but we did not measure these constraints in the midline evaluation.

[63] Because immunization dates were recorded only from cardholders, they could be affected by changes in the characteristics of cardholders over time; therefore, these results should be interpreted with caution.

Figure VII.2. Children ages 6–11 months who received DPT3 by age 4 months, among immunization cardholders



Source: Children ages 6–11 months who had immunization cards in the Ananya baseline and midline surveys.
N = 3,304 (baseline), 3,316 (midline).
*p < 0.10, **p < 0.05, ***p < 0.01 for adjusted difference-in-differences.

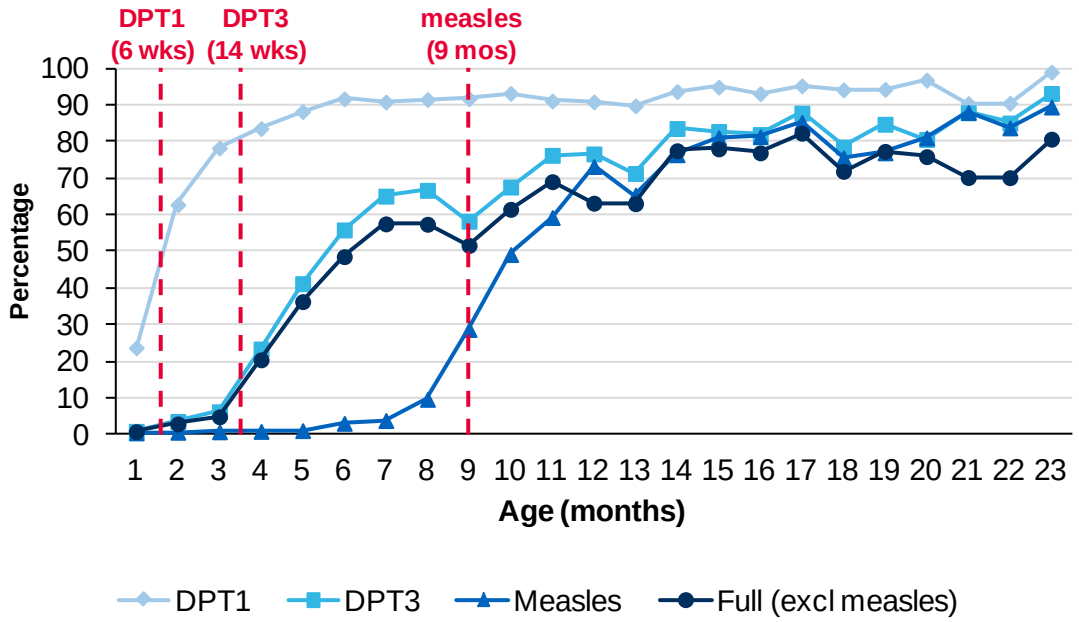
Examining the broader pattern of immunization rates by age at midline through age 23 months suggests that delays in immunizations remain a challenge (Figure VII.3). For example, immunization rates do not begin to stabilize until age 5 months for DPT1, age 10 months for DPT3, and 14 months for measles—well beyond the ages at which these immunizations are meant to be administered (at 1.5, 3.5, and 9 months, respectively). This pattern was broadly similar at baseline for the sample of children ages 0-11 months (not shown), with the age-specific differences between baseline and midline not statistically significant (in part this is because of small sample sizes for the age-specific estimates, which result in wide confidence intervals).

2. Children ages 12–23 months

For children ages 12–23 months, immunization rates for DPT3 were similar in focus and nonfocus districts, but measles and full immunization rates were higher in the focus districts (Figure VII.4). We cannot estimate impacts through difference-in-differences using our data for this age group because we did not collect data for it at baseline. However, we can use results from the 2011-2012 AHS-2 data to get a sense of the likely impacts. That survey computed average immunization rates for children ages 12–23 months from 2008–2010—before the Ananya interventions; it also used a similar approach to the Ananya midline to combine card data and self-reports, making the two sets of results comparable.

The immunization rates for children ages 12–23 months in the AHS-2 were very similar to the midline rates in the nonfocus districts but slightly lower than the midline rates in the focus districts. This finding suggests that Ananya might have differentially affected the rates in the focus districts, leading to a relative increase over time. We interpret the differential change between focus and nonfocus districts as the impact of Ananya, despite the limitations of combining data from different data sources in the same analysis.[64]

Figure VII.3. Patterns of immunizations, by age, in focus districts at midline



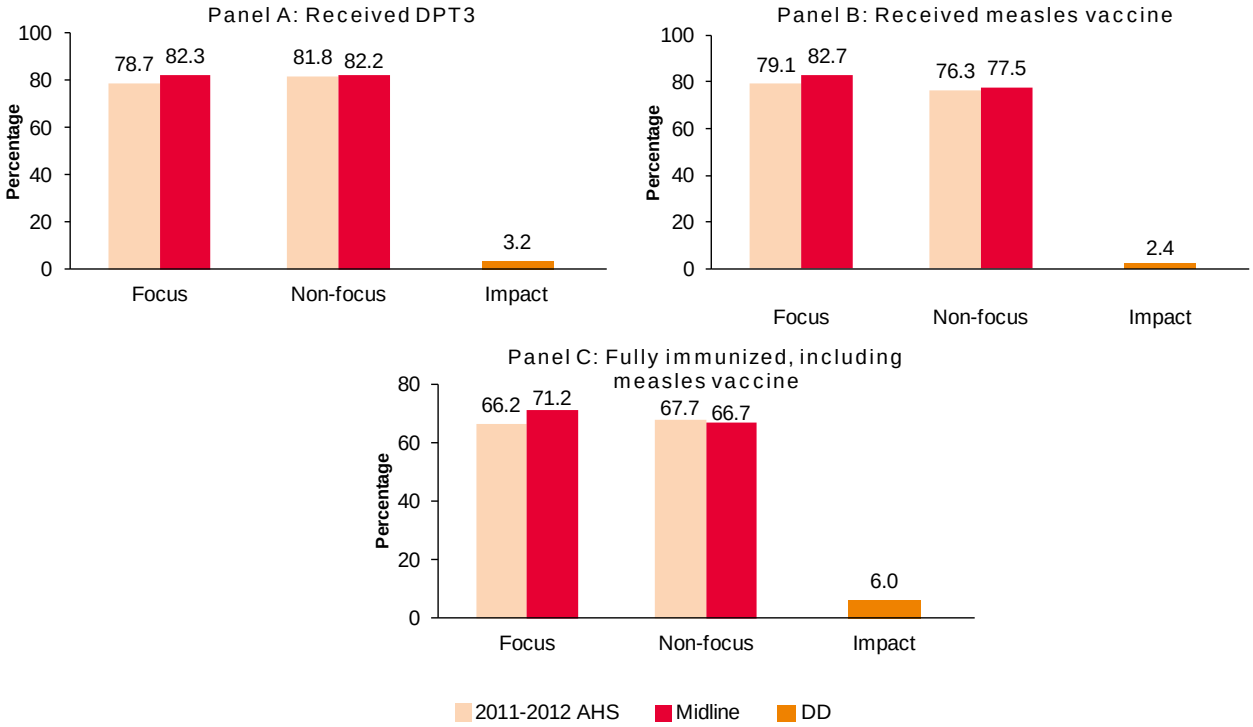
Source: Children ages 0–23 months in focus districts in Ananya midline survey.

Note: Red dashed lines indicate ages at which vaccines are recommended to be given, including DPT1 (6 weeks), DPT3 (14 weeks), and measles (9 months).

N = 3,706.

[64] Specifically, because the microdata are not publicly available, we were unable to adjust for demographic characteristics in the difference-in-differences estimates and could not estimate significance levels.

Figure VII.4. Children ages 12–23 months who received immunizations, combining card data and self-reports



Source: Children ages 12–23 months in Ananya midline survey and author calculations from the 2011–2012 AHS district-level data.

Note: Statistical significance of impacts could not be determined because the AHS microdata were not available.

N = 2,347–2,483 (Ananya midline).

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VIII. REPRODUCTIVE HEALTH

Increasing the use of modern contraceptive methods is an important strategy to improve the lives of mothers and children. Limiting total fertility through the use of these methods can increase household living standards, promoting improvements in family health and well-being. Even holding total fertility constant, increasing spacing between children through these methods can improve the health of both a mother and her children.

As of 2010–2012, the total fertility rate in rural Bihar was 3.6, having decreased from 4.6 a decade earlier (SRS 2012). Though this is a remarkable decline, fertility in Bihar is still considerably higher than in India as a whole (total fertility rate of 2.4, SRS 2012) and the level falls short of the Millennium Development Goal targets (Paul et al. 2011). Moreover, estimates of unmet need suggest that many women in Bihar would like to reduce their fertility but lack access to contraceptives or the capacity to use them. For example, AHS data suggest that about 31 percent of married women ages 15 to 49 had unmet need for family planning in 2008-2010, with 17 percent reporting an unmet need for spacing and 14 percent reporting an unmet need for limiting (Registrar General of India 2013). In the same survey, only about 38 percent of women reported using a modern method of contraception.

The Ananya baseline data suggest even lower rates of modern contraceptive use than the AHS (13 percent across the state), although the difference in use is likely explained by our survey of a different population of women (those who gave birth in the past year and not all married women of reproductive age).[65] Regardless, these data suggest that fertility is high and modern contraception is not common. We also found that modern contraceptive use at baseline was largely limited to permanent methods (that is, female sterilization). At baseline, 7 percent of women in our sample had been sterilized, 3 percent used an oral contraceptive pill, and 3 percent used condoms. Use of long-acting reversible contraceptives (LARCs), which are safe, economical, and highly effective, was even lower low, with 2 percent of women using an IUD.

The literature suggests that reducing total fertility and increasing the timing between births has the potential to improve overall family health in Bihar. Pregnancies within the first 12 months after a birth are at highest risk for adverse health outcomes to the mother and child

Key findings from this chapter

- Ananya had a large impact on the use of modern methods of contraception.
- The impact on contraceptive use was mostly driven by impacts on the use of temporary methods, such as condoms and oral contraceptives.
- Despite the programmatic focus on increasing the use of IUDs, Ananya had little impact on the use of this method. This finding might be caused by the low number of qualified providers of IUDs in Bihar.
- Ananya was associated with small reductions in unmet need for family planning.

[65] Unmet need data are not available in the Ananya baseline.

(DaVanzo et al. 2007; Gaffield et al. 2014). A study in rural areas of four Indian states of Bihar, Jharkhand, Maharashtra, and Tamil Nadu suggests that births identified as mistimed or unwanted had an 83 percent higher risk of neonatal mortality compared with wanted births (Singh et al. 2013b). Moreover, another study that used NFHS-3 data reported that unwanted children in India were twice as likely as wanted children to not receive all recommended vaccinations and had a 30 percent higher chance of being stunted. These children were also more than two, three, and five times more likely to die during the neonatal, post-neonatal, and early childhood periods, respectively (Singh et al. 2012c). Finally, Goldie et al. (2010) find that increasing family planning is the most cost-effective individual intervention to reduce pregnancy-related mortality.

The Ananya interventions aim to improve reproductive health, with a particular focus on increasing postpartum use of modern contraceptive methods, such as IUDs, contraceptive pills, and condoms. Many of the program's interventions encourage the use of these methods through interactions with FLWs and by stimulating awareness of and demand for family planning, including through media efforts. These informational campaigns attempt to address the gaps in knowledge and use of contraception.

The literature suggests these types of interventions can be effective in improving reproductive health. Studies exploring the gap between the availability and use of reproductive health services in Bihar reveal that women rely on FLWs for information and that there is a positive correlation between knowledge and use of family planning (Daniel et al. 2008; Banerjee et al. 2012). Further research on India and neighboring countries also indicates that FLWs are a promising channel for encouraging the use of appropriate reproductive health services (Andersen et al. 2013; El Arifeen et al. 2013). Further, an evaluation of a behavioral change communication intervention in Uttar Pradesh indicated that counseling by FLWs can be an effective and feasible strategy for promoting postpartum contraception (Sebestian et al. 2012). Past work on improving reproductive health through media campaigns suggests this strategy might also be particularly useful. In particular, Snyder et al. (2003) used a meta-analysis to demonstrate that mass media campaigns have typically positive impacts on knowledge and use of family planning.

This chapter examines the relationship between Ananya and contraceptive use and the unmet need for contraception. Statistics on contraceptive use enable us to understand the steps women are taking to prevent pregnancy. Building this understanding is useful but provides only a part of the story on family planning. To provide more complete information, we also analyze unmet need for contraception, an alternative measure of family planning. We consider both the overall impacts of Ananya and impacts by gender of most recent child and mother's age. These subgroups were chosen based on the literature. Kumar and Singh (2013) suggest unmet need can be particularly high among young mothers, making this population a potentially challenging one to serve. It is also well known that families exhibit a preference for sons in India (Sen 1992), suggesting that family planning behavior might differ after the birth of a female than a male child. Additionally, we examine estimates of Ananya's impact based on mother's parity and time since childbirth, both also potentially important determinants of contraceptive uptake.

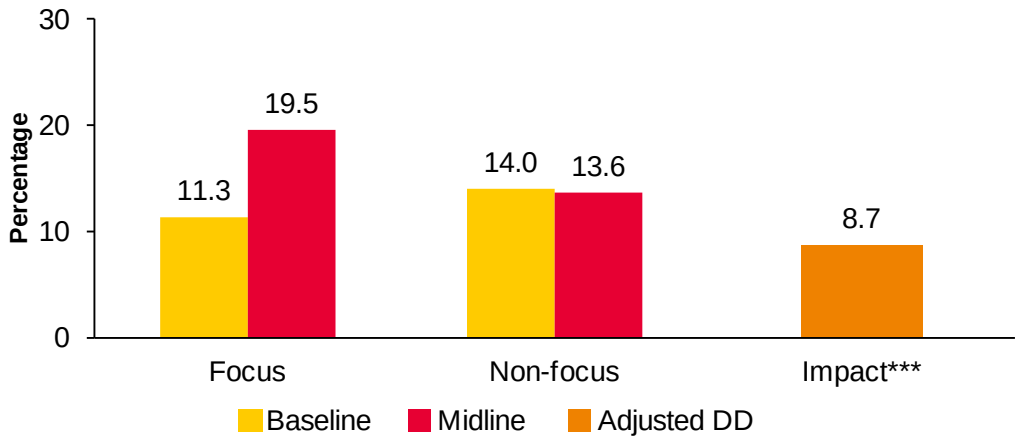
A. Use of contraception

Our main analysis of contraceptive use estimates impacts on modern contraceptive use for mothers of children ages 0–11 months, by comparing the changes in use in focus and nonfocus

districts between baseline and midline (difference-in-differences estimates). We also use data from the midline survey to examine midline differences in the levels of contraceptive use between focus and nonfocus districts for mothers of children ages 12–23 months (baseline data were not collected for children in this age range, so we cannot estimate impacts) and explore differences in impacts by subgroup.

Ananya was associated with increases in the use of modern contraceptive methods.[66] As Figure VIII.1 shows, contraceptive use increased in focus districts from 11 to 20 percent between baseline and midline, but stayed relatively constant (about 14 percent) in nonfocus districts over time. Comparing these changes, the estimated impact of Ananya was a statistically significant 9 percentage points (77 percent of the focus district baseline mean).

Figure VIII.1. Use of any modern method of contraception



Source: Women with children ages 0–11 months in Ananya baseline and midline surveys.
N = 12,283 (baseline), 11,521 (midline).
*$p < 0.10$, **$p < 0.05$, ***$p < 0.01$ for adjusted difference-in-differences.

To better understand which women are driving these impacts, we examined impacts for women with younger (0–5 months) and older (6–11 months) children. Although Ananya advocated the use of modern methods of contraception for all women, impacts could differ based on the timing of a women's most recent birth. For example, in the first six months after birth, the lactational amenorrhea method (LAM) associated with breastfeeding, can be relatively reliable for preventing conception (Kennedy 2002). Women relying on LAM could have been less receptive to messages on modern contraceptive use because they did not view their use as necessary; alternatively, they might have become convinced that relying on this method alone was not sufficient.

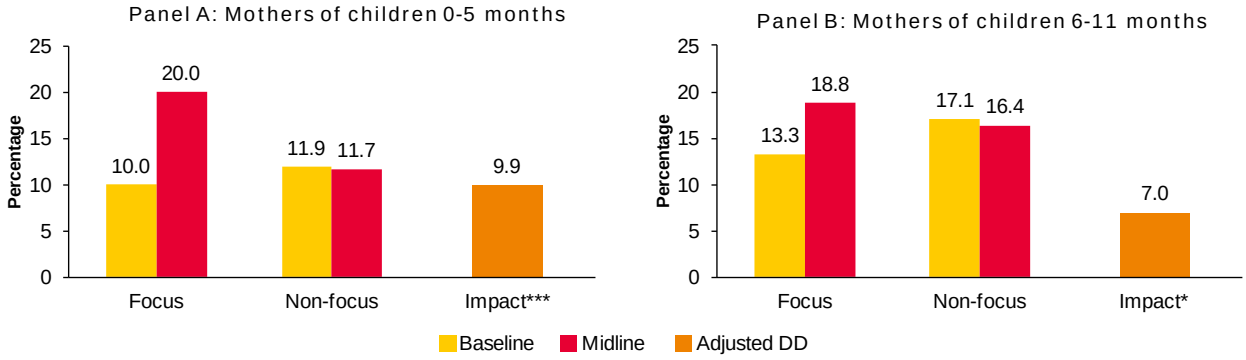
Figure VIII.2 demonstrates our results by children's ages. We find that the impact of Ananya on contraceptive use is concentrated among mothers of children ages 0–5 months. For these women, the impact of Ananya on modern contraceptive use was 10 percentage points (almost double the focus district baseline mean), a highly statistically significant difference. The

[66] We defined modern methods as sterilization of the woman or her husband (permanent modern methods), as well as condoms, pills, IUDs, or injectables (temporary modern methods).

impact estimate for mothers with a children ages 6–11 months is still substantively important but smaller at 7 percentage points (53 percent of the focus district baseline mean) and is significant only at the 10 percent level.

We also analyzed the relationship between Ananya and use of specific methods of contraception. The results suggest that impacts on contraceptive use were driven by increases in the use of temporary methods, particularly condoms and pills (Figure VIII.3).[67] The impacts of Ananya on pill use were the largest of all the methods we considered, at 4 percentage points (148 percent of the baseline focus district mean), driven by both an increase in focus districts and a slight decrease in nonfocus districts. Ananya also had a significant impact on condom use. Condom use more than doubled in focus districts between baseline and midline but stayed roughly constant in nonfocus districts, resulting in an impact of 3 percentage points (136 percent of the baseline focus district mean) which was significant at the 10 percent level. In contrast, the impacts of Ananya on female sterilization or use of IUDs were negative and statistically insignificant. These insignificant impacts could be related in part to supply constraints, because access to providers that offer these services might be limited in Bihar.

Figure VIII.2. Use of any modern method of contraception, by age of child



Source: Women with children ages 0–11 months in Ananya baseline and midline surveys.

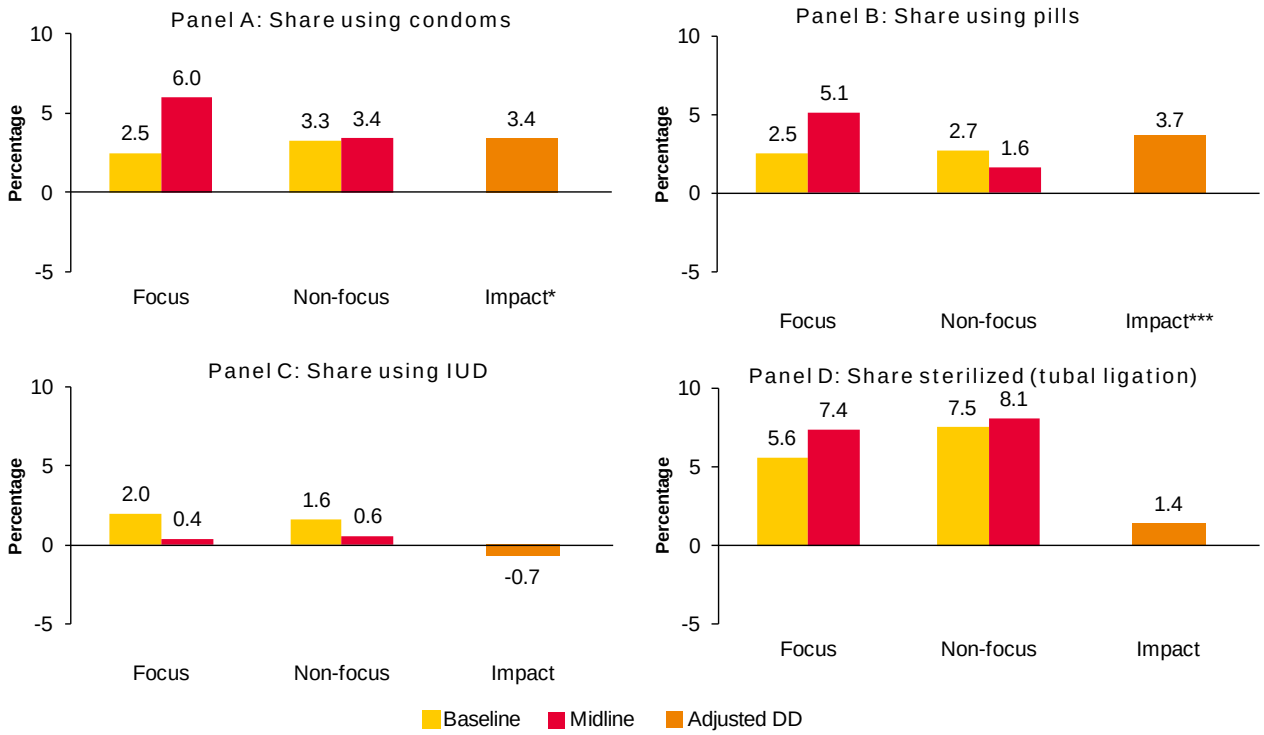
For Panel A, N = 7,440 (baseline), 6,735 (midline). For Panel B, N = 4,843 (baseline), 4,786 (midline).

*$p < 0.10$, **$p < 0.05$, ***$p < 0.01$ for adjusted difference-in-differences.

DD = difference-in-differences.

[67] This figure omits rates of use for other modern methods of contraception that were used by fewer than one percent of the sample (for example, male sterilization).

Figure VIII.3. Use of modern methods of contraception, by method



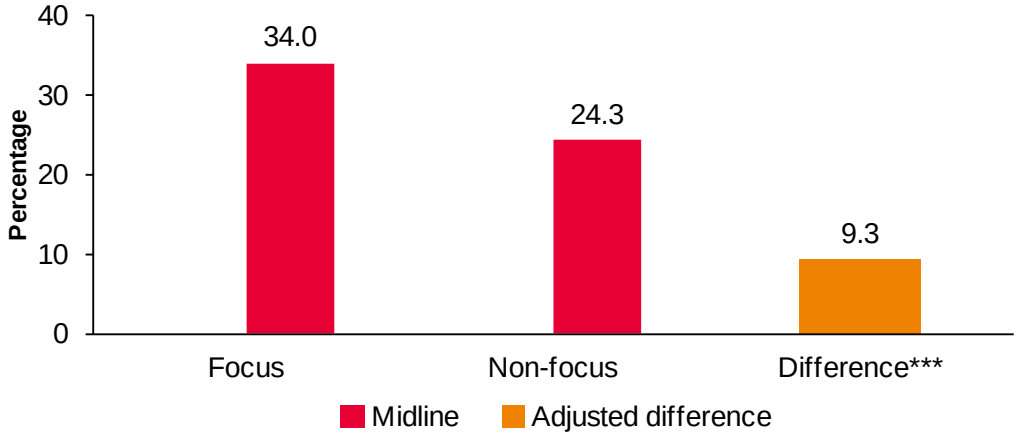
Source: Women with children ages 0–11 months in Ananya midline survey.

N = 12,283 (baseline), 11,521 (midline) across all panels.

*$p < 0.10$, **$p < 0.05$, ***$p < 0.01$ for adjusted differences-in-differences.

Although our baseline survey captured information on contraceptive use only for mothers of children ages 0–11 months, our midline survey captured this information for mothers of children up to 23 months. Figure VIII.4 considers the differences between focus and nonfocus districts at midline in contraceptive use for mothers of children in the 12–23-month age group. Use of contraception is higher at midline for mothers of children in this age group compared with those with children ages 0–11 months (this result was driven mainly by higher female sterilization, not shown). After adjusting for differences in demographic characteristics, use of modern methods was 9 percentage points higher for mothers of children ages 12–23 months in the focus districts compared with the nonfocus districts (38 percent of the nonfocus district mean). Similar to the results for women with children ages 0–11 months, these differences are driven by higher use of pills and condoms in focus districts (not shown).

Figure VIII.4. Use of any modern method of contraception, mothers of children ages 12–23 months

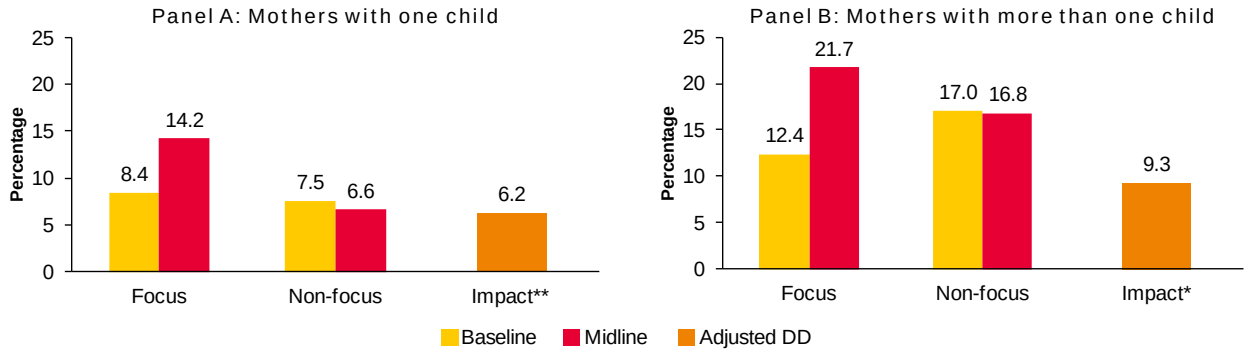


Source: Women with children ages 12–23 months in Ananya baseline and midline surveys.
N = 2,159.
*p < 0.10, **p < 0.05, ***p < 0.01 for adjusted difference-in-differences.

We also explored the estimated relationship between Ananya and contraceptive use by parity (whether the woman had only one or more than one child) and by the gender of the most recent child. We might expect Ananya to have different impacts across these groups. Previous research has suggested that a woman's contraceptive use is motivated both by family size and by the sex composition of her children. Edmeades et al. (2011) demonstrates that in India, a woman's decision to have a tubal ligation is motivated by son preference mainly at lower parities (three or fewer children) and by concerns about family size at higher parities. Other research using data from Nepal and India suggests that women have a desire to have at least two male children and alter their contraceptive use in response (Jayaraman et al. 2009; Edmeades et al. 2012).

Unsurprisingly, we see that women with one child are less likely to use contraception than those with more than one child (Figure VIII.5). For example, in focus districts at baseline, 8 percent of women with one child used some modern form of contraception, compared with 12 percent of women with more than one child. However, the impact of Ananya on modern contraceptive use is about the same across these two groups. Ananya is associated with a 6 percentage point increase in use for women with one child and a 9 percentage point increase in use for women with more than one child. Both changes are roughly equivalent to three-quarters of the corresponding focus district baseline mean, and the difference between the two estimates is not statistically significant.

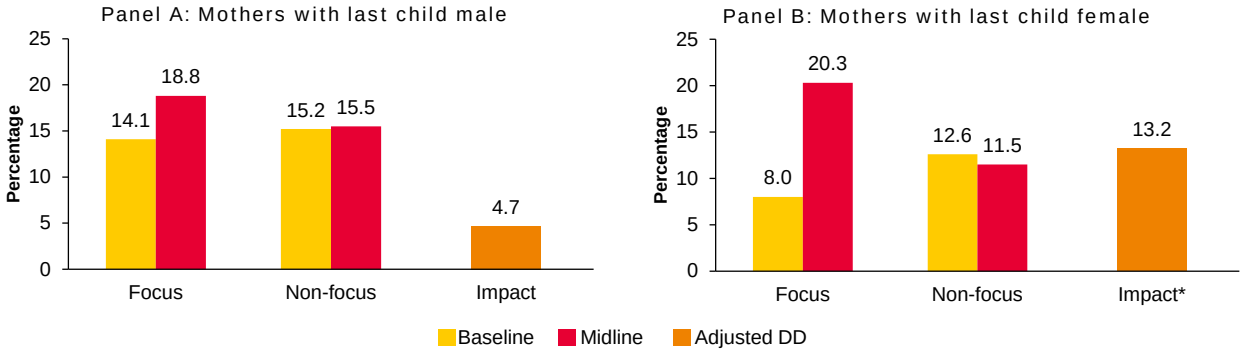
Figure VIII.5. Use of any modern method of contraception, by parity



Source: Women with children ages 0–11 months in Ananya baseline and midline surveys.
For Panel A, N = 3,882 (baseline), 3,561 (midline). For Panel B, N = 8,401 (baseline), 7,960 (midline).
*$p < 0.10$, **$p < 0.05$, ***$p < 0.01$ for adjusted difference-in-differences.

Conversely, Ananya had a much larger impact on the use of modern methods among women who recently had a female child than women who recently had a male child (Figure VIII.6).[68] At baseline, about 14 percent of women in focus districts who most recently had a boy used modern contraception, compared with 8 percent of women who most recently had a girl. This finding demonstrates the commonly cited preference of women in India to become pregnant more quickly after the birth of a girl. Ananya had an impact of 13 percentage points on contraceptive use among women who most recently had a girl (165 percent of the baseline focus district mean) but only 5 percentage points among women who just had a boy (33 percent of the focus district mean). The former estimate is statistically significant at standard levels, but the latter is not. Further, the difference between the estimates for mothers who just had a boy or girl is statistically significant. The net result of the larger impacts on women who recently had a girl is that, at midline, the gap in contraceptive use by gender of the most recent child is still evident in nonfocus districts but has largely disappeared in focus districts.

Figure VIII.6. Use of modern contraception, by gender of most recent child



Source: Women with children ages 0–11 months in Ananya baseline and midline surveys.
For Panel A, N = 6,410 (baseline), 6,210 (midline). For Panel B, N = 5,873 (baseline), 5,311 (midline).
*$p < 0.10$, **$p < 0.05$, ***$p < 0.01$ for adjusted difference-in-differences.

[68] We also considered estimates based on whether a woman had any living sons. The results were similar to those based on the gender of the most recent child.

B. Unmet need

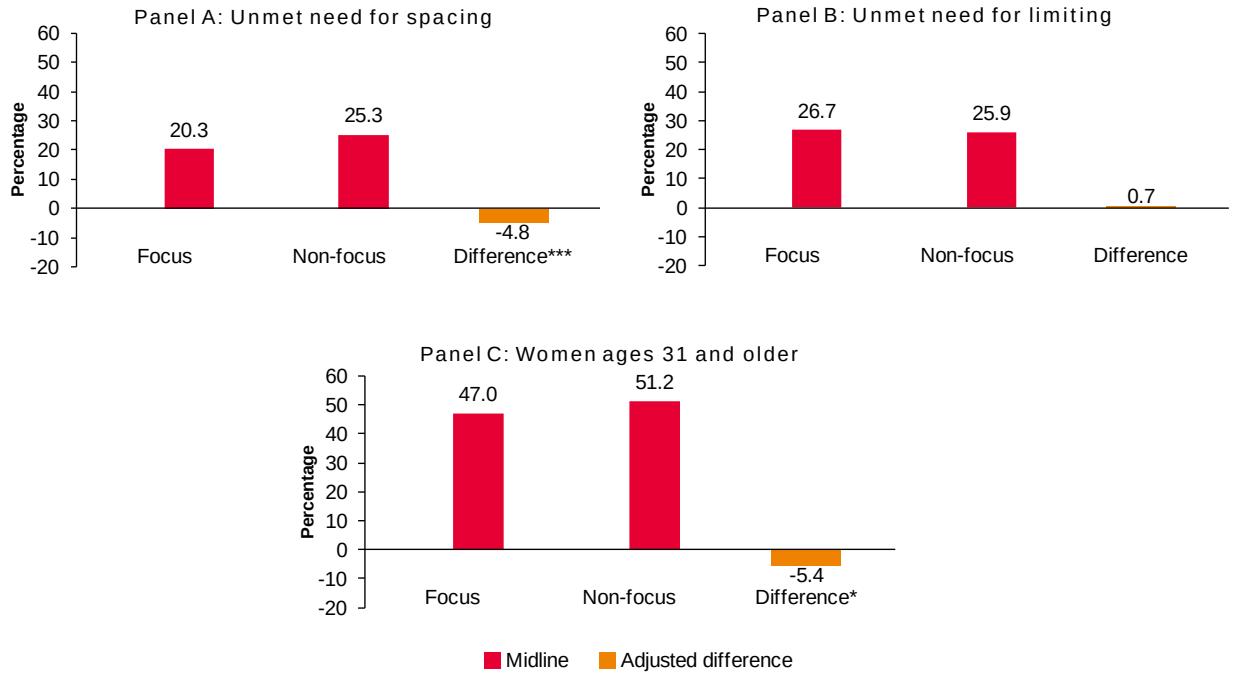
Unmet need is a valuable alternate measure for assessing family planning coverage rates. A woman is said to have unmet need for *spacing* if she (1) is not already pregnant, (2) can physically become pregnant, (3) is not currently using a modern method of contraception, and (4) would like to have another child but would like to wait 25 or more months before becoming pregnant again. A woman has unmet need for *limiting* if the first three conditions apply and she does not want any more children. A woman has any unmet need if either condition holds. We analyzed the relationship between Ananya and unmet need using data from only the midline, pooling women who last gave birth 0–23 months ago.[69] Measures of unmet need could increase or decrease in response to changes in contraceptive use as a result of Ananya, depending on how the supply of contraception changed over the evaluation period.

We find that Ananya is associated with lower levels of unmet need for spacing but not limiting (consistent with the increases in the use of temporary but not permanent methods of contraception). In focus districts at midline, 20 percent of women reported unmet need for spacing, compared with 25 percent of women in nonfocus districts (Figure VIII.7). The regression-adjusted difference is 5 percentage points (19 percent of the mean in nonfocus districts) and statistically significant. Conversely, we found that 27 percent of women in focus districts and 26 percent of women in nonfocus districts reported unmet need for limiting fertility, a small and insignificant difference. The share of women in focus districts who reported *any* unmet need that was 5 percentage points (11 percent) lower than the share reporting any unmet need in nonfocus districts, a marginally statistically significant difference. Thus, it appears that Ananya is associated with lower unmet need overall, but that this difference is entirely driven by unmet need for spacing.

We also examined the relationship between Ananya and unmet need for several subgroups of women. We first considered this variable by age of mother, as young mothers may have both limited agency and greater gaps in contraceptive coverage (Upadhyay et al. 2014; Snyder et al. 2003). However, the data suggest that unmet need tends to *increase* as women age (Figure VIII.8). Although this might seem counterintuitive, this difference is reasonable in light of variation in parity. Younger women have fewer children, are more likely to want to get pregnant again quickly, and thus will have lower unmet need for family planning. Our results further indicate that the difference in unmet need in focus and nonfocus districts at baseline is larger for younger women. This difference was 10 percentage points for women ages 20 and younger, 5 percentage points for women ages 21 to 30, and 3 percentage points for women older than 30; however, only the difference for women ages 21 to 30 is statistically significant. The lack of significance in the sample of younger mothers is driven largely by smaller sample sizes for this group.

[69] Our baseline data did not enable us to assess unmet need for spacing. Results for unmet need for limiting are similar when the baseline data are incorporated and the sample is restricted to women with children ages 0–11 months.

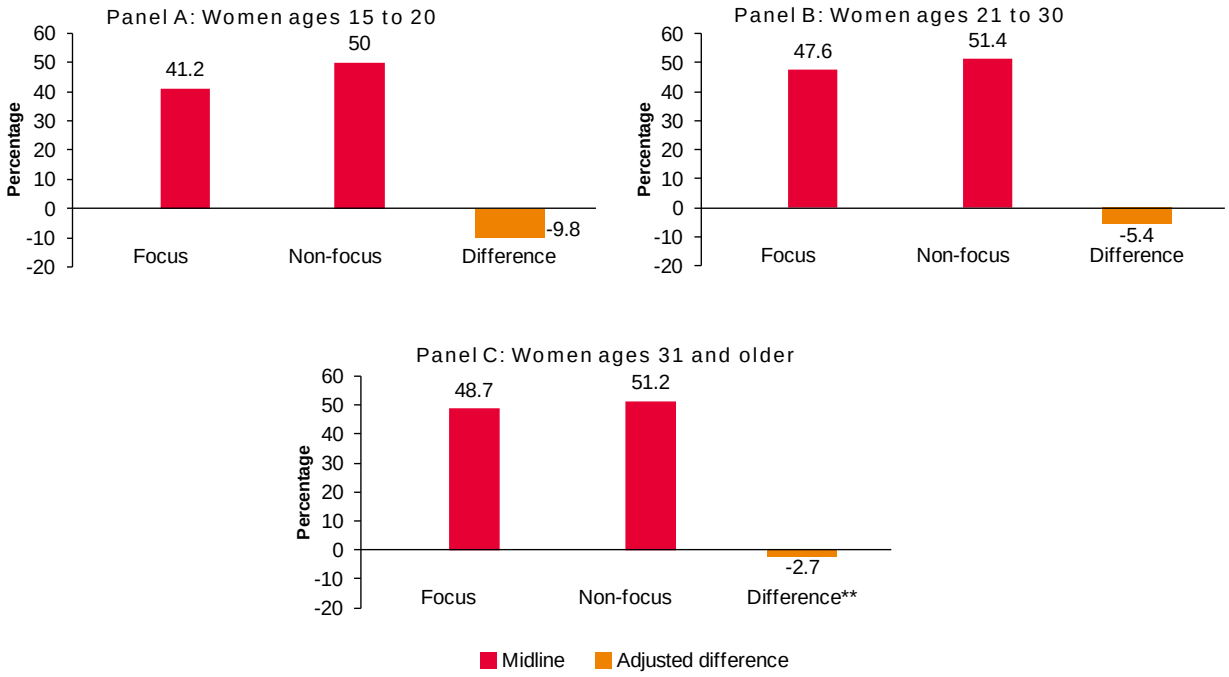
Figure VIII.7. Unmet need for contraception, mothers of children ages 0–23 months



Source: Women with children ages 0–23 months in Ananya baseline and midline surveys.
N = 13,618–13,626.
*p < 0.10, **p < 0.05, ***p < 0.01 for adjusted difference-in-differences.

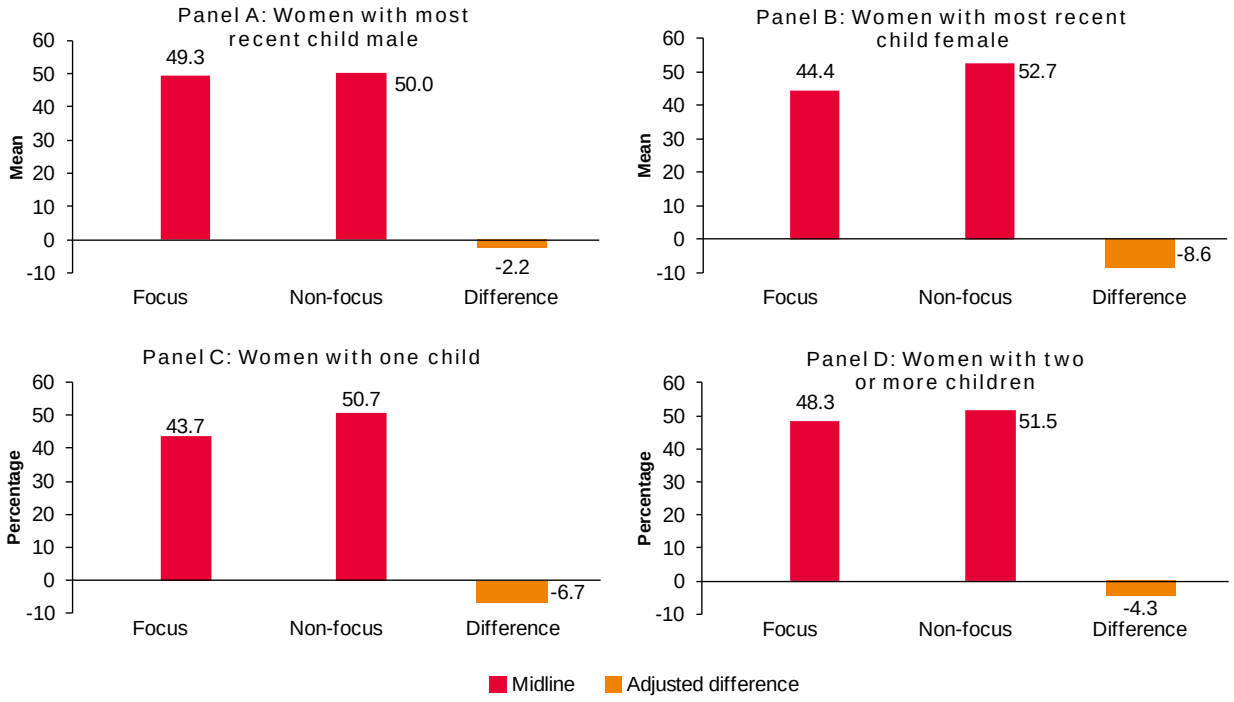
The association of Ananya with unmet need also varied by child's gender and woman's parity (Figure VIII.9). At midline, adjusting for the characteristics of women, unmet need at midline was 2 percentage points lower in focus districts compared with nonfocus districts for women who just had a male child but 9 percentage points lower for those who just had a female child. The latter difference is statistically significant and represents 16 percent of the mean in nonfocus districts. The estimated difference in unmet need between the focus and nonfocus districts at midline is also larger for women with only one child than for those with multiple children; however, the small number of women with a single child makes the former relationship statistically insignificant.

Figure VIII.8. Unmet need for contraception by age of mother, mothers of children ages 0–23 months



Source: Women with children ages 0–23 months in Ananya baseline and midline surveys.
N = 1,699 (Panel A), 10,680 (Panel B), 1,222 (Panel C).
**p* < 0.10, ***p* < 0.05, ****p* < 0.01 for adjusted differences.

Figure VIII.9. Unmet need for contraception by parity and gender of last child, mothers of children ages 0–23 months



Source: Women with children ages 0–23 months in Ananya baseline and midline surveys.

N = 6,294 (Panel A), 7,306 (Panel B), 4,249 (Panel C), 9,351 (Panel D).

*$p < 0.10$, **$p < 0.05$, ***$p < 0.01$ for adjusted differences.

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IX. IMPLICATIONS OF ANANYA FOR EQUITY

The results in Chapter IV showed that Ananya affected the number and quality of interactions between FLWs and households. Further, the analysis from Chapters V-VIII showed that Ananya led to improvements in several outcomes across the maternal and newborn health, nutrition, immunization, and reproductive health domains. In this chapter, we explore whether Ananya led to any reductions in disparities based on marginalization status in a representative set of these outcomes. We examine nine key outcomes related to both FLW–household interactions and family health, spanning the domains discussed in previous chapters.[70]

Although improving equity was not an explicit focus of the Ananya program, some interventions focused specifically on improving the health of more marginalized women (defined as women who might have less access to the health care system based on their religion, caste, literacy, or SES). For example, early enumeration and mapping efforts by the IFHI grant aimed to identify populations not receiving health services; these populations are disproportionately composed of marginalized people. Moreover, Ananya sought to improve maternal and child health across Bihar. If marginalized women initially had poorer health behaviors, there would be more room for improvement and Ananya could potentially have a larger impact on these groups.

The existence of gaps in health outcomes by marginalization status seems likely based on the literature. For example, Singh et al. (2013d) demonstrated that wealthier women in India tend to have far better health behaviors, broadly measured using a composite coverage index. Kumar et al. (2014) used the Ananya data to explore equity gaps in a variety of different measures. They also found large differences in use of ANC and PNC and facility delivery for poorer and

Key findings from this chapter

- Disparities in several outcomes existed between marginalized and nonmarginalized women at baseline. Disparities were particularly large for measures of ANC, facility deliveries, immunization, and modern contraception use.
- For some outcomes and indicators of marginalization, the effects of Ananya were stronger within more marginalized groups, suggesting that Ananya might lead to convergence in equity gaps (for example, our results suggest a decrease in ANC disparities).
- In other cases, we found that Ananya had larger impacts on less marginalized women. For example, Ananya is associated with large increases in modern contraceptive use for non-SC/ST women but not for SC/ST women. This finding suggests that Ananya contributed to the emergence of a gap in contraceptive use based on caste.
- If Ananya seeks to be a force for narrowing disparities in health and health care, interventions might have to more closely target marginalized women.

[70] We presented results for a large number of outcomes in previous chapters, but selected a more limited set of outcomes for this analysis. This approach was both to keep the analysis and interpretation manageable and to reduce of risk of spurious findings when examining a large number of outcomes across several definitions of marginalization. We therefore selected nine key illustrative outcomes that spanned all the domains that we considered.

wealthier women. However, the literature also suggests that improvements in population health do not always imply improvements in health for all segments of the population. Pathak et al. (2010) demonstrated that the poor were largely left out of the improvements in ANC and delivery care experienced in India as a whole from 1992 to 2006. That is, both ANC services and the use of skilled birth attendants increased across India by more than 12 percentage points over this period, but the same measures grew by 2 percentage points or less among the poorest women. Similarly, Mohanty et al. (2009) demonstrated that the gap in family planning by wealth rose from 1992 to 2005, despite increases in the use of modern contraceptive methods for the population as a whole.

Despite these findings, the Ananya theory of change and the focus of some interventions on marginalized groups suggest that Ananya might have led to increases in equity in Bihar, improving the health behaviors of more marginalized households to a larger extent than for less marginalized households. To explore this, we estimated the impact of Ananya within subgroups of women selected based on four measures related to marginalization—religion, SC/ST status, wealth, and literacy.[71] The analysis examined (1) the effect of Ananya within key subgroups, (2) whether Ananya led to improvements in health behaviors for the most marginalized women specifically, and (3) whether disparities in outcomes decreased in the focus districts between baseline and midline.

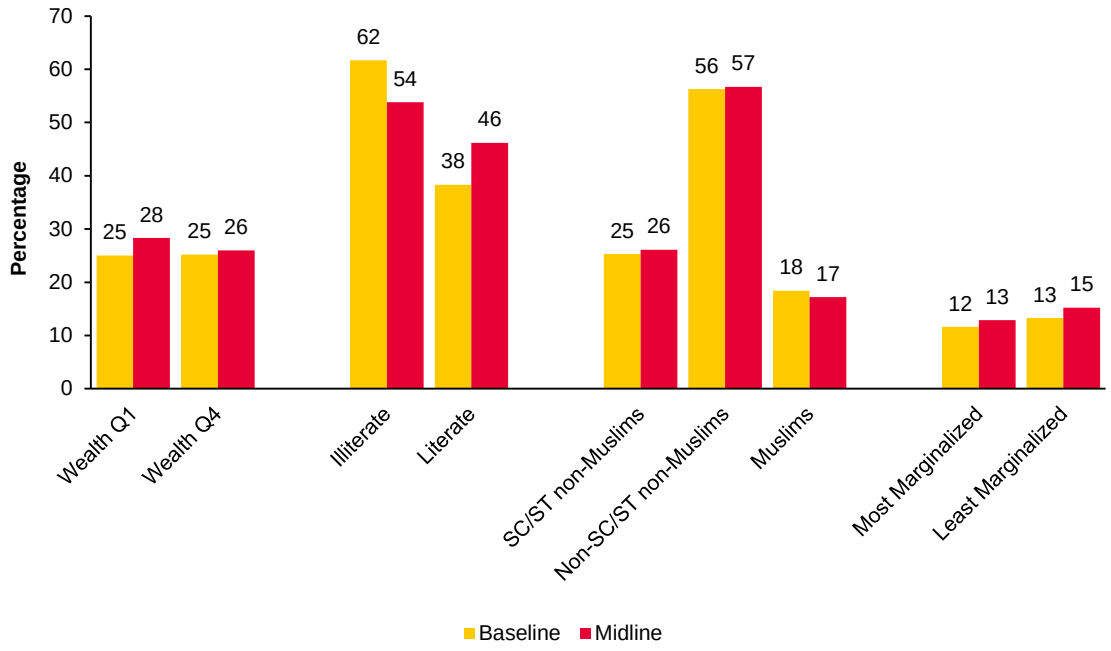
Many women in our sample are classified as marginalized (Figure IX.1).[72] Most of the sample is illiterate, 17 to 18 percent is Muslim, and 25 to 26 percent is SC/ST (all of whom are non-Muslim). About one-quarter of the sample falls into the lowest wealth quartile (by construction, because wealth quartiles were created based on the baseline wealth distribution). We classified 12 to 13 percent of the sample as the most marginalized women (defined as those who are SC/ST or Muslim, illiterate, and in the lowest wealth quartile) and 13 to 15 percent as the least marginalized (women who are non-Muslim, non-SC/ST, literate, and in the highest wealth quartile). Measures of marginalization are often correlated. For example, 82 percent of women in the lowest wealth quartile were also illiterate, compared with 25 percent of those in the highest wealth quartile.

This demographic profile is similar to that provided by other data sources on Bihar. For example, in the AHS 2008–2010, 57 percent of married women ages 15 to 49 in Bihar were illiterate. In the 2001 Census (the last for which data on religion were available), about 20 percent of all people living in Bihar were Muslim. In the 2011 Census, about 17 percent of all women in the state were from scheduled castes or tribes. This suggests the share of our sample from a marginalized group is approximately equal to the share of all people who are marginalized in Bihar (as we would expect based on our sampling design).

[71] These measures of marginalization were designed to identify women who likely have less access to the health care system. The measures were selected in consultation with program experts to identify a wide variety of women who might face structural issues in seeking health care.

[72] We presented some of these characteristics in Chapter III, for the full sample of mothers of children ages 0–23 months. Here we focus on mothers of children ages 0–11 months, because most of the outcomes we examine apply to that age group. The marginalization characteristics are similar for both groups, but may differ by a few percentage points.

Figure IX.1. Marginalization in Bihar



Sources: Ananya baseline and midline surveys conducted by Sambodhi in collaboration with Mathematica and PHFI in spring 2012 and spring 2014, respectively.

Note: Sample includes 12,384 mothers of children ages 0–11 months (baseline), and 11,654 mothers of children ages 0–11 months (midline). All estimates are for mothers of children ages 0–11 months unless otherwise specified. Impacts are DD estimates. The most marginalized women are SC/ST or Muslim, illiterate, and in the lowest wealth quartile. The least marginalized women are non-SC/ST, non-Muslim, literate, and in the highest wealth quartile

In this chapter, we explore whether Ananya led to larger changes among more marginalized women, implying a decrease in disparity, or whether it increased disparities by improving outcomes more for less marginalized women. Section A depicts the disparities occurring at baseline, providing context on the differences that existed before Ananya. Section B describes how the impact of Ananya differed across marginalized subgroups, explaining how the program could have narrowed or widened disparities. Section C discusses how equity gaps have changed in the focus districts between baseline and midline, changes that could be attributable in part to Ananya.

A. Disparities at baseline

Before exploring how Ananya might have affected differences in outcomes between marginalized and nonmarginalized women, we first analyzed differences in our key outcomes at baseline. Table IX.1 details the baseline means for each measure, as well as the differences between each indicator by marginalization status. These descriptive statistics enable us to establish which outcomes had the largest disparities and, therefore, where interventions targeting marginalized groups might be particularly relevant for policymakers who want to reduce inequities. Our comparisons suggest that the following disparities existed at baseline:

- **FLWs were less likely to visit some types of marginalized households but more likely to visit others.** Compared with non-Muslim women, Muslim women were 6 percentage points less likely to receive two or more final-trimester visits (16 percent of the overall baseline mean) and 5 percentage points less likely to receive a postpartum visit (24 percent of the overall baseline mean). Additionally, women in the lowest wealth quartile were less likely to be visited by an FLW before or after birth, although only the difference in postpartum visits was statistically significant (6 percentage points, or 28 percent of the overall baseline mean). Compared with the least marginalized women, the most marginalized women were 6 percentage points less likely to receive a post-delivery FLW visit (32 percent of the overall baseline mean). In contrast, we find that SC/ST women were significantly *more* likely to receive final-trimester FLW visits compared with non-SC/ST women.
- **Large disparities existed in the receipt of ANC and the share of women delivering in facilities.** Women in the lowest wealth quartile, illiterate women, SC/ST women, and the most marginalized women were all significantly less likely than their respective nonmarginalized counterparts to have received three or more ANC check-ups, with the difference ranging from 11 to 34 percentage points (from 38 to 119 percent of the baseline mean value). For facility deliveries, all comparisons we considered (based on wealth, religion, literacy, caste, and our composite measure) also suggested statistically significant disparities. These differences ranged from 10 to 32 percentage points (16 to 51 percent of the baseline mean value).
- **There were few significant disparities in newborn care.** We considered two measures of immediate newborn care in this analysis: clean cord care and immediate breastfeeding. Only a handful of differences between marginalized and nonmarginalized women in these outcomes were statistically significant, and only one contrast (clean cord care for SC/ST women) suggested that marginalized women were worse off at baseline.
- **There were statistically significant disparities in immunizations at baseline.** All contrasts that we considered in this domain suggest significantly lower immunization rates among marginalized women. The largest difference was between the most and least marginalized women. The most marginalized women were 15 percentage points (23 percent of the overall baseline mean) less likely than the least marginalized to have their children receive DPT3.
- **There were gaps in the complementary feeding practices of SC/ST and non-SC/ST women.** SC/ST women were 6 percentage points (9 percent of the overall baseline mean) less likely to practice complementary feeding than non-SC/ST women. No other statistically significant disparities existed for this outcome at baseline.
- **Disparities in the use of modern contraception methods existed across almost all measures of marginalization.** For all contrasts except for SC/ST versus non-SC/ST women, marginalization was associated with significantly lower use of modern methods. The difference was largest by wealth quartile, with the women in the lowest quartile 13 percentage points (97 percent of the baseline mean) less likely to use modern methods than those in the highest quartile.

Overall, we see strong evidence for equity gaps in ANC, facility delivery, immunization, and contraceptive use before the implementation of Ananya. This is consistent with the broader

Table IX.1. Differences in health outcomes, by marginalization status at baseline

Outcome	Average baseline value	Differences by marginalized subgroup: Wealth Q1 versus Q4	Illiterate versus literate	SC/ST versus non-SC/ST	Muslim versus non-Muslim	Most versus least marginalized	Evidence of equity gaps in outcome
Visited by FLW two or more times in last trimester	35.3	-2.2	2.4	4.4**	-5.5**	2.4	Mixed
Received post-delivery visit from FLW	19.9	-5.6***	-1.0	1.3	-4.8**	-6.4***	Moderate
Received three or more ANC check-ups	28.4	-23.3***	-15.9***	-10.7***	0.4	-33.9***	Strong
Delivered at facility	62.4	-24.9***	-17.3***	-11.3***	-10.1***	-31.8***	Strong
Clean cord care[a]	24.0	12.7***	1.0	-2.8*	-1.2	5.6*	Mixed
Breastfed child within an hour of birth	44.8	-3.0	-2.3	4.4**	-1.2	-2.0	None
Child received DPT3 (ages 6–11 months)	64.9	-8.1***	-8.6***	-6.3***	-6.3**	-14.8***	Strong
Child receives any solid or semisolid foods (ages 6–11 months)	65.3	4.4	-0.5	-5.8**	-0.9	1.8	Moderate
Used modern method of contraception[b]	13.3	-12.9***	-3.6***	-0.9	-6.7***	-8.9***	Strong

Source: Ananya baseline survey conducted by Sambodhi in collaboration with Mathematica and PHFI in spring 2012.

Notes: For outcomes using all mothers with children ages 0–11 months: N = 12,384 (baseline average), 12,383 (religion and literacy comparisons), 10,158 (SC/ST comparison), 6,465 (wealth comparison), and 3,261 (most versus least marginalized). For outcomes using all mothers with children ages 0–6 months: N = 4,929 (baseline average), 4,928 (religion comparison), 4,024 (SC/ST comparison), 2,609 (wealth comparison), and 1,345 (most versus least marginalized). Item-specific nonresponse might lead to small differences in sample sizes by outcomes.

Differences are calculated as mean for marginalized minus mean for nonmarginalized. Calculations based on SC/ST exclude Muslims. Regression-adjusted differences (correcting for parity, woman's age, and rural location) reported. *$p < 0.10$, **$p < 0.05$, ***$p < 0.01$ for adjusted difference.

Outcome is classified as providing no evidence of equity gaps if all estimates are insignificant or positive. Outcome is classified as providing mixed evidence of equity gaps if estimates are positive and significant for some groups and negative and significant for others. Outcome is classified as providing moderate evidence of equity gaps if no differences are significant and negative and one to three differences are significant and positive. Outcome is classified as providing strong evidence of equity gaps if no differences are significant and negative and four or five differences are significant and positive.

[a]Defined as a clean blade used to cut the cord, a clean thread used to tie it, and nothing applied to the cord after cutting or to the umbilicus after the cord drops off.

[b]We defined the following methods of contraception as modern methods: female sterilization, male sterilization, pills, injectable contraception, IUDs, and condoms.

literature on inequalities in health and health care in India, which has found substantial inequalities based on religion, caste, wealth, and literacy. Sanneving et al. (2013) demonstrated that economic status, caste, and education are some of the most important social drivers of maternal and reproductive health care.

A variety of studies have also examined specific gaps in care, finding many substantial inequities. Palliadavath et al. (2004) demonstrated a substantial correlation between ANC and SES and Lauridsen and Pradhan (2011) showed a significant positive relationship between household wealth and rates of child immunization. Speizer et al. (2012) further showed differences in the contraceptive behavior of women in Uttar Pradesh based on their level of education. The study demonstrated that less educated women were more likely to be sterilized but less likely to use other forms of modern contraception. Similar results were found in Punjab by Singh et al. (2009). Mukherjee et al. (2011) argued that caste is the most important social determinant of health in India. This was supported by work on differences in antenatal, delivery, and post-delivery care in Jharkland (Maiti et al. 2005) and Uttar Pradesh (Hazarika 2011). Finally, many studies cited religion as an important determinant of health care, with reproductive health often a particular focus. For example, Speizer et al. (2012) demonstrated gaps in contraceptive use between Muslim and Hindu women in Uttar Pradesh; Hazarika (2010) showed significant differences in delivery care across religious groups using data from women living in slums across India.

B. Ananya's impacts on marginalized women and implications for equity

Given these large gaps in health outcomes, we assessed how the impact of Ananya on our nine key outcomes varied by marginalization status. To estimate the impact of Ananya for a given marginalized subgroup, we looked at how outcomes changed from baseline to midline in the focus districts among women in that subgroup and compared that difference with the change occurring among women with the same characteristic in nonfocus districts.[73] This approach provided us with a difference-in-differences estimate of Ananya's impact on individuals within the subgroup of interest. If the impact of Ananya for a marginalized group of women was larger than that for their nonmarginalized counterparts for a given outcome for which a disparity existed at baseline, this suggests that Ananya led to reduction in the disparity for that outcome. Table IX.2 provides the estimated impacts of Ananya for each subgroup and outcome considered; figures throughout the chapter highlight specific impacts of note.

Although there were no significant gaps at baseline in final-trimester FLW visits based on wealth or literacy status (and SC/ST women actually had higher rates of such visits than non-SC/ST women), we found that Ananya had larger impacts on final-trimester visits for all marginalized groups (Figure IX.2). These estimates suggest that Ananya might have led FLWs to target marginalized women more than others for home visits. Our results also suggest that Ananya might be associated with reducing the one disparity in final-trimester FLW visits that we found, namely between Muslim and non-Muslim women, because the impact was 5 percentage points larger for Muslim women. We also examined the relationship between Ananya and postpartum FLW visits and found no notable differences in the impacts for any of our marginalized subgroups (Table IX.2).

[73] Our analysis also controlled for mother's age and parity and household's location (district and rural location).

Table IX.2. The impacts of Ananya, by subgroup

Variable	Impacts										
	Overall	Wealth Q1	Wealth Q4	Illiterate	Literate	SC/ST non-Muslims	Non-SC/ST non-Muslims	Muslims	Non-Muslims	Most marginalized	Least marginalized
Visited by FLW two or more times in last trimester	9.6***	16.9***	3.3	13.2***	5.2	13.9**	6.9*	13.5*	9.0***	14.8**	1.7
Received post-delivery visit from FLW	0.1	0.6	-2.5	2.3	-2.4	-1.1	0.4	3.5	-0.7	-5.9	-7.1
Received three or more ANC check-ups	4.6	13.2**	4.8	6.8**	1.4	4.1	5.2	5.8	4.3	12.0**	1.1
Delivered at facility	-0.4	-1.0	-5.3**	-0.4	-1.1	2.7	0.3	-0.4	0.0	2.2	-1.1
Clean cord care[a]	7.4***	7.0	5.1	8.3***	5.9*	13.6***	6.8*	-1.3	9.2**	11.1*	5.2
Breastfed child within an hour of birth	2.7	7.0	3.3	5.5	-0.6	14.2***	2.0	-10.1	5.4*	23.9***	6.4
Child received DPT3 (ages 6–11 months)	2.2	5.9	-1.8	-3.5	5.2	5.7	5.3	2.9	1.0	9.3	3.2
Child receives any solid or semisolid foods (ages 6–11 months)	8.5*	12.1*	2.0	4.3	11.3**	10.5*	7.2	8.9	7.8*	22.1***	-0.7
Used modern method of contraception[b]	8.3***	9.9***	7.5**	11.2***	5.1**	1.7	11.8***	11.0***	8.3***	7.4	0.7
Sample size (outcomes for mothers of children ages 0–11 months)	**24,037**	**6,021**	**6,745**	**13,571**	**10,466**	**6,172**	**13,597**	**4,268**	**19,769**	**2,858**	**3,741**

Sources: Ananya baseline and midline surveys conducted by Sambodhi in collaboration with Mathematica and PHFI in spring 2012 and spring 2014, respectively.

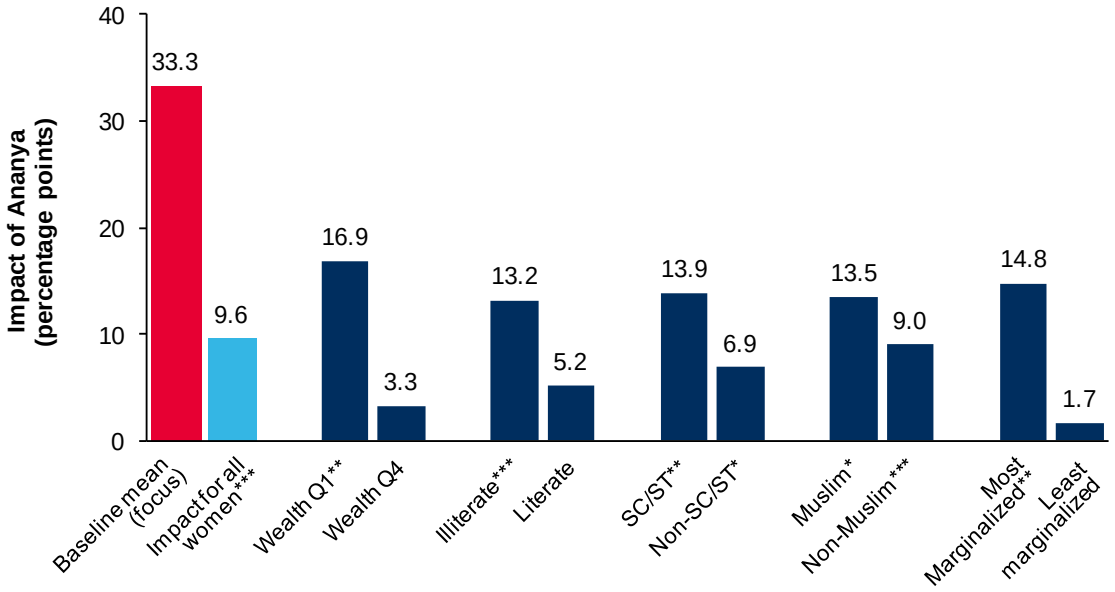
Note: Sample includes 4,889 mothers of children ages 6–11 months (baseline), 4,923 mothers of children ages 6–11 months (midline), 12,384 mothers of children ages 0–11 months (baseline), and 11,654 mothers of children ages 0–11 months (midline). All estimates are for mothers of children ages 0–11 months unless otherwise specified. Impacts are DD estimates. Green squares marked with a plus sign are positive, significant impacts. Dark blue squares marked with a minus sign are negative impacts. The most marginalized women are SC/ST or Muslim, illiterate, and in the lowest wealth quartile. The least marginalized women are non-SC/ST, non-Muslim, literate, and in the highest wealth quartile.

[a]Defined as nothing applied to the cord after cutting or to the umbilicus after the cord drops off.

[b]We defined the following methods of contraception as modern methods: female sterilization, male sterilization, pills, injectable contraception, IUDs, and condoms.

*$p < 0.10$, **$p < 0.05$, ***$p < 0.01$ for adjusted DD impacts.

Figure IX.2. Impacts of Ananya on receipt of two or more FLW visits in the final trimester, by key marginalized subgroups



Sources: Ananya baseline and midline surveys conducted by Sambodhi in collaboration with Mathematica and PHFI in spring 2012 and spring 2014, respectively.

Note: Red bar is the baseline mean for all women in focus districts, light blue bar is the impact estimate for all women, and dark blue bars are the estimated impacts for the given subgroup. Women with children ages 0–11 months.

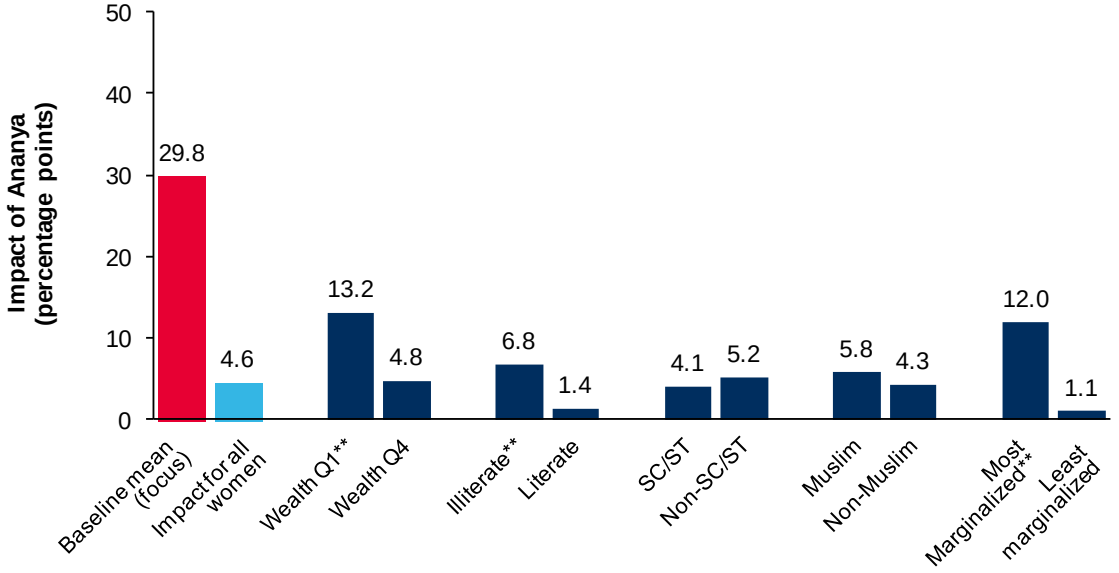
N = 12,310 (baseline), 11,651 (midline).

*$p < 0.10$, **$p < 0.05$, ***$p < 0.01$ for adjusted difference-in-differences.

Our results also suggest that Ananya might be associated with reducing disparities in ANC that our earlier analysis showed were large for almost all marginalization categories. For example, Ananya had a significant impact of 13 percentage points on the percentage of women in the lowest wealth quartile receiving three or more ANC check-ups, but a smaller and insignificant impact for the wealthiest group (Figure IX.3). Similarly, Ananya was associated with significant impacts on ANC among illiterate, but not literate, women and among the most marginalized, but not least marginalized, women. These findings suggest Ananya might have improved equity in ANC.

We also considered impacts on the share of women delivering in a facility by marginalization subgroup (Table IX.2). As with the overall impacts of Ananya on the share of women delivering in facilities, estimates for all but one subgroup were statistically insignificant (women in the highest wealth quartile demonstrated a significant decrease in facility delivery). Thus, it appears that Ananya did not decrease the large disparities in this outcome that existed at baseline.

Figure IX.3. Impacts of Ananya on receipt of three or more ANC checkups, by key marginalized subgroups



Sources: Ananya baseline and midline surveys conducted by Sambodhi in collaboration with Mathematica and PHFI in spring 2012 and spring 2014, respectively.

Note: Red bar is the baseline mean for all women in focus districts, light blue bar is the impact estimate for all women, and dark blue bars are the estimated impacts for the given subgroup. Women with children ages 0–11 months.

N = 12,384 (baseline), 11,654 (midline).

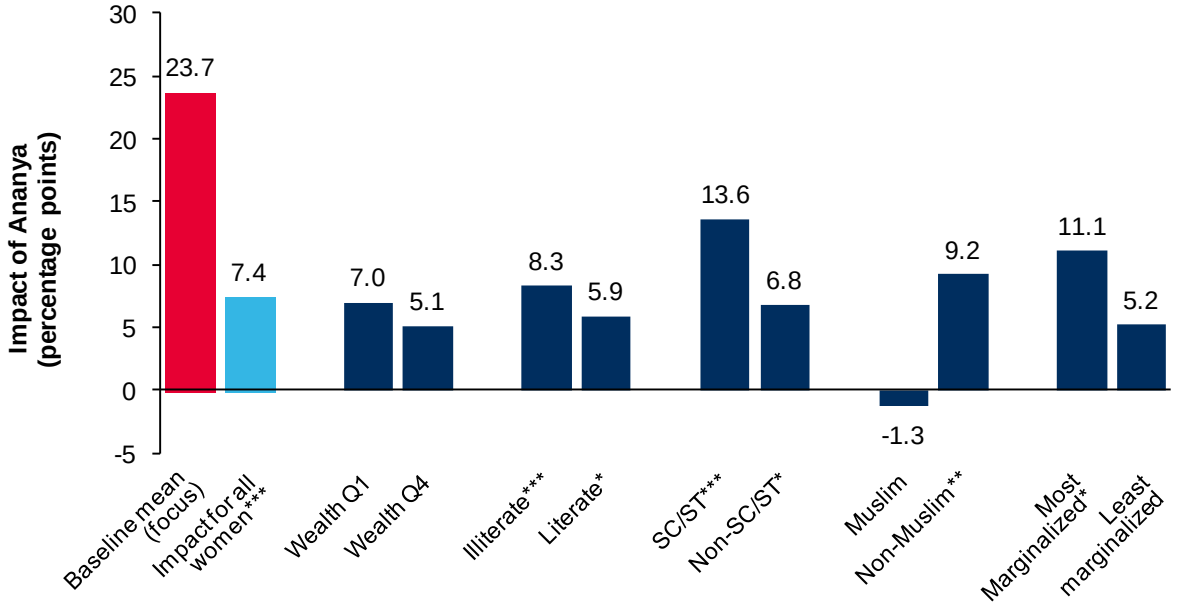
*p < 0.10, **p < 0.05, ***p < 0.01 for adjusted difference-in-differences.

We also examined two outcomes in the newborn care domain: clean cord care and immediate breastfeeding. For immediate breastfeeding, no group of marginalized women exhibited significantly lower coverage rates at baseline compared with their nonmarginalized counterparts. Thus, we focused the equity analysis on clean cord care (Figure IX.4), which showed a statistically significant coverage gap at baseline based on SC/ST status. Our results suggest that Ananya might have led to a reversal of this gap. Ananya had a statistically significant impact of 14 percentage points on clean cord care among SC/ST mothers, but a smaller and only marginally significant impact for non-SC/ST women.

Our key measure of immunization (DPT3 receipt) used for this analysis demonstrated large equity gaps at baseline and is thus potentially important to analyze by marginalized subgroup. However, our estimates suggest that immunization changed little in all of the marginalized subgroups that we considered (Table IX.2). This finding implies that Ananya was not associated with improvements in immunization coverage or a narrowing of the disparities in this coverage across marginalized groups.

In the nutrition domain, our equity analysis focused on the share of children ages 6–11 months who received any solid or semisolid food. Our baseline analysis suggested that few marginalization indicators were significantly associated with this outcome. Likewise, we did not find any consistent patterns in the impacts of Ananya on complementary feeding based on marginalization (Table IX.2). Differences were marginally significant for those in the lowest

Figure IX.4. Impacts of Ananya on application of nothing to cord or umbilicus, by key marginalized subgroups



Sources: Ananya baseline and midline surveys conducted by Sambodhi in collaboration with Mathematica and PHFI in spring 2012 and spring 2014, respectively.

Note: Red bar is the baseline mean for all women in focus districts, light blue bar is the impact estimate for all women, and dark blue bars are the estimated impacts for the given subgroup. Women with children ages 0–11 months.

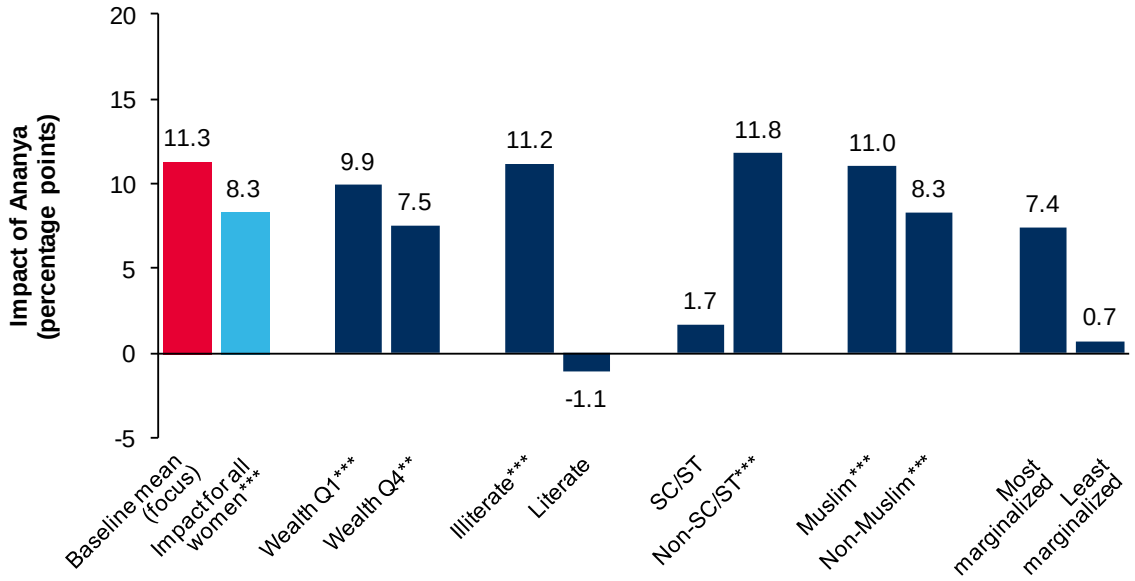
N = 12,297 (baseline), 11,057 (midline).

*p < 0.10, **p < 0.05, ***p < 0.01 for adjusted difference-in-differences.

wealth quartile and SC/ST women and smaller and insignificant for higher-wealth and non-SC/ST women. Furthermore, Ananya led to an increase in complementary feeding of 22 percentage points for the most marginalized women but no significant change for the least marginalized. These differences suggest Ananya might increase equity in the nutrition domain. But the reverse is true when we consider gaps based on literacy and religion. Here we see significant increases only for less marginalized women.

Finally, disparities in the use of modern contraceptive methods were notable at baseline, and our results suggest that Ananya could help to close this gap—at least for some dimensions of marginalization (Figure IX.5). Among illiterate women, Ananya was associated with a significant increase in the use of modern contraceptive methods of 11 percentage points, whereas we found a negative and insignificant relationship between Ananya and contraception among literate women. Additionally, the relationship between Ananya and contraception use by women in the lowest wealth quartile, Muslim women, and the most-marginalized women was stronger than for their respective nonmarginalized counterparts. Interestingly, no equity gap existed in modern contraceptive use by SC/ST status at baseline, but non-SC/ST women experienced much larger impacts on modern contraceptive use than SC/ST women. Among non-SC/ST women, Ananya had a statistically significant impact on modern contraceptive use of 12 percentage points; the relationship for SC/ST women was far weaker (2 percentage points) and statistically insignificant.

Figure IX.5. Impacts of Ananya on the use of any modern method of contraception, by key marginalized subgroups



Sources: Ananya baseline and midline surveys conducted by Sambodhi in collaboration with Mathematica and PHFI in spring 2012 and spring 2014, respectively.

Note: Red bar is the baseline mean for all women in focus districts, light blue bar is the impact estimate for all women, and dark blue bars are the estimated impacts for the given subgroup. Women with children ages 0–11 months.

N = 12,283 (baseline), 11,521 (midline).

*p < 0.10, **p < 0.05, ***p < 0.01 for adjusted difference-in-differences.

C. Changes in disparities in the focus districts

Table IX.3 further details the equity gaps existing in focus districts at both baseline (spring 2012) and midline (spring 2014), providing a summary of changes in these gaps during the initial phase of Ananya's implementation. Note that changes in equity gaps might not necessarily be attributable to Ananya. The changes could also be due to underlying trends in inequality in health and access to health care.

Comparing the equity gaps over time, there is little evidence that equity changed consistently in focus districts during the two-year period examined. For example, consider differences between the most and least marginalized women. The gap in facility deliveries decreased in focus districts between baseline and midline, from 30 to 22 percentage points. Conversely, the gap in receipt of DPT3 increased from 9 percentage points at baseline to 18 percentage points at midline. These results do not lead to straightforward conclusions about equity. Changes are similarly ambiguous for gaps related to literacy, caste, and religion. There is more evidence for a declining gap related to wealth. Comparing those in the highest and lowest quartiles suggests increases in equity during Ananya's implementation, particularly when one considers outcomes related to ANC, delivery at a facility, and contraception.

Table IX.3. Differences in health outcomes, by marginalization status at baseline and midline in focus districts

Outcome	Average baseline value	Differences by marginalized subgroup									
		Wealth Q1 versus Q4		Illiterate versus literate		SC/ST versus non-SC/ST		Muslim versus non-Muslim		Most versus least marginalized	
		Baseline	Midline	Baseline	Midline	Baseline	Midline	Baseline	Midline	Baseline	Midline
Visited by FLW two or more times in last trimester	33.3	-1.3	5.9	1.6	1.6	2.9	6.9*	-3.1	1.8	6.6	11.9*
Received post-delivery visit from FLW	21.6	0.4	2.1	0.5	0.8	0.8	-0.6	-5.0*	-2.5	-1.0	-1.9
Received three or more ANC check-ups	29.8	-30.6***	-22.9***	-19.1***	-15.6***	-8.1**	-7.1**	2.2	-2.5	-37.4***	-34.2***
Delivered at facility	68.1	-23.9***	-12.8***	-12.8***	-8.5***	-13.9***	-8.4***	-1.9	-5.4	-30.2***	-21.8***
Clean cord care[a]	23.7	6.0	2.7	1.4	7.5***	-1.1	6.7**	0.5	-4.3	1.1	10.8
Breastfed child within an hour of birth	47.0	0.4	6.6**	-2.7	1.9	0.3	1.8	0.7	-10.9***	-0.4	8.5
Child received DPT3 (ages 6–11 months)	62.7	-15.4**	-14.5**	-5	-9.2**	-5.8	-6.7	-3.0	-5.5	-9.3	-18.4**
Child received any solid or semisolid foods (ages 6–11 months)	64.7	5.8	-1.6	0.8	-9.1***	-3.7	2.0	0.3	2.8	-3.3	-3.6
Used modern method of contraception[b]	11.3	-8.2***	-2.0	-3.9*	-2.8	1.1	-6.3***	-2.7	-2.3	-7.8**	-5.4

Sources: Ananya baseline and midline surveys conducted by Sambodhi in collaboration with Mathematica and PHFI in spring 2012 and spring 2014, respectively.

Notes: For outcomes using all mothers with children ages 0–11 months, N = 2,978 (baseline average), 2,977 (religion and literacy comparisons, baseline), 3,092 (religion and literacy comparisons, midline), 2,378 (SC/ST comparison, baseline), 2,465 (SC/ST comparison, midline), 1,550 (wealth comparison, baseline), 1,716 (wealth comparison, midline), 728 (most versus least marginalized, baseline), and 852 (most versus least marginalized, midline). For outcomes using all mothers with children ages 0–6 months, N = 1,164 (baseline average), 1,163 (religion and literacy comparisons, baseline), 1,309 (religion and literacy comparisons, midline), 938 (SC/ST comparison, baseline), 1,016 (SC/ST comparison, midline), 615 (wealth comparison, baseline), 717 (wealth comparison, midline), 296 (most versus least marginalized, baseline), and 353 (most versus least marginalized, midline). Item-specific nonresponse might lead to small differences in sample sizes by outcomes.

Differences are calculated as mean for marginalized minus mean for nonmarginalized. Calculations based on SC/ST exclude Muslims. Regression-adjusted differences (correcting for parity, woman's age, and rural location) reported. *$p < 0.10$, **$p < 0.05$, ***$p < 0.01$ for adjusted difference.

[a]Defined as nothing applied to the cord after cutting or to the umbilicus after the cord drops off.

[b]We defined the following methods of contraception as modern methods: female sterilization, male sterilization, pills, injectable contraception, IUDs, and condoms.

Overall, our analysis suggests that if the Ananya program seeks to more consistently improve disparities in health and health care between marginalized and nonmarginalized women (instead of simply improving overall population health), a more targeted approach might be necessary. Within some domains and for some groups, Ananya could be a force for increased equity. For example, poorer women were far less likely to receive ANC at baseline than wealthier women, and Ananya was associated with larger increases in ANC for the poorer group. This finding suggests that Ananya might have led to a narrowing in this particular disparity. But the reverse is true for other equity gaps. Indeed, SC/ST and non-SC/ST women had relatively similar rates of use of modern contraception at baseline, but Ananya led to improvements in contraception use for only non-SC/ST women. This finding implies that Ananya contributed to creating a disparity in reproductive health based on caste. Thus, an intervention approach that more closely targets marginalized women might be necessary to achieve the joint goals of increasing family health overall and reducing its disparities.

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X. RELATIONSHIP BETWEEN PROGRAM EXPOSURE AND BEHAVIORS

The Ananya program theory of change posits that improvements in the number and quality of FLW–household interactions, combined with messaging from media and other efforts, will result in behavioral change. Specifically, these interventions aimed to improve households' knowledge of important health behaviors, provide them with information about relevant health services, and convince and motivate them to adopt appropriate behaviors. Earlier chapters have documented the impacts of the Ananya program as a whole on measures of program exposure, and impacts on behaviors across several domains. In this chapter, we further explore whether specific measures of program exposure are correlated with behaviors. If the Ananya theory of change is valid, one would expect these correlations between exposure to program interventions and behaviors to be strong and positive.

However, evidence of any observed correlations should be interpreted with caution and does not necessarily represent a causal relationship. For example, women with better knowledge of good health practices might be more likely adopt certain behaviors and also be more receptive to FLW home visits. FLWs who use mobile kunji and other job-aid tools could be more motivated than those who do not, and could be more likely to affect household behavior regardless of the use of these tools. Similarly, women who adopt a certain behavior might be more likely to recall hearing media messages about it. In these cases, at least part of the correlation between program exposure (FLW visits, tool use, or media messages) and health outcomes would not be attributable to the exposure itself. Because exposure was not randomly assigned and because many of the potentially confounding characteristics (such as FLWs' motivation) are difficult to measure and control for, we have limited ability to rule out some of these competing explanations. Nevertheless, positive correlations between exposure to interventions and health outcomes do provide suggestive evidence to support the Ananya theory of change.

In this chapter, we examine correlations between relevant behaviors and three measures of exposure to interventions of specific interest to the program: (1) FLW interactions, especially home visits; (2) use of job-aid tools, particularly Mobile Kunji; and (3) messages received from media.[74] In examining these correlations we are cognizant of the multiple comparisons issue, which suggests that the more correlations we examine, the more are likely to be spuriously significant by chance (Schochet 2008). Therefore, we focus on correlations between the key measures of program exposure and a handful of key behavioral outcomes in each domain.

We find the strongest correlations for behaviors related to pregnancy and delivery preparation, which were significantly correlated with most of the measures of program exposure that we analyzed. Many behaviors related to complementary feeding and family planning were strongly correlated with FLW home visits. Finally, we attempt to disentangle the associations between behavior and multiple measures of exposure in a regression model, and find that

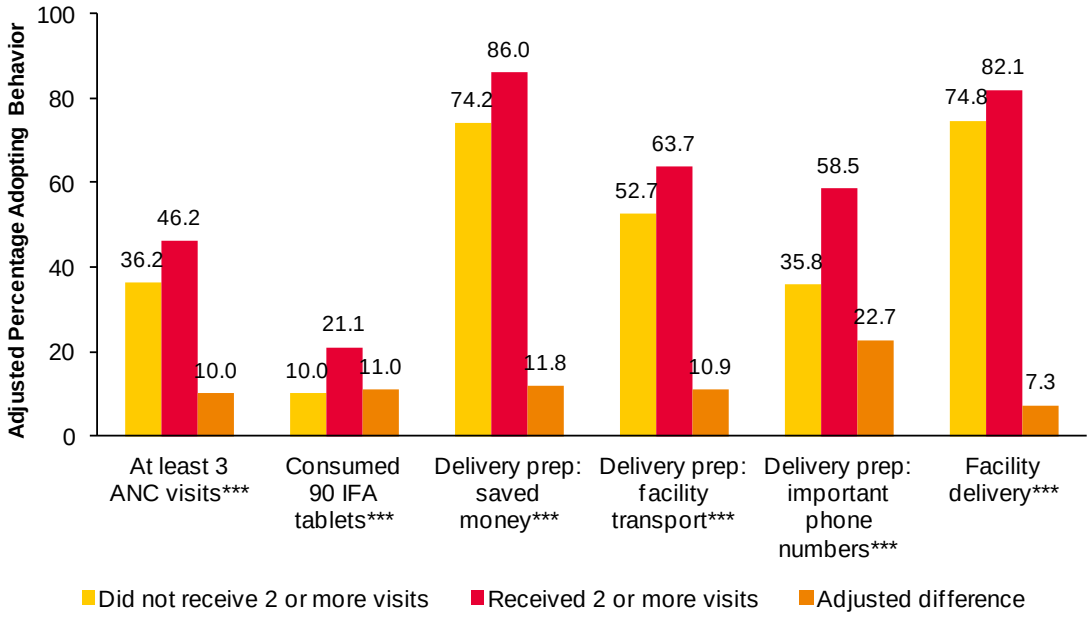
[74] All the estimates correlations reported in this chapter adjust for differences in the demographic characteristics described in Appendix A. However, despite controlling for observed differences, we still cannot rule out the possibility that unobserved differences between those exposed and not exposed to specific interventions are driving the estimated correlations.

exposure to mobile kunji is a particularly strong predictor of behavior for delivery preparation and complementary feeding but not for family planning.

A. Relationship between FLW visits and behaviors

The receipt of two or more FLW home visits in the final trimester of pregnancy was strongly correlated with the adoption of desirable health behaviors related to pregnancy and delivery in the focus districts (Figure X.1). Beneficiaries who received these visits were significantly more likely to have received the recommended three ANC check-ups (by almost one-third), consumed the recommended number of 90 IFA tablets (by more than double), and implemented the delivery preparations emphasized by the program (especially keeping important telephone numbers, by almost two-thirds). They were also significantly more likely to have delivered at a facility rather than at home.

Figure X.1. Correlations between receiving two or more FLW home visits in the final trimester and behaviors, focus districts at midline



Source: Women with children ages 0–11 months in focus districts in Ananya midline survey.

Note: About 39 percent of beneficiaries received two or more FLW home visits in the final trimester.

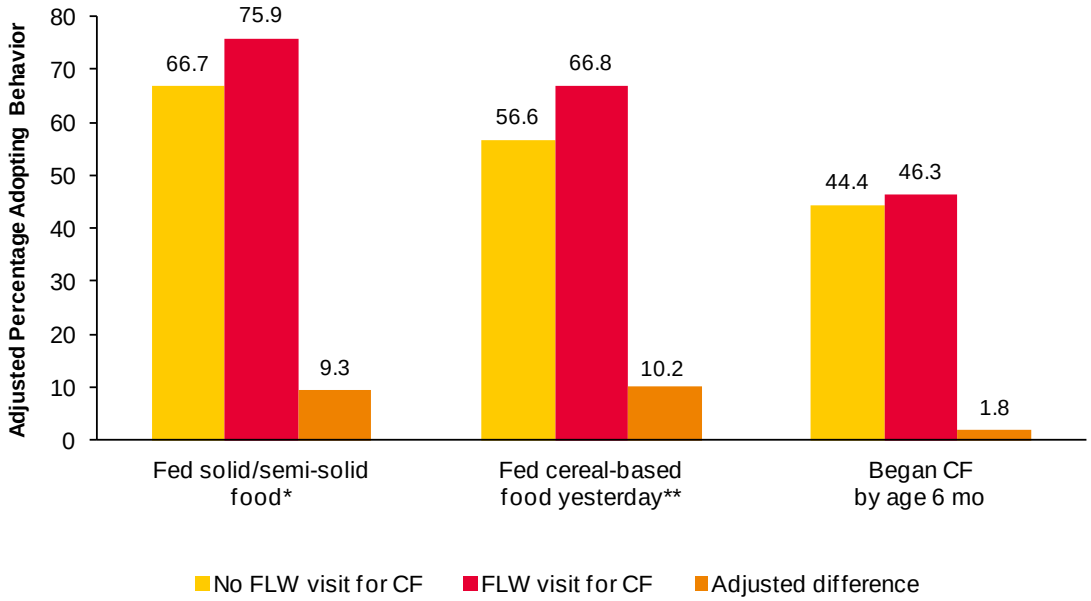
N = 3,023–3,089.

*p < 0.10, **p < 0.05, ***p < 0.01 for adjusted differences.

For delivery preparation and three ANC check-ups, the correlations were weaker in the nonfocus districts, although they were similar for other behaviors (not shown). This finding provides some evidence of improved quality of final-trimester home visits in the focus districts, perhaps increasing these visits' effectiveness in changing behavior.

FLW visits related to complementary feeding and family planning were also significantly correlated with relevant behaviors. Specifically, beneficiaries who received a home visit related to complementary feeding were more likely to be feeding their children solid or semisolid food (by 9 percentage points, or 14 percent more than those not receiving visits) and to have fed their children a cereal-based meal in the previous day (by 10 percentage points, or 18 percent; Figure X.2). However, the likelihood of having initiated complementary feeding by age 6 months was similar. Beneficiaries who had discussions with an FLW about family planning during pregnancy were almost twice as likely to be using modern methods of contraception, as were those who received an FLW home visit related to family planning after delivery (Figure X.3).

Figure X.2. Correlations between any home visit related to complementary feeding and behaviors, mothers of children ages 6–11 months, in focus districts at midline



Source: Women with children ages 6–11 months in focus districts in Ananya midline survey.

Note: About 14 percent of beneficiaries received a home visit related to complementary feeding.

CF = complementary feeding.

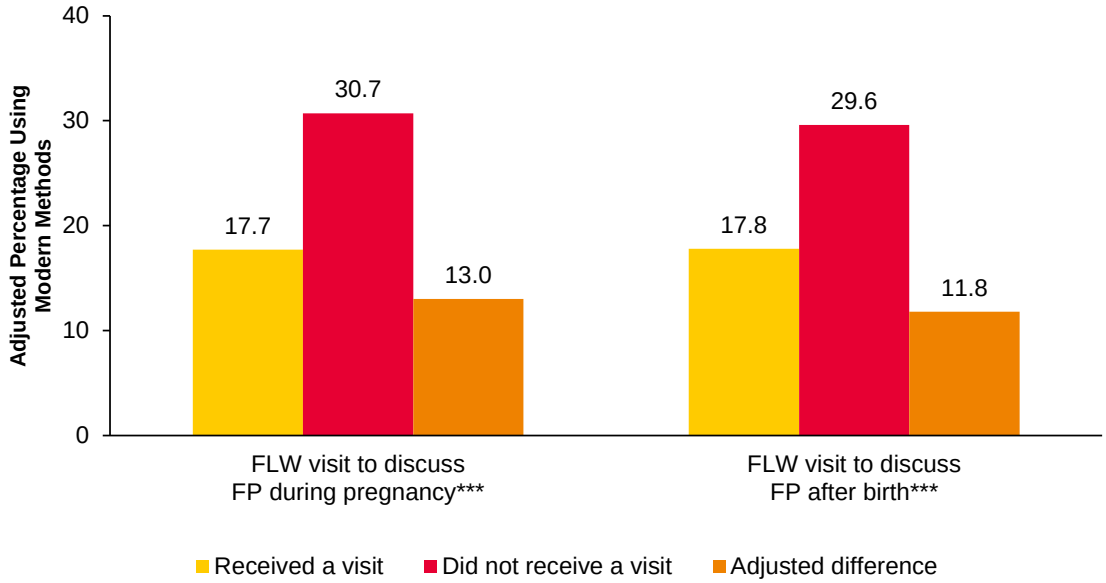
N = 1,303–1,308.

*p < 0.10, **p < 0.05, ***p < 0.01 for adjusted differences.

B. Relationship between mobile kunji use and behaviors

The midline survey collected information on whether tools such as mobile kunji were used in home visits with beneficiaries in the six months before the survey. As we described in Chapter I, mobile kunji is a colorful card deck containing information on specific health messages along with a short code message-playing telephone service, created specifically by the Ananya program to help FLWs provide better health messaging to households. Ideally, we would explore correlations between exposure to specific mobile kunji topics and health practices. However, the ideal data required to examine these correlations are not available, because specific discussion

Figure X.3. Correlations between visits related to family planning and use of modern methods of contraception, in focus districts at midline



Source: Women with children ages 0–11 months in focus districts in Ananya midline survey.

Note: About 14 percent of beneficiaries received a visit related to family planning during pregnancy, and about 14 percent received a visit related to family planning after delivery.

FP = family planning.

N = 3,047.

*p < 0.10, **p < 0.05, ***p < 0.01 for adjusted differences.

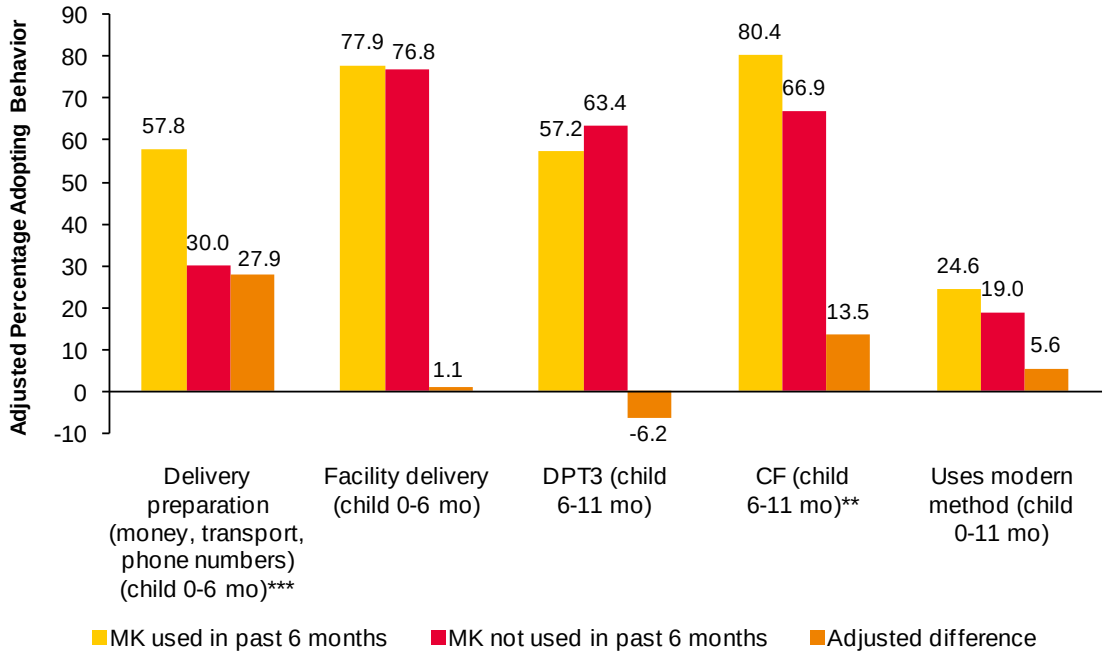
topics for which mobile kunji was used were captured for only the last home visit (it was not feasible to capture all the topics that the respondent was ever exposed to through mobile kunji because of the potential for recall error). Because of this limitation, we examine correlations between broad exposure to mobile kunji (any use in the previous six months, regardless of topics) and health practices.[75]

Exposure to mobile kunji in the previous six months is positively and significantly correlated with delivery preparation and complementary feeding (Figure X.4). Specifically, beneficiaries exposed to mobile kunji were almost twice as likely to undertake the delivery preparations emphasized by the program and about 20 percent more likely to be feeding their children solid or semisolid foods.[76] However, correlations with facility delivery, receipt of DPT3, and use of modern methods of contraception were small and not statistically significant.

[75] We focus on mobile kunji because it was one of the primary interventions of the BBC Media Action grant, and its expansion is planned across the state. As we mentioned in Chapter IV, use of other tools introduced by CARE is highly correlated with mobile kunji use, so similar results would be obtained from analyses of correlations with other tools.

[76] For delivery preparation and facility delivery, we restricted the sample to women who gave birth in the previous six months, so their mobile kunji exposure could have plausibly occurred during pregnancy and have affected these behaviors.

Figure X.4. Correlations between exposure to mobile kunji in the previous six months and behaviors, in focus districts at midline



Source: Women with children ages 0–5 months (delivery preparation and facility delivery), 6–11 months (DPT3 and complementary feeding), and 0–11 months (modern methods) in focus districts in Ananya midline survey.

Note: About 9 percent of beneficiaries were exposed to mobile kunji in the previous six months.

CF = complementary feeding; MK = mobile kunji.

N = 1,771–1,783 (delivery preparation and facility delivery); 1,309 (DPT3 and complementary feeding); and 3,047 (modern methods).

*$p < 0.10$, **$p < 0.05$, ***$p < 0.01$ for adjusted differences.

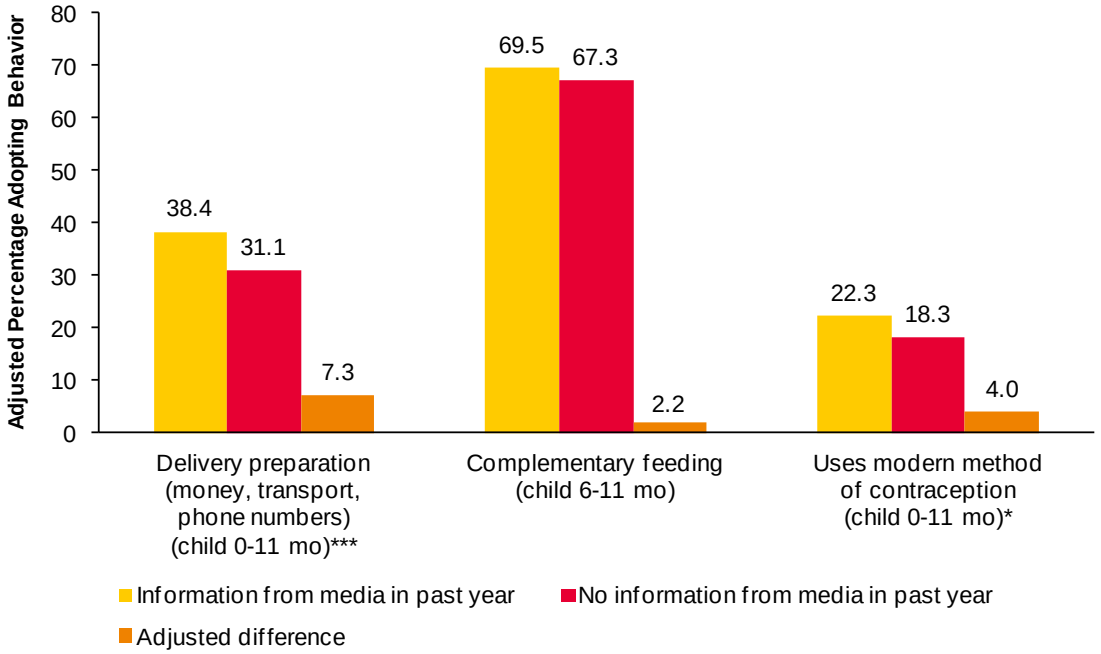
Without data on exposure to specific mobile kunji topics, it is difficult to determine whether the stronger correlations for some topics reflect greater use of mobile kunji for those topics, or whether mobile kunji was more effective in changing those behaviors. It is also possible that these correlations do not have a causal interpretation. For example, mobile kunji use could simply be a proxy for FLWs' motivation (more motivated FLWs are more likely to use kunji but also more effective at changing behavior), whereas part of the correlation could also be driven by the act of the home visit itself rather than kunji use (though we try to disentangle the two below). Although we have limited ability to explore the mechanisms behind these correlations with the midline data (for example, we did not measure FLWs' motivation), this would be an interesting topic for further research.

C. Relationship between media exposure and behaviors

Because the SDP grant's behavioral change interventions included a large media component, we examined whether information received from the media was correlated with behavior. In the midline survey, we collected data on whether information was received from the media in the previous year in three domains: (1) pregnancy and delivery preparation, (2) complementary feeding, and (3) family planning. The correlations with behavior suggest that beneficiaries who received information from the media on pregnancy and delivery preparation

were significantly more likely to adopt delivery preparation practices (Figure X.5). Consistent with this result, beneficiaries exposed to BBC's *Char Gaanth* birth-preparedness television show were significantly more likely to adopt these practices (50 percent of those exposed, compared with 32 percent of those not exposed, not shown).[77] However, the associations between media messages about complementary feeding and family planning and the relevant behaviors were much weaker, suggesting that media messages might have been less effective in changing those behaviors.

Figure X.5. Correlations between exposure to media messages in the previous year and behavior, in focus districts at midline



Source: Women with children ages 0–11 months (delivery preparation and use of modern methods) and 6–11 months (complementary feeding) in focus districts in Ananya midline survey.

Note: About 30 percent of beneficiaries received information on pregnancy and delivery preparation from the media in the previous year, 25 percent on complementary feeding, and 30 percent on family planning.

N = 3,092 (delivery preparation); 1,309 (complementary feeding); and 3,047 (modern contraceptive methods).

**p* < 0.10, ***p* < 0.05, ****p* < 0.01 for adjusted differences.

D. Relationship between behavior and combined exposure

The analyses described earlier examined correlations between specific measures of program exposure and behavior. However, many beneficiaries might have been exposed to multiple program elements, and it would be valuable for the program to understand which elements might be more influential in driving behavioral change. We therefore estimated the associations between program elements and behavior in a regression model that attempts to separate the contributions of specific elements. We focus on the three domains described previously (pregnancy and delivery preparation, complementary feeding, and family planning), because

[77] We report correlations with *Char Gaanth* because it focuses on a specific topic, namely delivery preparation. We do not have information on exposure to specific topics through other BBC media interventions such as the radio show *Khirki Mehendiwali*, only overall exposure to those interventions.

these were the domains for which the relevant measures of exposure were well defined and captured in the midline survey. The measures of exposure in the regression model included (1) relevant home visits by FLWs; (2) information from FLWs in the previous year, not limited to home visits; (3) information from the media in the previous year; and (4) general exposure to mobile kunji in the previous six months.[78,79] Although these regressions do not have a causal interpretation, they do provide valuable evidence of the types of exposure that might be driving behavior.

For delivery preparation, the results suggest that receipt of any relevant information from an FLW in the previous year is associated with a statistically significant increase in the probability of adoption of delivery-preparation practices (14 percent, or more than half of the predicted mean of 24 percent with no program exposure; Table X.1). The association with FLW home visits in the final trimester is lower than receipt of general information from FLWs but still statistically significant (8 percentage points, or about one-third of the mean with no exposure), whereas exposure to mobile kunji has a very strong association (about 20 percentage points, or almost double the mean with no exposure). However, the association with information from media is small and statistically insignificant. Combined, these results suggest that interactions with FLWs are important for delivery preparation, and mobile kunji can add additional value. The predicted probability of adopting delivery preparation for a beneficiary who received information from an FLW *and* who was exposed to mobile kunji is 35 percentage points higher (the sum of the two coefficients) than the predicted mean of 24 percent with no exposure.

The results for complementary feeding and use of modern methods generally showed very weak associations with information from media and small but still substantive associations with relevant FLW interactions. For family planning, general information from FLWs and home visits after delivery were much weaker predictors than FLW discussions during pregnancy, which increased the predicted adoption of modern methods by 8 percentage points (about half of the predicted mean with no exposure). Mobile kunji use was strongly associated with complementary feeding but not with adoption of family planning. Overall, the results suggest that the programmatic elements that might be effective in changing behavior could differ across behaviors.

[78] Because FLW home visits are likely included in the overall measure of information from FLWs, we did not include them in the same regression model.

[79] The regressions were estimated using a probit model in which the relevant behavior was the dependent variable and the independent variables were measures of exposure and demographic controls. All regression coefficients were transformed into percentage terms (marginal effects) for ease of interpretation; the coefficients presented give the predicted percentage increase in behavior associated with each measure of exposure. This regression model is described in further detail in Appendix A.

Table X.1. Associations between behavior and multiple measures of program exposure in a regression model, in focus districts at midline (percentages)

	All three delivery preparations, mothers of children ages 0–5 months		Feeds child solid or semisolid foods, mothers of children ages 6–11 months		Uses modern method of contraception, mothers of children ages 0–11 months	
Regression specification	(1)	(2)	(1)	(2)	(1)	(2)
Predicted base level	23.6	25.5	65.4	66.2	16.7	15.7
Predicted increase in behavior associated with:						
Information from media on topic in past year	2.6	3.9	0.8	1.6	3.4	2.9
Information from FLW on topic in past year	13.7***		7.0*		1.9	
Any FLW home visit in final trimester		7.6**				
Any FLW home visit related to complementary feeding				6.7		
Discussions with FLW related to family planning during pregnancy						8.1***
Any FLW home visit related to family planning after delivery						4.6
Mobile kunji used in past six months	21.4***	19.7***	11.5***	11.4***	4.2	0.6

Source: Women with children ages 0–5 months (delivery preparation), 6–11 months (complementary feeding), and 0–11 months (use of modern methods) in focus districts in Ananya midline survey.

Note: Results were estimated from a probit model with behavior (column headings) as the dependent variable and measures of exposure (row headings) and demographic controls as dependent variables. Coefficients for each measure of exposure were converted into percentage point effects (marginal effects).

N = 1,771 (delivery preparation); 1,309 (complementary feeding); and 3,047 (modern methods).

*$p < 0.10$, **$p < 0.05$, ***$p < 0.01$ for adjusted differences.

XI. CONCLUSION

This report has summarized the effects of the interventions implemented under the Ananya program—primarily under the IFHI and SDP grants—after two years of implementation in the eight focus districts. We examined effects on both proximal measures of exposure to the various intervention elements and effects on health outcomes across the continuum of care targeted by the program. To estimate these effects, we compared changes in outcomes between baseline and midline in the eight focus districts to the changes in the nonfocus districts over this period (a difference-in-differences approach). Given the similarity in the pre-Ananya levels and trends of key outcomes in the focus and nonfocus districts, we argued that these difference-in-differences estimates can be interpreted as the midline impacts of Ananya.

Table XI.1 summarizes our findings on the midline impacts of Ananya on key outcomes. We focus on outcomes measured at baseline and midline, enabling us to produce difference-in-differences impact estimates.[80] The table shows the baseline level of each outcome in the focus districts (column 1), how the outcome changed between baseline and midline (column 2), and the impact of Ananya estimated using difference-in-differences (column 3). To enable us to compare impacts across outcomes with different baseline levels, we also converted the percentage point impacts into a percentage of the baseline mean (column 4).[81] We highlight all impacts that were statistically significant at least at the 10 percent level. We consider statistically significant impacts of less than 25 percent to be medium (light green) and those that are more than 25 percent to be strong (dark green).[82]

For example, Table XI.1 shows that the percentage of women reporting at least two final-trimester home visits by an FLW increased by 5.9 percentage points in the focus districts between baseline and midline, from a baseline of 33.3 percentage points. However, the increase relative to the nonfocus districts (the difference-in-differences estimate) was even larger, at 9.7 percentage points. This statistically significant estimate, which we interpret as the impact of Ananya, is equivalent to a 29 percent increase from the baseline focus district mean (a strong impact based on our criterion). This strong and significant impact suggests that the entire increase in the focus districts between baseline and midline was driven by Ananya rather than by other external factors. Because the impact of Ananya is even larger than the increase in the focus districts, this increase would have been a *decrease* in the absence of Ananya.

[80] As noted earlier, for outcomes that were available only at midline, we were able to estimate midline differences only between focus and nonfocus districts, which cannot be attributed to Ananya with the same degree of attribution as the difference-in-differences impact estimates.

[81] For example, an impact of 10 percentage points should be viewed as larger if the baseline level is 10 percentage points (an increase of 100 percent, or a doubling) compared with if the baseline level is 50 percentage points (an increase of 20 percent). Expressing impacts as percentages enables us to make this type of comparison.

[82] This cutoff is loosely based on the Imbens and Wooldridge (2009) standard of 0.25 standard deviations for a large difference between two means (in the context of an RCT). For an outcome with a mean of 50 percentage points, this is equivalent to a 25 percent difference.

Table XI.1. Summary of Ananya's impacts on key outcomes across domains

Outcome	Baseline mean in focus districts (percentage points)	Change in focus districts from baseline to midline (percentage points)	Midline regression-adjusted impact (percentage points)	Midline regression-adjusted impact (percent)	Summary of findings
FLW interactions					
Received two or more home visits from an FLW in the final trimester of pregnancy	33.3	+5.9**	+9.7***	+29%***	Increase in the focus districts was driven by Ananya; there would have been a decrease in the absence of the program.
Received a home visit by an FLW within 1 week of delivery	15.0	+3.2	+1.5	+10%	No significant change in focus or non-focus districts; no evidence of Ananya impacts.
Any FLW home visit related to family planning after delivery	8.3	+5.8**	+2.3	+28%	Increase in focus districts was largely driven by external factors, rather than by Ananya.
Maternal and newborn health					
Received ANC three or more times	29.8	+10.3***	+5.1	+17%	Ananya might have partly contributed to the increase in focus districts, but this contribution is not statistically significant.
Delivered at a facility	68.1	+9.5***	-0.4	0%	Increase in focus districts was driven by external factors, rather than by Ananya.
Nothing applied to cord or umbilicus	23.7	+6.5***	+7.4***	+31%***	Increase in focus districts was driven by Ananya.
Child placed unclothed on mother's chest/abdomen in skin-to-skin contact	19.5	+23.5***	+9.5	+49%	Ananya might have partly contributed to the increase in focus districts, but this contribution is not statistically significant.[a]
First bath delayed by two or more days	54.6	+10.5***	+2.1	+4%	Most of the Increase in focus districts was driven by external factors, rather than by Ananya.
Breastfed child within one hour of birth	47.0	+5.1**	+2.7	+6%	Much of the Increase in focus districts was driven by external factors, rather than by Ananya.
Child nutrition					
Child exclusively breastfed in past 24 hours, children ages 0– 5 months	59.1	+19.2***	+2.9	+5%	Most of the increase in focus districts was driven by external factors, rather than by Ananya.
Children ages 6–11 months who are currently receiving any solid or semisolid food	64.7	+3.3	+8.5*	+13%*	Although there was no significant change in the focus districts, there would have been a decrease in the absence of Ananya. Ananya reversed the decrease, largely maintaining existing levels.
Children ages 6–11 months who received cereal-based food in the previous day	60.7	-2.6	+8.2**	+14%**	Although there was no significant change in the focus districts, there would have been a decrease in the absence of Ananya. Ananya slowed the decrease, largely maintaining existing levels.
Immunization					
Children ages 6–11 months who received DPT3	62.7	+0.2	+2.2	+4%	No significant change in focus or nonfocus districts; no evidence of Ananya impacts.

Outcome	Baseline mean in focus districts (percentage points)	Change in focus districts from baseline to midline (percentage points)	Midline regression-adjusted impact (percentage points)	Midline regression-adjusted impact (percent)	Summary of findings
Reproductive health					
Use of any modern method of contraception	11.3	8.2***	+8.7***	+77%***	All of the increase in focus districts was driven by Ananya.

Sources: Ananya baseline and midline surveys conducted by Sambodhi in collaboration with Mathematica and PHFI in spring 2012 and spring 2014, respectively.

Note: All outcomes apply to women with children ages 0–11 months in the focus districts unless otherwise noted. Columns 1 and 2 show unadjusted numbers; columns 3 and 4 show impact estimates that are regression-adjusted for demographic differences. Medium impacts are defined as statistically significant difference-indifferences estimates of less than 25 percent of the baseline mean and are highlighted in light green. Strong impacts are defined as statistically significant difference-in-differences estimates of 25 percent or more of the baseline mean and are highlighted in dark green.

[a]Although the estimated impact on this outcome is large relative to the baseline mean, we verified that it is not statistically significant when the appropriate statistical adjustments are made for district-level correlations in outcomes.

*p < 0.10, **p < 0.05, ***p < 0.01 for adjusted difference-in-differences estimates.

Most proximal to the interventions, our findings showed that Ananya was associated with improvements in the number and quality of household interactions with FLWs. There was a strong and significant impact on the number of interactions during pregnancy, but the impact on the number of interactions immediately after delivery was more limited. Although most measures of quality were available only at midline (and therefore are not included in Table XI.1), comparing focus and nonfocus districts at midline suggests that Ananya was associated with improved visit quality in terms of increased discussion of targeted topics by FLWs during home visits, a longer duration of visits, and the use of job-aid tools provided by Ananya to improve communication with households. In contrast, exposure to some of the other program components—such as mass media campaigns and community group interventions—were still limited at midline, likely because of lack of media exposure and delayed roll-out and limited geographic implementation of the community group intervention during the evaluation period.

In terms of health outcomes, the evidence suggests that Ananya had its strongest significant impacts on cord care, complementary feeding for children ages 6 months or older, and use of modern methods of contraception. Although comparable baseline measures were not available to compute impact estimates (and therefore are not included in Table XI.1), we also found that measures of birth preparedness were significantly higher in focus districts relative to nonfocus districts at midline.

In addition, as described in Chapter IX, we found evidence that Ananya reduced existing disparities between marginalized and nonmarginalized women (defined based on religion, caste, literacy, and wealth) for some health outcomes, but not others. For example, we found that Ananya reduced some of the significant baseline disparities in ANC and use of modern contraception, at least for some dimensions of marginalization. However, significant baseline disparities for facility delivery and immunizations—outcomes for which Ananya had nonsignificant overall impacts—were not affected.

We also compared the level of outcomes in the eight focus districts at midline to the midline targets that the Foundation had set based on the results from the baseline survey (Table XI.2).

These targets focused on intermediate health outcomes that, if improved, were likely to lead to the ultimate program goals of reduced maternal and neonatal mortality, child undernutrition, and fertility.

These comparisons suggest that the program had mixed success in achieving its midline targets, meeting five of the eight targets that we examined. For some outcomes that met targets, such as facility delivery, the small and insignificant impact estimates suggest that the targets have been achieved even without the presence of Ananya due to underlying trends. For other outcomes, such as applying nothing to the cord or umbilicus and contraceptive use, the impact estimates suggest that Ananya played an important role in achieving the target. Finally, although the impact of Ananya on complementary feeding was significant, this impact largely served to maintain existing levels (that is, prevent a decline) rather than lead to substantial increases in this outcome. As a result, the midline level for this outcome fell short of the target.

Table XI.2. Comparison of outcomes in the eight focus districts with program targets

Domain	Baseline mean in focus districts (percentage points)	Baseline mean (percentage points)	Midline mean (percentage points)	Midline target	Was target met?
Maternal and newborn health	Mother consumed at least 90 IFA tablets during pregnancy	12.5	15.1	20	No, and Ananya did not affect this outcome.
	Received ANC three or more times	29.8	40.2	35	Yes, but not because of Ananya.
	Facility delivery	68.1	77.6	70	Yes, but not because of Ananya.
	Applied nothing to cord or umbilicus	23.7	30.3	32	Yes, largely because of Ananya.
	Breastfed child within one hour of birth	47.0	52.1	59	No, and Ananya did not affect this outcome.
Child nutrition	Child exclusively breastfed for six months (excluding water), children ages 6–11 months	38.9	53.1	46	Yes, largely because of Ananya.[a]
	Children ages 6–11 months who are currently receiving any solid or semisolid food	64.7	67.9	70	No, Ananya reversed a decline in nonfocus districts but largely maintained existing levels.
Reproductive health	Use of any modern method of contraception	11.3	19.5	19	Yes, largely because of Ananya.

Sources: Ananya baseline and midline surveys conducted by Sambodhi in collaboration with Mathematica and PHFI in spring 2012 and spring 2014, respectively. Targets obtained from Bill & Melinda Gates Foundation.

Note: All outcomes apply to women with children ages 0–11 months in the focus districts unless otherwise noted. Outcomes for targets that were met but not because of Ananya are highlighted in light green. Outcomes for targets that were met because of Ananya are highlighted in dark green.

[a]Our preferred exclusive breastfeeding measure based on the World Health Organization's definition (child exclusively breastfed in past 24 hours, children ages 0–5 months) also increased substantially between baseline and midline. However, this increase is not attributable to Ananya.

To probe the validity of the Ananya theory of change, we also explored the correlation between elements of program exposure and health outcomes (Chapter X), which we summarize in Table XI.3. The table shows the means for each outcome with and without exposure to the given program element, regression-adjusted for demographic characteristics. The difference between the two means for each outcome is the correlation with the given element of exposure.

As in our previous summary of Ananya impacts, we highlight all statistically significant correlations of less than 25 percent in light green (medium correlations) and all those that are 25 percent or greater in dark green (strong correlations).

Table XI.3. Summary of correlations between key outcomes and measures of program exposure, in focus districts at midline

Exposure measure	Mean exposure at midline (percentage points)	Outcome	Adjusted mean if not exposed (percentage points)	Adjusted mean if not exposed (percentage points)	Adjusted difference (percentage points)	Adjusted difference (percent)	Summary
FLW interactions							
Received at least two FLW home visits in the final trimester of pregnancy	39.2	Received ANC three or more times	36.2	46.1	10.0***	28%***	Medium-strong correlation with behaviors related to pregnancy and delivery FLW last trimester visits a significant predictor of delivery preparation after controlling for other types of exposure (Chapter X)
		Consumed 90 or more IFA tablets	10.0	21.1	11.0***	110%***	
		Delivery preparation—saved money	74.2	86.0	11.8***	16%***	
		Delivery preparation—arranged transportation to facility	52.7	63.7	10.9***	21%***	
		Delivery preparation—had important telephone numbers handy	35.8	58.5	22.7***	63%***	
		Delivered at a facility	74.8	82.1	7.3***	10%***	
Received any FLW home visit related to complementary feeding	14.3	Children ages 6–11 months who are currently receiving any solid or semisolid food	66.7	75.9	9.3*	14%*	Medium correlation with certain complementary feeding behaviors FLW visits not a significant predictor of complementary feeding after controlling for other types of exposure (Chapter X)
		Children ages 6–11 months who received cereal-based food in the previous day	56.6	66.8	10.2**	18%**	
		Children ages 6–11 months who began complementary feeding at age 6 months	44.4	46.3	1.8	4%	
FLW visit to discuss family planning during pregnancy	13.8	Use of any modern method of contraception	17.7	30.7	13.0***	73%***	Strong correlation with use of modern methods Only visits during pregnancy are a significant predictor of use of modern methods after controlling for other types of exposure (Chapter X)
FLW visit to discuss family planning after delivery	14.1	Use of any modern method of contraception	17.8	29.6	11.8***	66%***	
Mobile Kunji							
Exposed to mobile kunji cards or audio in previous 6 months[a]	9.4	Delivery preparation—saved money, arranged transport, and kept important phone numbers (children ages 0–6 months)	57.8	30.0	27.9***	48%***	Mixed findings—strong correlations for delivery preparation and medium for complementary

Exposure measure	Mean exposure at midline (percentage points)	Outcome	Adjusted mean if not exposed (percentage points)	Adjusted mean if not exposed (percentage points)	Adjusted difference (percentage points)	Adjusted difference (percent)	Summary
		Delivered at a facility (children ages 0–6 months)	77.9	76.8	1.1	1%	feeding, but insignificant for other behaviors
		Children ages 6–11 months old who received DPT3	57.2	63.4	-6.2	-11%	These correlations for delivery preparation and complementary feeding hold after controlling for other types of exposure (Chapter X)
		Children ages 6–11 months who are currently receiving any solid or semisolid food	80.4	66.9	13.5**	17%**	
		Use of any modern method of contraception	24.6	19.0	5.6	23%	
		Media					
Exposed to relevant media messages in previous year	29.8	Delivery preparation—saved money, arranged transport, and kept important phone numbers (children ages 0–6 months)	38.4	31.1	7.3***	19%**	Mixed findings—medium correlations for delivery preparation and use of modern methods
	24.5	Children ages 6–11 months who are currently receiving any solid or semisolid food	69.5	67.3	2.2	3%	These correlations are not significant after controlling for other types of exposure (Chapter X)
	29.2	Use of any modern method of contraception	22.3	18.3	4.0*	18%*	

Source: Women in focus districts in the Ananya baseline and midline surveys. All outcomes apply to women with children ages 0–11 months unless otherwise noted. Adjusted means and differences account for differences in demographic characteristics. Medium correlations are defined as statistically significant regression-adjusted differences of less than 25 percent of the nonexposed mean and are highlighted in light green. Strong correlations are defined as statistically significant regression-adjusted differences of 25 percent or more of the nonexposed mean and are highlighted in dark green.

[a]Results are for general exposure to mobile kunji; information on exposure to information on specific topics through the kunji is not available.

*$p < 0.10$, **$p < 0.05$, ***$p < 0.01$ for adjusted differences.

Consistent with the Ananya theory of change, we found that elements of program exposure were strongly correlated with many health outcomes. The correlations between relevant outcomes and FLW home visits were particularly strong, including visits during pregnancy, visits related to complementary feeding, and visits related to family planning. The findings for exposure to mobile kunji and media messages were more mixed, with significant correlations for some outcomes but not others. Similarly, our analysis of the associations between outcomes and multiple measures of exposure using a regression framework in Chapter X also found mixed results across outcomes. For example, FLW home visits were significant predictors of behavior for delivery preparation and family planning, mobile kunji exposure was a significant predictor for delivery preparation and complementary feeding, and media exposure was statistically insignificant throughout. The overall pattern of correlations suggests that the logic underlying the Ananya approach to improving health outcomes through the program elements is sound, though not all outcomes are equally affected by the same elements.

Despite these positive correlations and significant impacts of Ananya on some outcomes, levels of many outcomes are still low, suggesting that there is room for further improvement as Ananya interventions are scaled up under the TSU. For example, undernutrition remains common and contraceptive use is still very low despite the strong impacts of Ananya, while newborn care practices also suggest important coverage gaps. Further, substantial disparities for marginalized women persist in a number of key maternal and child health outcomes. In addition, exposure to some key program elements was still relatively limited—for example, only about 40 percent of women received at least two FLW home visits in the final trimester, and only about 10 percent women were exposed to mobile kunji in the previous six months. As key Ananya program elements expand across the state under the TSU, increasing the penetration of the interventions and emphasizing some specific domains—as well as specific types of beneficiaries—could help improve the relevant outcomes and lead to fewer health disparities throughout Bihar.

However, it is also important to emphasize that the estimated midline impacts apply to the Ananya interventions that were intensively implemented in the eight focus districts over the two-year midline period. They therefore do not necessarily reflect the impacts that could be expected across the state moving forward. It is possible that the broader health systems change included in the TSU (for example, addressing supply-side constraints)—together with additional interventions that had not been widely implemented by midline—could result in similar or larger impacts of Ananya at the state level. On the other hand, with less intensive direct support from the program, these impacts might be lower. Further, the midline evaluation focused on proximal health outcomes; impacts on ultimate outcomes related to mortality, fertility, and undernutrition will take longer to manifest and cannot be determined directly from the midline results. Future efforts to study the effectiveness of Ananya will focus on understanding how health systems have improved as a result of the TSU, and how these have led to improvements in outcomes and attainment of the RMNCH+A goals and targets set by the GoB at the state level.

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APPENDIX A: TECHNICAL APPENDIX

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Appendix A provides technical details regarding the sampling approach for the Ananya baseline and midline surveys (Section A), the analysis approach used to produce the estimates in the body of the report (Section B), and the validation of the comparison group design that we used to estimate the impacts of Ananya (Section C).

A. Sampling approach

In this section we discuss the sample frame, sampling approach, and sample sizes for the Ananya baseline and midline surveys. As described here, the selection of sampling units for the evaluation was conducted only once, at baseline. At midline, we returned to the same sampling units but identified a new cohort of women for the survey.

1. Sample frame

To identify a representative sample of women who had given birth in the previous year in communities across Bihar, we required a sample frame of communities. We used the 2001 census—the latest publicly available census at the time of the baseline—as our rural sample frame. This included a list of all districts, blocks, and rural communities in Bihar, and their population sizes. We worked with the Registrar General's office to adjust this sample frame in response to the reclassification of some communities from rural to urban since 2001, as well as other administrative reorganizations. However, the 2001 census did not provide a sufficiently detailed urban sample frame, because it included only the names and population sizes of entire towns or cities and did not subdivide them into more manageable sampling units. For the urban sample frame, we therefore obtained and used the 2007–2010 National Sample Survey Office (NSSO) sample frame from the Urban Frame Survey (UFS), which included a list of urban communities and maps showing their division into urban blocks (BLs).

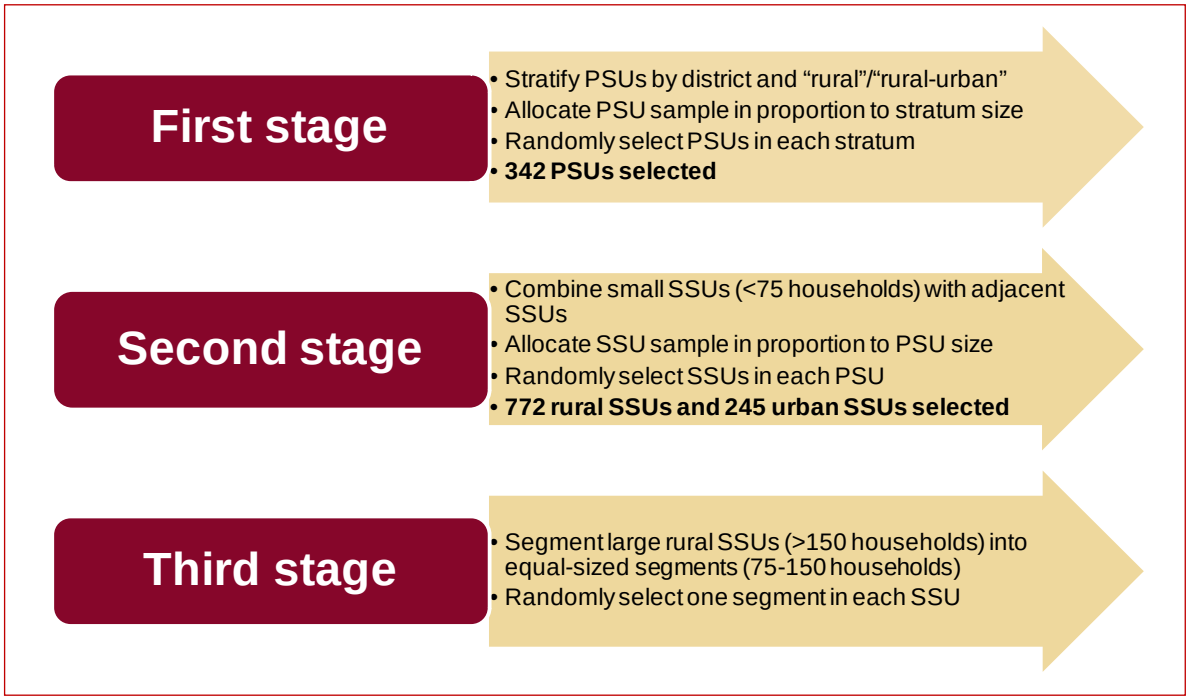
2. Drawing the sample

To draw the household sample for the baseline survey, we used a two-stage sampling design in each district, except in the case of large rural villages, when it became a three-stage design (Figure A.1):

- In the first stage, we selected a representative sample of blocks (the primary sampling unit, or PSU) in each district, with larger districts receiving proportionally more PSUs. To ensure that sufficient urban communities were included, we first divided the PSUs in each district into two strata based on whether the PSU had any urban communities and drew PSUs separately in each of these strata.
- In the second stage, we drew a representative set of secondary sampling units (SSUs) in the sampled PSUs, with larger PSUs receiving proportionally more SSUs. In accordance with our sampling frame, SSUs were defined as villages in rural areas and BLs in urban areas. Small SSUs (those with fewer than 75 households) were combined with nearby SSUs into a single SSU before sampling to meet our sample size requirements.
- In the third stage, we divided large rural SSUs (those with 150 households or more) into several equal-sized segments of 75 to 150 households per segment, and randomly selected a single segment into the sample (because urban BLs were rarely much larger than 100 households, this step was necessary only for rural SSUs). This was an additional stage of

sampling that applied only to these SSUs and was introduced to make listing and surveying in these SSUs more manageable.

Figure A.1. Sampling approach for the Ananya evaluation



Note: The sampling frame for SSUs was the 2001 census (rural areas) or the 2007–2010 National Sample Survey Organization urban sampling frame (urban areas).

PSU = primary sampling unit; SSU = secondary sampling unit.

Each final SSU or segment therefore included approximately 100 households on average, which yielded approximately 15 women who had given birth in the previous year—as discussed later, this was our targeted sample size per SSU (we computed the necessary segment size to meet this target in advance, using current birth rates). We therefore attempted to survey *all* eligible women in the sampled SSUs or segments who were identified in our household listing.

At midline, we returned to the same SSUs or segments but conducted a new listing to identify the new cohort of women who had given birth in the previous year. The midline also included an additional sample of mothers of children 12 to 23 months old. These women were identified in the listing; because the required sample sizes were smaller (three children per village, on average), children were randomly selected from the eligible group for inclusion in the survey.

3. Sample sizes

As we conducted our minimum detectable impact (MDI) calculations to determine the optimal sample size, we were aware of the importance of estimating impacts for a wide variety of outcomes with different baseline prevalence rates using our comparison group design. In addition, the Foundation expressed a strong interest in measuring statewide changes in neonatal

mortality (NMR) from baseline to the end of the Ananya program. Because of low prevalence, the NMR indicator requires a particularly large sample size to detect expected changes. This outcome therefore drove our sample size determination; with sufficient sample size to detect the expected statewide changes in NMR, our calculations indicated that we would have sufficient statistical power for other household outcomes in the comparison group design.

Based on the MDI calculations, we determined that a total sample size of 38 districts, 342 blocks (9 per district on average), 1,026 SSUs (3 per block on average), and approximately 15,400 eligible women (15 per SSU on average) would enable us to detect a statewide reduction in NMR of about 6 per 1,000 live births from a projected baseline of 32 per 1,000. Although this is larger than the decrease implied by the program target of 28 per 1,000, it is reasonable given the downward trend in NMR in Bihar.[83]

B. Analysis approach

In this section we describe the regression models that we used to produce the estimates in the body of this report, including the main impact estimates and estimates of correlations between program exposure and health behaviors.

1. Difference-in-difference impact estimates and midline difference estimates

As we described in Chapter I, the midline analysis included two types of estimates: (1) difference-in-differences (DD) estimates, for outcomes available at baseline and midline; and (2) estimates of midline differences, for outcomes available only at midline. To enable us to improve the precision of our estimates through control variables and to obtain the correct standard errors, we produced both of these types of estimates in a regression framework.

The simple DD estimates were estimated using the following regression model:

(1) $$Y_{ijt} = \alpha + \beta focus_j + \gamma midline_t + \delta midline_t * focus_j + \varepsilon_{ijt} \ ,$$

where Y_{ij} is the outcome for individual i in district j at time t (baseline or midline), $focus_j$ is a binary indicator for the focus districts, $midline_t$ is a binary indicator for midline, $midline_t*focus_j$ is the interaction between the focus district and midline indicators, and ε_{ijt} is a random error term. The coefficient δ gives the DD estimate, which we interpret as the impact of Ananya. Standard errors were adjusted for clustering at the district level, the level at which implementation varied.

The adjusted DD estimates were estimated using a slightly modified regression model:

(2) $$Y_{ijt} = \alpha + \beta \lambda_j + \gamma midline_t + \delta midline_t * focus_j + \phi Z_{ijt} + \varepsilon_{ijt} \ ,$$

[83] For example, the NMR has decreased from 40 per 1,000 live births in the 2005-2006 National Family Health Survey (NFHS) to 32 per 1,000 in our baseline survey—a 20 percent decline over approximately five years. Even if the trend in NMR is not linear, it seems likely that a further reduction to the program target of 28 per 1,000 births over the subsequent five years—a 12.5 percent decline—might be achieved even in the absence of the Ananya program.

where λ_j is a set of binary indicators, one for each district, Z_{ijt} is a set of controls for demographic and socioeconomic characteristics, and all other variables are as defined for Equation (1). This specification improves the precision of the estimates by controlling for district-level characteristics that are fixed over time (through the district effects, λ_j) as well as individual demographic and socioeconomic characteristics (through the controls Z_{ijt}). The individual controls include binaries for rural location, SC/ST status, religion, literacy, formal education for the respondent, formal education for the respondent's husband, age of the woman (several categories), number of children, and socioeconomic quartile. Again, the coefficient δ gives the (adjusted) difference-in-differences estimate, and standard errors were adjusted for clustering at the district level.

For outcomes that were available only at midline, the simple midline difference between the focus and nonfocus districts was estimated using the following regression model, applied to midline data:

(3) $$Y_{ij} = \alpha + \delta focus_j + \varepsilon_{ij} \ ,$$

where $focus_j$ is a binary indicator for the focus districts. The coefficient δ gives the simple difference estimate, and standard errors were again adjusted for clustering at the district level.

To obtain adjusted difference estimates, we added to Equation (3) controls for the demographic and socioeconomic characteristics that we described earlier. In addition, we added controls for baseline district-level means of key outcomes in the same domain. For example, for outcomes related to frontline worker (FLW) interactions that were available only in the midline, we controlled for baseline district-level means of the proportion of women who received two final-trimester FLW home visits, and any post-delivery FLW home visits. In the absence of baseline data on the specific outcome being analyzed, these district-level controls were an attempt to adjust for any underlying baseline differences between focus and nonfocus districts.

To estimate subgroup impacts, we restricted the sample to the relevant subgroup. For subgroups related to marginalization, we did not include any marginalization indicators as control variables, because women are often affected by multiple dimensions of marginalization. These controls were, however, included in other subgroups analyses, such as gender, age of the child, or birth parity.

2. Relationship between measures of exposure and behavior

In Chapter VIII, we present the results of correlations between measures of program exposure and behaviors in focus districts. For example, we compare the means of facility delivery for beneficiaries who did and did not receive FLW home visits in the final trimester. To adjust for differences in demographic characteristics in comparing these means, we estimated linear regression models of the following type:

(4) $$Y_i = \alpha + \pi \, exposure_i + \lambda Z_i + \varepsilon_i \ ,$$

where Y_i is the behavior of interest (for example, facility delivery) for individual i; $exposure_i$ is the measure of exposure (for example, FLW home visits in the final trimester); and Z_i is the set of demographic characteristics described above The regression-adjusted mean for those with

exposure is given by $\alpha + \pi + \lambda \overline{Z}$, and the mean for those without exposure is given by $\alpha + \lambda \overline{Z}$, where $\overline{Z}$ is the mean of each demographic characteristics. The difference between the two is given by the regression coefficient on the measure of exposure, π, which is our measure of the correlation between behavior and exposure. The standard errors of this estimate were adjusted to reflect the sampling approach within districts (sampling of blocks and villages).

3. Relationship between multiple measures of exposure and behavior

In Chapter X we also estimated the associations between multiple program elements and behavior in a regression model that attempts to separate the contributions of specific elements. To do this, we estimated probit regression models of the following types:

$$(5) \quad Y_i = \alpha + \sum_k \pi_k \, \text{exp}osure_{ik} + \lambda Z_i + \varepsilon_i ,$$

where Y_i is the behavior of interest, $exposure_{ik}$ are the various measures of exposure, and Z_i is the set of demographic characteristics described above. The probit regression coefficients, π_k, were transformed into percentage terms (marginal effects at the means of the covariates) for ease of interpretation using the margins command in Stata. The entries presented in TableX.1 therefore give the predicted percentage increase in behavior associated with each measure of exposure; the predicted base level is computed as the predicted value from regression (5) with all exposure coefficients set to zero. Again, standard errors were adjusted to reflect the sampling approach within districts (sampling of blocks and villages).

C. Validation of comparison group design

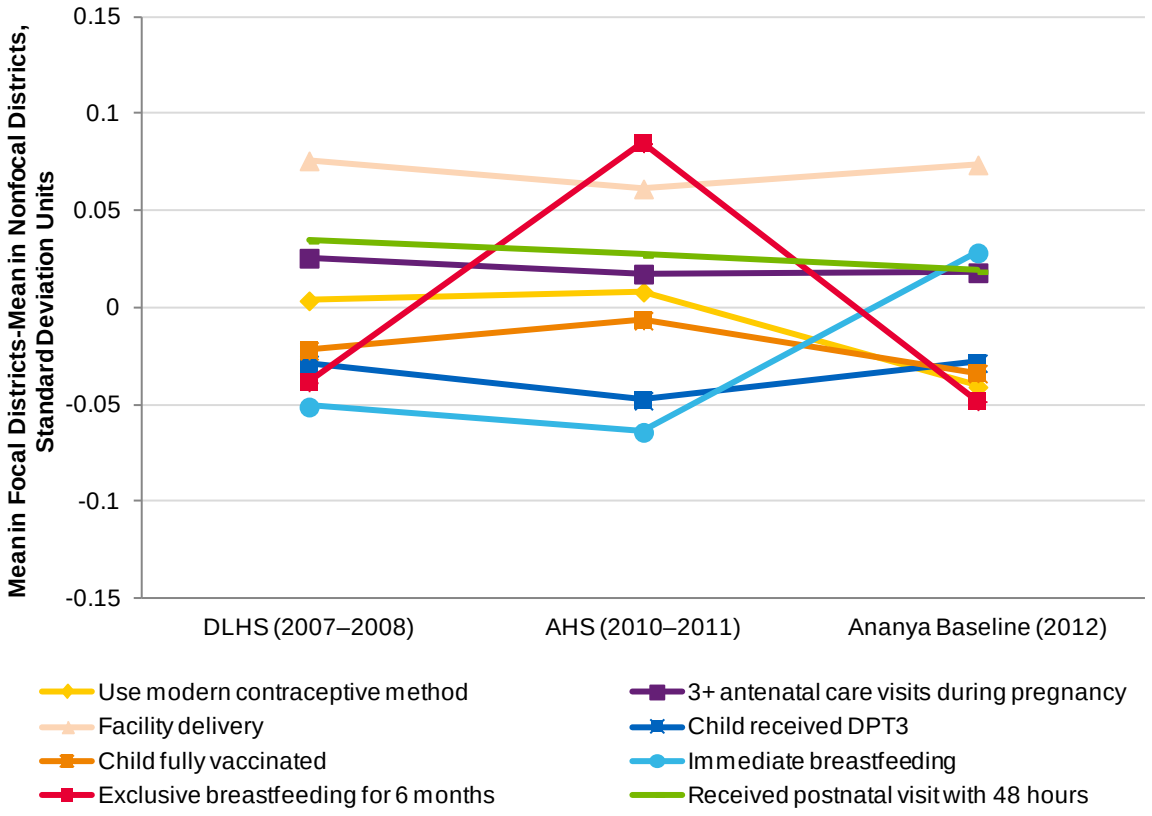
A standard test of the validity of estimating impacts in a comparison group design using a DD approach is to examine whether outcomes in the treatment and comparison groups were changing in a similar manner before the intervention. This method typically involves computing the difference between outcomes in the treatment and comparison groups at each point in time, and examining the trend in these differences over the period before an intervention occurred. A trend with a positive or negative slope indicates that the treatment and comparison groups were diverging before the intervention, and thus a DD approach is not appropriate. A trend that is relatively flat or has an equal number of increases and decreases of approximately the same size over time (that is, a jagged line with little overall movement), suggests that the treatment and comparison groups were not changing differently before the intervention, and thus a DD approach is likely to be valid.

Because the Ananya baseline captured information at only a single point in time, we need additional data to understand pre-existing trends in outcomes and evaluate the validity of the DD approach. To achieve this objective, we extracted district-level data from the 2010-2011 Annual Health Survey (AHS-1) and 2007-2008 District-Level Household and Facility Survey (DLHS-3).[84] We were able to gather data from both of these surveys on eight key outcomes. To increase comparability across surveys, the data were normalized to have a mean of zero and standard deviation of one across the population of Bihar for each outcome and survey.

[84] Averages for Arwal are taken from Jehanabad for these surveys, because the Arwal was previously part of the Jehanabad.

Figure A.2 shows the differences between outcomes in focus and nonfocus districts for these normalized measures. Most outcomes exhibit no strong trend over the period considered. Only one of eight outcomes of interest (postnatal care within 48 hours of birth) exhibits a difference that moves in the same direction from the DLHS to the AHS and from the AHS to the Ananya baseline survey. The slope of this trend is also quite shallow, with this indicator changing less than 0.02 standard deviations over four years. Thus, it appears there were no systematic differences in the way maternal and child health was evolving in focus and nonfocus districts before Ananya activities. Simply using all individuals in all nonfocus districts as a comparison group in a DD approach thus appears valid.

Figure A.2. Differences between focus and nonfocus districts (in standard deviations)



Source: Rotz et al. (2014a).

Note: Difference is the mean in focus districts minus the mean in nonfocus districts. Data at each survey are normalized to have a mean of zero and a standard deviation of one across Bihar.

The simple DD approach can be further justified by demonstrating that the groups of focus and nonfocus districts are similar at baseline across a variety of outcomes. Table A.1 therefore compares the values of key outcomes and demographic characteristics within these groups using the Ananya baseline. All normalized differences are less than 0.25, a common cutoff for

assessing baseline equivalence.[85] Additionally, most differences are not statistically distinguishable from zero, and the average absolute value of the normalized difference is quite small, at 0.05 standard deviations.

Given the trends in Figure A.1 and the small differences shown in Table A.1, the conditions required for a DD approach using all nonfocus districts as the comparison group appear to be met. In particular, we believe that a DD approach that controls for district-fixed effects and demographic characteristics to correct for the small differences at baseline can provide plausible estimates of the effect of Ananya activities in the eight focus districts.

Table A.1. Differences at baseline between focus and nonfocus districts (percentage points)

Variable	Focus district mean	Nonfocus district mean	Differ-ence	Normalized difference
Key outcomes				
Women visited two or more times by FLW in final trimester	36.6	35.4	1.2	0.03
Women receiving a visit from an FLW within one day of birth	19.5	22.8	-3.3	-0.09
Women receiving three or more ANC checkups during pregnancy	27.9	28.3	-0.4	-0.01
Women who delivered in facility	59.7	66.6	-6.9***	-0.14
Women who applied nothing to child's cord or umbilicus	24.4	23.4	1.1	0.02
Women who breastfed within one hour of birth	44.1	47.6	-3.5	-0.07
Children ages 6–11 months who received DPT3	65.1	62.1	3.0	0.06
Children ages 6–11 months fed solid or semisolid foods in past 24 hours	65.4	63.5	1.9	0.04
Women using a modern method of contraception	13.8	10.9	2.9**	0.08
Women in lowest wealth quartile	26.8	23.3	3.5	0.08
Women highest wealth quartile	22.9	24.9	-2.0	-0.04
Women who are literate	36.5	37.3	-0.8	-0.02
Women who are Muslim	18.5	18.8	-0.3	-0.01
Non-Muslim women who are SC/ST	31.2	29.6	1.6	0.03
Women having their first child	31.6	28.6	3.0	0.06
Women having their fourth or later child	21.9	23.5	-1.6	-0.04
Women living in rural area	93.2	93.2	0.0*	0.00

Source: Ananya baseline data.

Note: For outcomes using all mothers with children ages 0–11 months, N = 12,384. For outcomes using all mothers with children ages 6–11 months, N = 4,929. Item-specific nonresponse might lead to small differences in sample sizes by outcomes.

*p-value < 0.10, **p-value < 0.05, ***p-value < 0.01.

[85] Imbens and Wooldridge (2009) suggest using the normalized difference, rather than t-tests, to assess balance between treatment and comparison observations, considering a sufficiently small value of this normalized difference below 0.25 in absolute value. Mathematica has adopted similar standards for What Works Clearinghouse evaluations.

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APPENDIX B: SENSITIVITY OF RESULTS TO ALTERNATE COMPARISON GROUPS

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As we described in Chapter I, most of the Ananya program interventions were initially implemented in 8 focus districts, with the goal of eventually scaling them up to the remaining 30 districts. The analysis in the main body of this report used a comparison group design in which the 8 focus districts form the treatment group and all 30 nonfocus districts form the comparison group. To determine the impacts of Ananya, the changes in the focus districts between baseline and midline were compared with the changes in the nonfocus districts using a regression model—a difference-in-differences (DD) approach. Using this method, we found that Ananya was successful in increasing the quantity and quality of interactions between households and frontline workers (FLWs) and led to improvements in some health outcomes.

In a February 2014 memo (Rotz et al. 2014a), we described some of the merits and potential pitfalls of this analytic approach and explored alternative methods, such as propensity-score matching and synthetic control estimates. Our analysis suggested that variations on the DD approach that use a different comparison group were unlikely to produce substantial gains. Therefore, we recommended using a simple DD technique as the primary analytic method for evaluating Ananya activities in the eight focal districts, and using the synthetic control method to verify the robustness of the DD results (that is, to see how stable estimates are if we use different analytical approaches).[86] This appendix includes the results from this synthetic control robustness analysis.

In addition to verifying the robustness of our results to using a comparison group selected by the synthetic control method, we also explored their robustness to purposefully omitting certain districts from the comparison group. This is important because the basic DD estimates presented in this report can be interpreted as the impact of Ananya *relative to the activities taking place in the nonfocus districts* over the same period. As described in Chapter II, other development partners were implementing health programs targeting similar outcomes in many nonfocus districts over this period. If these other programs led to substantial changes in outcomes in the nonfocus districts between baseline and midline, then the estimated impacts of Ananya might be lower than if the focus districts were compared to districts in which no such activities were taking place.

Because of these concerns, in an August 2014 memo (Rotz et al. 2014b), we explored how our impact estimates changed when the districts in which other partners were operating were omitted from the comparison group of non-focus districts. This provided us a sense of the impacts of Ananya relative to no external interventions. We note that, even though other development partners' programs might have historically improved health outcomes, our analysis compares changes occurring only between the baseline and midline surveys. That is, if another program led to large improvements several years ago but outcomes have been relatively constant since then (including between baseline and midline), then that other program would not substantially affect our impact estimates.

[86] We excluded propensity-score methods from consideration because they were unstable and the small sample size of districts made them unlikely to work in the Ananya evaluation.

This appendix reviews the results from these two robustness analyses. In Section A, we provide a brief overview of the synthetic control method we used (see Rotz et al. 2014a for more details) and describe the results of this analysis. In Section B, we provide an overview of the districts in which other development partners have had substantial investments and summarize the results obtained from omitting these districts from our analysis. Overall, the different comparison groups result in similar estimates in most domains, suggesting that the results in the body of the report are robust to these alternative methods.

A. Impact estimates using the synthetic control method

Proposed by Abadie et al. (2010), the synthetic control estimator systematically selects the set of districts that should serve as a comparison for each treated district. The estimator achieves this objective by selecting the comparison group most closely matching the treatment group based on a set of researcher-defined variables. To implement this approach, we first take the set of all potential comparison districts and select a set of characteristics that is substantively most important in predicting the outcome of interest. This set potentially includes baseline or other past values of one or more outcomes of interest (also called lagged outcomes). Next, we search for a set of district-level weights such that the weighted average of the potential comparison group observations (the synthetic control) minimizes the difference between the treatment and comparison observations with respect to these characteristics. We then use this synthetic control to calculate a treatment effect using DD. Intuitively, the synthetic control approach involves reweighting potential comparison districts so that, as a whole, they are more similar to the focus districts.

For our analysis, a synthetic control district was selected for each focus district using district-level average values drawn from the Ananya baseline, Annual Health Survey (AHS), and District-Level Household and Facility Survey (DLHS). We focused this analysis on nine key outcomes across the domains discussed in Chapters IV–VIII and selected our matching variables accordingly. Table B.1 lists the matching variables and their data sources. District-level average demographic characteristics are drawn only from the Ananya baseline survey; outcome values are drawn from all surveys in which they are available. Thus, matching is based on as many as three lagged values of each outcome. We used the Stata package synth.ado to find a synthetic control group for each focal district. We then used the population of each district to create the overall average for the focus districts and the synthetic controls for use in the analysis.

Table B.1. Variables used in synthetic matching procedure

Variable	Ananya baseline (2012)	AHS (2010–2011)	DLHS (2007–2008)
Control variables			
Lowest wealth quartile	X		
Highest wealth quartile	X		
Literate	X		
Muslim	X		
SC/ST (among non-Muslims)	X		
First child	X		
Fourth or later child	X		
Lagged outcomes			
Two or more FLW home visits in final trimester	X		
FLW home visit within one day of delivery	X	X	X
Three or more ANC check-ups during pregnancy	X	X	X
Delivered in facility	X	X	X
Applied nothing to child's cord or umbilicus	X		
Breastfed within one hour of birth	X	X	X
Children ages 6–11 months who received DPT3	X	X	X
Children ages 6–11 months who were fed sold or semi-solid foods in past 24 hours	X		X
Women with children ages 0–11 months using a modern method of contraception	X	X	X

Note: In some cases, the precise definition of the variable may differ across surveys. Some variables are derived from slightly different populations in the AHS or DLHS: breastfeeding child in first hour (mothers of living children in DLHS, mothers of children younger than 3 in AHS); children who have been fully vaccinated (ages 12 to 23 months in AHS and DLHS); and women using modern contraception (all currently married women ages 15 to 49).

ANC = antenatal care

The synthetic control results were generally very similar to the simple DD estimates in the body of the report (Table B.2). Point estimates were similar in magnitude across most of the outcomes considered, although some of the significance levels changed (for example, impacts on three or more antenatal care [ANC] visits became marginally significant, whereas those on complementary feeding and cord care lost significance). Overall, these findings suggest that our findings are largely robust to the use of this alternative method of selecting the comparison group.

B. Impact estimates omitting districts in which other development partners were operating

As described earlier, if other development partners' activities were affecting the same outcomes as Ananya in the districts in which they were operating, we would expect that omitting these districts from the comparison group would increase the estimated DD impacts of Ananya (because any changes observed in the comparison group would be smaller). We therefore use DD to estimate the impacts of Ananya, excluding certain districts where other activities were

Table B.2. Synthetic control estimates

Outcome (percentage)	Baseline (2012)		Midline (2014)			
	Focus district mean	Synthetic control mean	Focus district mean	Synthetic control mean	Synthetic control estimate	Estimate using DD
Two or more FLW home visits in final trimester	35.3	35.2	41.4	30.1	11.2***	9.7***
FLW home visit within one day of delivery	22.9	22.0	22.1	18.0	3.2	2.7
Three or more ANC check-ups during pregnancy	28.8	28.8	39.4	31.9	7.4*	5.1
Delivered in facility	66.5	66.4	77.0	76.1	0.8	-0.4
Applied nothing to child's cord or umbilicus	23.6	24.1	29.8	26.1	4.3	6.1**
Breastfed within one hour of birth	46.6	46.2	52.8	59.4	-7.0	2.7
Children ages 6–11 months who received DPT3	61.1	61.1	63.1	60.2	2.9	3.1
Children ages 6–11 months who were fed sold or semisolid foods in past 24 hours	63.2	63.4	68.3	62.0	6.5	8.5*
Women with children ages birth to 11 months using a modern method of contraception	11.1	11.1	19.1	14.0	5.1***	7.0***

Source: Ananya baseline and midline surveys conducted by Sambodhi in collaboration with Mathematica and PHFI in spring 2012 and spring 2014, respectively.

Note: Because we used slightly different weights to create aggregate estimates for this procedure, the focus group means and simple DD estimates might not exactly match those reported in the body of the text.

*$p < 0.10$, **$p < 0.05$, ***$p < 0.01$.

taking place from the comparison group (which includes all other nonfocus districts). Table B.3 provides an overview of other developing partners operating in Bihar, as discussed in Chapter II. Our analysis excludes these groups of districts (one group at a time), as well as the eight Ananya scale-up districts, which are nonfocus districts where some Anaya activities might have begun before our midline analysis.

Table B.3. Activities of other development partners in Bihar, 2010–2014

Donor	Implementing partner	Years of operation	Districts
DFID	B-TAST	2010–present	Araia, Seohar, Supaul, Madhubanai, Kishanganj, Purnia, Madhepura, Jamui, and Banka. In 2013 added Gaya, Jahanabad, and Katihar
NIPI	UNDP	2010–present	Nalanda, Shekhpura and Jahanabad
UNICEF		Past 30 years	Vaishali
UNFPA		2010–present	Sitamari and Madhubani
MacArthur Foundation	Pathfinder	2009–2012	Patna and Vaishali
CIFF	Micronutrient Initiative	Vitamin A: 2006–present Diarrhea intervention: 2011–present	Diarrhea intervention: Munger, Khagaria, Bhagalpur, Bangka, Sitamarhi, Madhepura, Saharsa, Supaul, East Champaran, Sheohar, Gaya, Jhanabad, Nalanda, Sheikpura and Purnia
David and Lucile Packard & UNFPA	Pathfinder	2001–2012	Nalanda, Nawada, Patna. In 2008 added Sheikhpura and Gaya
DkT International	Janani	1996–present	E.Champaran, W. Champaran, Siwan, Saran, Patna, Ara, Rohtas, Aurangabad, Gaya, Nawada, Jamui, Banka, Munger, Bhagalpur, Begusarai, Saharsa, Purnia, Kishanganj, Madhubani, Vaishali, Nalanda, Muzaffarpur, Sitamarhi

Sources: Web-based search of development partner activities and qualitative semistructured interviews with technical leads of development partners.

Table B.4 presents estimates of Ananya's impact on several key variables, excluding these various groups of districts from the comparison group. Overall, the impact estimates are remarkably robust to the choice of the comparison group, both in magnitude and significance. Although there are a handful of differences for some outcomes and comparisons, these findings suggests that the presence of other development partners is not substantively affecting the estimated impacts. As mentioned previously, this does not necessarily imply that other development partners are having no impact. Some of the changes attributable to these other programs might well have happened before the Ananya baseline. Also, some of the development partners might focus on other outcomes than those measured here. Further, some of these programs are taking place in only a few districts and are therefore unlikely to have a large effect on the comparison group, which consists of 30 districts.

Table B.4. Impacts of Ananya when districts where other development partners operated are omitted from the comparison group

Variable	None	Impact omitting districts where donor operates								
		BMFG (Ananya scale-up)	DFID	NIPI	UNICEF	UNFPA	Mac-Arthur Found-ation	CIFF	Packard Found-ation/ UNFPA	DkT
Two or more FLW home visits in final trimester	9.7***	10.2***	9.8***	9.7***	9.5***	10.8***	9.7**	10.1**	10.8***	12.3*
Received any post-delivery FLW visit	0.1	1.0	1.8	-0.4	-0.1	1.6	0.6	0.6	0.7	-3.7
Three or more ANC check-ups during pregnancy	5.1	3.6	2.9	5.0	5.1	4.9	5.2	3.8	5.7	3.5
Received 90 or more IFA tablets	1.2	3.2	3.9	0.4	1.3	2.0	3.8*	1.7	2.4	-2.1
Delivered at facility	-0.4	2.1	0.6	-0.6	-0.4	1.0	0.4	-1.6	-0.2	2.8
Applied nothing to child's cord or umbilicus	7.4***	10.0***	8.1***	7.1***	7.7***	6.4**	7.2**	4.5	6.5**	8.9
Delayed child's first bath at least two days	2.1	1.2	-0.5	1.5	1.7	1.8	3.5	-0.2	2	-4.7
Skin-to-skin care	9.5	14.1	11.9	8.7	9.8	10.0	16.1**	13.8	12.6*	21.3**
Breastfed within one hour of birth	2.7	2.7	4.1	2.6	2.9	3.3	0.5	6.1	-0.3	3.1
Child exclusively breastfed through 6 months (children ages 6–11 months)	8.6	7.0	7.7	8.5	7.9	8.8	10.3	6.1	9.6	14
Any complementary feeding (children ages 6–11 months)	8.5*	8.5	5.3	8.4	8.6*	9.3*	10.5*	10.9**	10.8*	17.9**
Any cereal-based complementary feeding (children ages 6–11 months)	8.2**	6.1	4.8	8.1**	8.5**	8.6**	9.8**	8.7**	9.4*	13.8**
Received DPT3 (children ages 6–11 months)	2.2	1.6	0.2	3.1	1.6	3.3	-1.1	7.9	0.2	2.3
Child fully vaccinated, excluding measles (children ages 6–11 months)	-0.2	-1.6	-2.0	0.4	-0.8	1.6	-2.7	4.6	-2.2	1.2
Currently use a modern method of contraception	8.7***	8.8***	8.8***	8.5***	9***	9.1***	11.1***	6.9*	10.3***	10.2**
Currently use a permanent methods of contraception (children ages 6–11 months)	1.5	1.4	1.8	1.5	1.3	1.7	1.4	2.8*	1.6	1.0
Sample size (outcomes for children ages birth to 11 months)	**24,038**	**18,810**	**17,339**	**22,765**	**23,389**	**22,697**	**22,045**	**15,572**	**20,315**	**7,028**
Sample size (outcomes for children ages 6–11 months)	**9,827**	**7,703**	**7,131**	**9,317**	**9,550**	**9,277**	**8,999**	**6,414**	**8,355**	**2,849**

Source: Ananya baseline and midline surveys conducted by Sambodhi in collaboration with Mathematica and PHFIin spring 2012 and spring 2014, respectively.

*$p < 0.10$, **$p < 0.05$, ***$p < 0.01$ for adjusted difference-in-differences.

IFA = iron and folic acid.

APPENDIX C: RESULTS BY GEOGRAPHICAL AREA

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Appendix C explores the extent to which the Ananya interventions might have had different impacts across Bihar using two different analyses. In Section A, we estimate the impact of Ananya for various groups of the eight focus districts, using the difference-in-differences (DD) approach to compare baseline-to-midline changes in these groups of focus districts to those in the nonfocus districts. In Section B, we focus on simple baseline-to-midline changes in outcomes by division, an administrative geographic unit that includes several districts. These changes might provide useful information to stakeholders about trends in key outcomes over time across Bihar.

A. Estimates for groups of focus districts

The eight Ananya focus districts consist of two clusters of districts: the focus districts in the central part of the state (Patna, Samastipur, Begusarai, Saharsa, and Khagaria) and those in the northwestern part of the state (East Champaran, West Champaran, and Gopalganj). We used DD estimates, restricting the focus districts to these two clusters and using the full set of nonfocus districts as the comparison group, to see if Ananya's impacts differed by geography. We also present estimates that exclude Patna district from the full set of focus districts or from the central cluster; Patna is atypical in Bihar because it contains the state capital and is the most urban of Bihar's districts. For comparison, we also show the estimates for the full set of focus districts, which are presented in the body of the report.

An important caveat to these analyses is that Appendix A verified only the assumptions necessary for attribution to Ananya—specifically, the baseline similarity in outcome levels and trends between focus and nonfocus districts—for the full set of focus districts. There could be systematic differences between these smaller clusters of focus districts and the nonfocus districts (especially because of their geographic concentration), which could limit the degree of attribution of these estimates to Ananya. Therefore, these results should be viewed as suggestive.

For many outcomes, the impact of Ananya differed little across clusters of focus districts in sign, magnitude, and statistical significance (Table C.1). Results are particularly robust for facility delivery, clean cord care, delayed bathing, and use of permanent or modern contraception.

There are some differences in estimated impacts across focus district clusters, but the pattern of these differences is not consistent across clusters or outcomes. For example, if we exclude Patna from the focus districts, the estimated impact of Ananya on skin-to-skin care increases from 10 to 16 percentage points and becomes statistically significant, but impacts on other outcomes are little changed. The estimated impacts on several other outcomes are more positive and highly significant for the central cluster compared to the northwestern cluster. These include impacts on frontline worker (FLW) visits in the final trimester, immediate breastfeeding, DPT3 receipt, and complementary feeding practices. Some of these impacts were not significant in the main analysis (immediate breastfeeding and DPT3 receipt), which seems to have been the net effect of positive and significant changes in the central cluster and negative changes in the northwestern cluster. Impacts on other outcomes (FLW visits in the final trimester and complementary feeding) were significant in the main analysis, and seem to have been driven largely by impacts in the central cluster, with no significant changes in the northwestern cluster. Conversely, Ananya had statistically significant impacts on exclusive breastfeeding, antenatal care, and iron and folic acid (IFA) receipt in the northwestern—but not central—focus districts.

Table C.1. Impacts of Ananya in different groups of focus districts

Variable	All	Focus districts used			
		All districts except Patna	Northwest districts	Central districts	Central districts except Patna
Two or more FLW home visits in final trimester	9.7***	9.9***	6.8	11.9***	13.2***
Received any post-delivery FLW visit	0.1	0.9	6.2	-4.2**	-4.7*
Three or more ANC check-ups during pregnancy	5.1	5.2	11.4***	0.5	-1.4
Received 90 or more IFA tablets	1.2	3.6	5.6**	-2.1	1.4
Delivered at facility	-0.4	0.4	0.5	-1.2	0.1
Applied nothing to child's cord or umbilicus	7.4***	6.9**	7.7*	7.2***	6.3**
Delayed child's first bath at least two days	2.1	3.8	4.9	0.0	2.7
Skin-to-skin care	9.5	15.8**	2.3	14.6	30.2***
Breastfed within one hour of birth	2.7	0.3	-4.8	8.0**	5.5
Child exclusively breastfed through 6 months (children ages 6–11 months)	8.6	11.0*	23.0***	-2.2	-2.3
Any complementary feeding (children ages 6–11 months)	8.5*	10.3*	1.9	13.2*	19.4**
Any cereal-based complementary feeding (children ages 6–11 months)	8.2**	9.5**	3.5	11.6**	16***
Received DPT3 (children ages 6–11 months)	2.2	-0.6	-7.7**	9.4**	7.3
Child fully vaccinated, excluding measles (children ages 6–11 months)	-0.2	-2.1	-8.5	5.8	4.9
Currently use a modern method of contraception	8.7***	10.8***	10.3***	7.6**	11.3***
Currently use a permanent methods of contraception (children ages 6–11 months)	1.5	1.5	1.4	1.6	1.7
Sample size (outcomes for children ages 0–11 months)	**24,038**	**22,694**	**20,719**	**21,287**	**19,943**
Sample size (outcomes for children ages 6–11 months)	**9,827**	**9,276**	**8,478**	**8,706**	**8,155**

Source: Ananya baseline and midline surveys conducted by Sambodhi in collaboration with Mathematica and PHFI in spring 2012 and spring 2014, respectively.

*$p < 0.10$, **$p < 0.05$, ***$p < 0.01$ for adjusted difference-in-differences.

ANC = antenatal care.

Overall, these differences provide evidence that Ananya's impacts might have been heterogeneous by geography, though the degree and nature of heterogeneity tended to differ across outcomes. However, as mentioned earlier, it is challenging to attribute the cluster-specific estimates to Ananya with confidence (unlike the main estimates). Therefore, the evidence on heterogeneous effects for specific outcomes should be viewed as suggestive; we cannot rule out that factors unrelated to Ananya (such as region-specific trends) influenced some of the estimated effects.

B. Division-specific changes

To provide further information on how outcomes changed over time across Bihar, Tables C.2 to C.4 provide division-level means at baseline (spring 2012) and midline (spring 2014) for each of Bihar's nine administrative divisions. Each division contains two to six districts and can include a mix of focus and nonfocus districts; analyzing changes by division rather than district provides larger sample sizes and therefore more precisely estimates means. These simple pre-post changes could reflect multiple influences (for example, Ananya interventions in the focus districts, and other interventions in the focus and nonfocus districts) and therefore do not directly reflect the results of Ananya. Nevertheless, they could be useful to stakeholders who seek to better understand the trends in key outcomes over time in various geographies of Bihar.

Table C.2. Baseline and midline means, by division—Bhagalpur, Darbhanga, and Kosi divisions

	All of Bihar		Bhagalpur		Darbhanga		Kosi	
Variable	Baseline	Midline	Baseline	Midline	Baseline	Midline	Baseline	Midline
Two or more FLW home visits in final trimester	35.3	33.8	36.3	33.2	31.0	29.6	36.2	26.4
Received any post-delivery FLW visit	19.9	19.3	21.1	17.2	16.8	19.4	16.9	19.8
Three or more ANC check-ups during pregnancy	28.4	35.2	29.2	36.7	21.9	27.2	29.8	26.2
Received 90 or more IFA tablets	17.7	17.2	29.2	20.7	12.7	14.0	12.8	16.6
Delivered at facility	62.4	72.6	76.8	67.9	53.1	68.0	67.3	63.7
Applied nothing to child's cord or umbilicus	24.0	24.8	25.7	26.0	30.8	26.9	28.4	17.6
Delayed child's first bath at least two days	48.3	57.0	54.7	59.1	48.4	51.8	46.3	50.8
Skin-to-skin care	18.5	34.6	54.5	15.9	11.7	26.8	1.9	34.8
Breastfed within one hour of birth	44.8	47.8	50.7	44.9	49.9	57.2	36.7	52.0
Child exclusively breastfed through 6 months (children ages 6–11 months)	51.2	63.2	70.1	49.7	55.8	62.1	61.3	60.9
Any complementary feeding (children ages 6–11 months)	65.3	62.7	59.2	62.8	57.6	58.7	67.6	48.6
Any cereal-based complementary feeding (children ages 6–11 months)	60.0	51.6	43.8	56.3	54.4	51.2	56.9	45.3
Received DPT3 (children ages 6–11 months)	64.9	64.2	69.9	66.8	65.1	65.9	76.5	73.1
Child fully vaccinated, excluding measles (children ages 6–11 months)	53.8	56.8	65.5	57.5	48.6	62.0	65.7	59.1
Currently use a modern method of contraception	13.3	15.0	18.5	15.9	9.4	14.7	14.8	15.4
Currently use a permanent methods of contraception (children ages 6–11 months)	7.3	8.0	15.2	7.3	6.1	8.0	12.0	10.9
Sample size (outcomes for children ages birth to 11 months)	**12,384**	**11,654**	**822**	**719**	**1,120**	**1,086**	**639**	**557**
Sample size (outcomes for children ages 6–11 months)	**4,929**	**4,904**	**325**	**320**	**435**	**452**	**261**	**217**

Source: Ananya baseline and midline surveys conducted by Sambodhi in collaboration with Mathematica and PHFI in spring 2012 and spring 2014, respectively.

Note: Bhagalpur division includes Banka and Bhagalpur districts. Darbhanga division includes Darbhanga, Madhubani, and Samastipur districts. Kosi division includes Madhepura, Saharsa, and Supaul districts.

Table C.3. Baseline and midline means, by division—Magadh, Munger, and Patna divisions

	All of Bihar		Magadh		Munger		Patna	
Variable	Baseline	Midline	Baseline	Midline	Baseline	Midline	Baseline	Midline
Two or more FLW home visits in final trimester	35.3	33.8	40.1	36.0	39.7	38.0	35.4	36.6
Received any post-delivery FLW visit	19.9	19.3	16.7	20.2	24.9	22.8	22.3	16.2
Three or more ANC check-ups during pregnancy	28.4	35.2	46.5	27.0	34.2	33.2	33.0	42.7
Received 90 or more IFA tablets	17.7	17.2	13.6	20.9	25.5	22.3	20.9	14.6
Delivered at facility	62.4	72.6	70.1	65.9	74.6	81.4	74.6	82.6
Applied nothing to child's cord or umbilicus	24.0	24.8	19.2	22.5	21.8	21.7	19.4	20.1
Delayed child's first bath at least two days	48.3	57.0	37.7	35.8	49.9	66.8	44.6	55.9
Skin-to-skin care	18.5	34.6	21.8	28.9	9.8	53.5	37.9	27.9
Breastfed within one hour of birth	44.8	47.8	40.3	43.7	49.4	58.1	42.5	43.2
Child exclusively breastfed through 6 months (children ages 6–11 months)	51.2	63.2	51.2	52.0	54.2	63.0	48.7	63.7
Any complementary feeding (children ages 6–11 months)	65.3	62.7	67.7	69.7	64.0	68.9	69.0	66.8
Any cereal-based complementary feeding (children ages 6–11 months)	60.0	51.6	50.3	62.9	58.9	52.1	61.9	57.1
Received DPT3 (children ages 6–11 months)	64.9	64.2	60.3	67.8	65.7	67.6	56.7	68.9
Child fully vaccinated, excluding measles (children ages 6–11 months)	53.8	56.8	53.5	62.2	58.3	57.2	46.1	60.9
Currently use a modern method of contraception	13.3	15.0	14.6	15.8	9.3	12.4	17.5	12.5
Currently use a permanent methods of contraception (children ages 6–11 months)	7.3	8.0	8.6	9.0	5.1	8.1	7.4	7.0
Sample size (outcomes for children ages birth to 11 months)	**12,384**	**11,654**	**1,228**	**1,154**	**1,320**	**1,240**	**2,326**	**2,084**
Sample size (outcomes for children ages 6–11 months)	**4,929**	**4,904**	**443**	**480**	**527**	**537**	**841**	**887**

Source: Ananya baseline and midline surveys conducted by Sambodhi in collaboration with Mathematica and PHFI in spring 2012 and spring 2014, respectively.

Notes: Magadh division includes Arwal, Aurangabad, Gaya, Jehanabad, and Nawanda districts. Munger division includes Jamui, Khagaria, Lakhisarai, Mungerm, and Sheikpura districts. Patna division includes Bhojpur, Buxar, Kaimur (Bhabua), Nalanda, Patna, and Rhotas districts.

Table C.4. Baseline and midline means, by division—Purnia, Saran, and Tirhut divisions

	All of Bihar		Purnia		Saran		Tirhut	
Variable	Baseline	Midline	Baseline	Midline	Baseline	Midline	Baseline	Midline
Two or more FLW home visits in final trimester	35.3	33.8	40.8	33.3	32.4	42.4	30.1	31.9
Received any post-delivery FLW visit	19.9	19.3	22.8	20.5	17.9	24.3	15.9	20.7
Three or more ANC check-ups during pregnancy	28.4	35.2	30.5	29.5	48.4	30.3	23.2	32.8
Received 90 or more IFA tablets	17.7	17.2	18.4	24.1	13.4	19.1	13.5	14.3
Delivered at facility	62.4	72.6	46.7	64.7	78.5	68.3	56.5	69.0
Applied nothing to child's cord or umbilicus	24.0	24.8	18.4	28.4	20.8	15.7	29.2	32.4
Delayed child's first bath at least two days	48.3	57.0	45.3	51.2	71.2	52.0	53.6	66.6
Skin-to-skin care	18.5	34.6	7.5	34.8	30.5	32.0	14.6	38.5
Breastfed within one hour of birth	44.8	47.8	43.3	44.1	42.9	42.4	45.8	46.4
Child exclusively breastfed through 6 months (children ages 6–11 months)	51.2	63.2	55.2	65.0	65.1	33.7	51.2	66.1
Any complementary feeding (children ages 6–11 months)	65.3	62.7	66.0	56.6	59.9	66.4	65.1	66.5
Any cereal-based complementary feeding (children ages 6–11 months)	60.0	51.6	60.9	42.6	51.5	62.1	61.8	57.4
Received DPT3 (children ages 6–11 months)	64.9	64.2	62.0	60.7	70.4	69.9	63.6	54.9
Child fully vaccinated, excluding measles (children ages 6–11 months)	53.8	56.8	54.7	56.7	58.7	58.6	49.7	47.5
Currently use a modern method of contraception	13.3	15.0	10.7	10.5	15.0	18.1	11.7	20.4
Currently use a permanent methods of contraception (children ages 6–11 months)	7.3	8.0	6.8	6.8	4.3	8.2	6.7	7.8
Sample size (outcomes for children ages birth to 11 months)	**12384**	**11654**	**1369**	**1307**	**1168**	**1236**	**2392**	**2271**
Sample size (outcomes for children ages 6–11 months)	**4929**	**4904**	**549**	**531**	**519**	**536**	**1029**	**944**

Source: Ananya baseline and midline surveys conducted by Sambodhi in collaboration with Mathematica and PHFI in spring 2012 and spring 2014, respectively.

Notes: Purnia division includes Araaria, Katiharm Kishanganj, and Purnia districts. Saran division includes Gopalganj, Saran, and Siwan districts. Tirhut division includes East Champaran, Sheohar, Sitamarhi, Vaishali, and West Champaran districts.

APPENDIX D: DEFINITIONS OF OUTCOME INDICATORS

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Appendix D provides the definitions for all variables referenced in this report. Table D.1 includes a description of each outcome variable, indicates whether it was available at both baseline and midline or at midline only, and mentions the page on which it is first introduced and the main chapter in which it is analyzed. Table D.2 details the other (socio-demographic) variables used in the analysis as control variables or for subgroup analyses.

Table D.1. List of outcome variables analyzed

Variable	Description	Midline only?	Main chapter
Any home visit in the first 24 hours after home delivery or 24 hours after returning from facility	A binary variable equal to one if an individual received a home visit from an ANM, ASHA, or AWW within 24 hours of returning from delivering at a facility or within 24 hours of delivering at home and equal to zero if no FLW visited the individual within 24 hours of delivering at home or returning from delivering at a facility.	x	IV
Any home visit in first week after delivery	A binary variable equal to one if an individual received a home visit from an ANM, ASHA, or AWW within seven days of delivery and equal to zero if no FLW visited the individual's home during the seven days following delivery.		IV
Any home visit in the first month after delivery	A binary variable equal to one if an individual received at least one home visit from an ANM, ASHA, or AWW within one month of delivery and equal to zero if no FLW visited the individual's home within one month of delivery.	x	IV
Received two or more home visits from an FLW in the final trimester of pregnancy	A binary variable equal to one if an individual received two or more home visits from an ANM, ASHA, or AWW during her third trimester of pregnancy and equal to zero if the individual was visited only once or not at all.		IV
Any home visit after delivery	A binary variable equal to one if an individual received at least one home visit from an ANM, ASHA, or AWW at any time after delivering at home or at a facility and equal to zero if no FLW visited the individual at home at any time following delivery.		IV
Received any home visit from an FLW related to complementary feeding (mothers of children ages 5–11 months)	A binary variable equal to one if an ASHA or AWW visited an individual's home to discuss topics related to complementary feeding or equal to zero if no such visit occurred. This variable is missing if the individual's child is younger than 5 months or older than 11 months.	x	IV
Any discussions with an FLW related to family planning during pregnancy	A binary variable equal to one if an ANM, ASHA, or AWW spoke with an individual or her husband about contraception while she was pregnant and equal to zero if no such discussion occurred.		IV
Any home visit by an FLW related to family planning after delivery	A binary variable equal to one if an ANM, ASHA, or AWW came to an individual's home after her delivery to speak to her about contraception and equal to zero if no such visit occurred.		IV
Received an FLW visit during the last trimester related to pregnancy and delivery preparation	A binary variable equal to one if the sum of all visits to an individual's home during the last trimester of her pregnancy by ANMs, ASHAs, or AWWs is greater than or equal to one and equal to zero if the sum this sum is equal to zero.		IV
Received any information relevant to pregnancy and delivery preparation from an FLW in the past year	A binary variable equal to one if an individual received any information related to pregnancy and preparing for delivery from an ANM, ASHA, or AWW in the past 12 months and equal to zero if the individual did not receive any information related to pregnancy or preparing for delivery from an FLW in the past 12 months.	x	IV
Received any information relevant to complementary feeding from an FLW in the past year	A binary variable equal to one if an individual received any information related to complementary feeding from an ANM, ASHA, or AWW in the past 12 months and equal to zero if the individual did not receive any information related to complementary feeding from an FLW in the past 12 months.	x	IV
Received any information relevant to family planning from an FLW in the past year	A binary variable equal to one if an individual received any information related to family planning from an ANM, ASHA, or AWW in the past 12 months and equal to zero if the individual did not receive any information related to family planning from an FLW in the past 12 months.	x	IV
Registered pregnancy with an FLW	A binary variable equal to one if an individual registered her most recent pregnancy with an ANM, ASHA, or AWW and equal to zero if she did not.		IV

Variable	Description	Midline only?	Main chapter
Accompanied by an FLW for delivery in a facility	A binary variable equal to one if an individual reported that she was accompanied by an ANM, ASHA, or AWW to a health facility for her delivery and equal to zero if she did not report that an FLW accompanied her to a health facility for her delivery.		IV
Any exposure to mobile kunji in past six months	A binary variable equal to one if an individual was visited by an ASHA or AWW who used the mobile kunji cards or audio messages during the past six months and zero if the individual did not receive a visit in the past six months or received a visit but did not see the mobile kunji cards and did not listen to any mobile kunji audio during any visit by an ASHA or AWW in the past six months.		IV
Received advice on keeping important telephone numbers handy for delivery	A binary variable equal to one if an individual received advice during her pregnancy related to keeping important telephone numbers, such as the telephone numbers of the ASHA, hospital, and ambulance, from an ANM, ASHA, or AWW and equal to zero if the individual did not receive advice during her pregnancy from an FLW on keeping important telephone numbers handy.	x	IV
Received advice on saving money for delivery	A binary variable equal to one if an individual received advice from an ANM, ASHA, or AWW during her pregnancy related to saving money for potential delivery-related complications and equal to zero if the individual did not receive advice during her pregnancy from an FLW related to saving money.	x	IV
Received advice on identifying transportation to a health facility for delivery	A binary variable equal to one if an individual received advice from an ANM, ASHA, or AWW during her pregnancy related to identifying transportation to go to a health facility for delivery or in case of emergency and equal to zero if the individual did not receive advice from an FLW during her pregnancy related to identifying transportation to a health facility.	x	IV
Received advice on specific maternal danger signs	A binary variable equal to one if an individual received advice from an ANM, ASHA, or AWW during her pregnancy about the danger of excessive vaginal bleeding, foul vaginal discharge, abdominal pain, or fever after birth and equal to zero if the individual did not receive information about any of these danger signs from an FLW while she was pregnant.	x	IV
Received advice on not applying anything to the cord	A binary variable equal to one if an individual received advice from an ANM, ASHA, or AWW during her pregnancy about clean cord care after giving birth and equal to zero if the individual did not receive any advice about clean cord care from an FLW while she was pregnant.	x	IV
Received advice on skin-to-skin care	A binary variable equal to one if an individual received advice from an ANM, ASHA, or AWW during her pregnancy about skin-to-skin (kangaroo) care and equal to zero if the individual did not receive any advice about skin-to-skin care from an FLW while she was pregnant.	x	IV
Received advice on immediate breastfeeding	A binary variable equal to one if an individual received advice from an ANM, ASHA, or AWW during her pregnancy about immediate breastfeeding and equal to zero if the individual did not receive any advice about immediate breastfeeding from an FLW while she was pregnant.	x	IV
Received advice on specific newborn danger signs	A binary variable equal to one if an individual received advice from an ANM, ASHA, or AWW during her pregnancy about the danger of the baby having trouble breathing, being difficult to awaken, losing interest in breastfeeding, or being cold to the touch and equal to zero if the individual did not receive advice about these danger signs in newborns from an FLW while she was pregnant.	x	IV
Received advice on exclusive breastfeeding	A binary variable equal to one if an individual received advice from an ANM, ASHA, or AWW during the first visit of the first week after delivery about not giving the baby anything other than breast milk and equal to zero if the individual did not receive any advice about exclusive breastfeeding during the first FLW visit following the child's birth. This variable is missing if the respondent did not receive a visit from an FLW in the week following delivery.		IV

Variable	Description	Midline only?	Main chapter
Received advice on specific maternal danger signs	A binary variable equal to one if an individual received advice from an ANM, ASHA, or AWW during the first visit of the first week after delivery about the danger of excessive vaginal bleeding, foul vaginal discharge, abdominal pain, or fever after birth and equal to zero if the individual did not receive any advice about these maternal danger signs from the FLW during the first visit following the child's birth. This variable is missing if the respondent did not receive a visit from an FLW in the week following birth.		IV
Received advice on skin-to-skin care	A binary variable equal to one if an individual received advice from an ANM, ASHA, or AWW during the first visit of the first week after delivery about skin-to-skin (kangaroo) care and equal to zero if the FLW did not mention skin-to-skin care during the first visit following the child's birth. This variable is missing if the respondent did not receive a visit from an FLW in the week following delivery.		IV
Received advice on specific newborn danger signs	A binary variable equal to one if an individual received advice from an ANM, ASHA, or AWW during the first visit following delivery about the danger of the baby having trouble breathing, being difficult to awaken, losing interest in breastfeeding, or being cold to the touch and equal to zero if the individual did not receive advice from an FLW about these danger signs in newborns during the first visit following birth. This variable is missing if the respondent did not receive a visit from an FLW in the week following delivery.		IV
Duration of most recent FLW home visit	A continuous variable indicating the duration of the most recent visit an individual received from an FLW, provided that the visit occurred in the past six months.	x	IV
Any home visit in past six months	A binary variable equal to one if an individual reported receiving a visit from an ANM, ASHA, or AWW in the past six months to discuss the health of the woman or child, excluding visits only for immunization care, and equal to zero if the individual had not received such a visit in the past six months.	x	IV
Saw mobile kunji cards in past six months	A binary variable equal to one if an individual reported that an FLW used the mobile kunji cards during any visit in the past six months and equal to zero if the FLW did not use mobile kunji cards during any visit in the past six months. This variable is missing for individuals who did not receive a visit from an FLW in the past six months.	x	IV
Listened to kunji audio in past six months	A binary variable equal to one if an individual reported that an FLW used the mobile kunji audio during any visit in the past six months and equal to zero if the FLW did not use mobile kunji audio during any visit in the past six months. This variable is missing for individuals who did not receive a visit from an FLW in the past six months.	x	IV
FLW used katora/spoon in past six months	A binary variable equal to one if an individual reported that an FLW used a katora to discuss complementary feeding during the most recent FLW visit and equal to zero if the FLW did not use a katora during the most recent visit. This variable is defined for individuals who discussed complementary feeding during the most recent FLW visit, provided that the visit occurred during the past six months.	x	IV
FLW used uterus model in past six months	A binary variable equal to one if an individual reported that an FLW used a uterus model to discuss family planning during the most recent FLW visit and equal to zero if the FLW did not use a uterus model during the most recent visit. This variable is defined for individuals who discussed family planning during the most recent FLW visit, provided that the visit occurred during the past six months.	x	IV
FLW used Copper-T IUD in last six months	A binary variable equal to one if an individual reported that an FLW used a Copper-T intrauterine device (IUD) to discuss family planning during the most recent FLW visit and equal to zero if the FLW did not use a Copper-T IUD during the most recent visit. This variable is defined for individuals who discussed family planning during the most recent FLW visit, provided that the visit occurred during the past six months.	x	IV
FLW used Mala-D in last six months	A binary variable equal to one if an individual reported that an FLW used Mala-D contraceptive pills to discuss family planning during the most recent FLW visit and equal to zero if the FLW did not use Mala-D contraceptive pills during the most recent visit. This variable is defined for individuals who discussed family planning during the most recent FLW visit, provided that the visit occurred during the past six months.	x	IV

Variable	Description	Midline only?	Main chapter
Received information from media on pregnancy and delivery preparedness	A binary variable equal to one if a woman reported receiving information on pregnancy or delivery preparedness from media (including radio, television, and billboards) and equal to zero if the woman did not receive information on this topic from any of these sources.	x	IV
Received information from media on complementary feeding	A binary variable equal to one if a woman reported receiving information on complementary feeding from media (including radio, television, and billboards) and equal to zero if the woman did not receive information on this topic from any of these sources.	x	IV
Received information from media on family planning	A binary variable equal to one if a woman reported receiving information on family planning from media (including radio, television, and billboards) and equal to zero if the woman did not receive information on this topic from any of these sources.	x	IV
Watched the *Char Gaanth* message on television in past year	A binary variable equal to one if an individual ever saw the *Char Gaanth* message on television in the past year and equal to zero if she did not.	x	IV
Heard *Khirki Mehendiwali* radio show in past year	A binary variable equal to one if an individual ever heard the *Khirki Mehendiwali* radio show in the past year and equal to zero if she did not.	x	IV
Registered for Kilkari mobile phone service	A binary variable equal to one if an individual signed up for the Kilkari mobile phone service and equal to zero if an individual did not sign up for the Kilkari mobile phone service, had never heard of the Kilkari mobile phone service, or did not own or have access to a mobile phone.	x	IV
Saw street performance on maternal and child health in the past year	A binary variable equal to one if an individual ever saw street performances on maternal and child health called “Baat Pate Ki,” “Char Gaanth,” or “Baap no. 1” in the past year and zero if the individual had not seen such a street performance.	x	IV
Participation in community groups among SC/ST women	A binary variable equal to one if an individual participated in or attended any community group meetings in the past three months and belongs to a scheduled caste or scheduled tribe (SC/ST), equal to zero if the individual did not attend community group meetings in the past three months, or is missing if the individual does not belong to a scheduled caste or scheduled tribe.		IV
Aware of any community group in area (SC/ST women only)	A binary variable equal to one if an individual was aware of any community group in her area and belongs to an SC/ST. If the individual is not aware of any community groups in her area, the variable equals zero, and if the individual is not a member of an SC/ST the variable is missing.		IV
Discussion of maternal/child health topics among SC/ST women in any of the past three community group meetings	A binary variable equal to one if an individual is a member of a self-help group such as Jeevika or Parivartan or any other group in which maternal and child health topics have been discussed at a meeting in the past three months and the individual belongs to an SC/ST. If the individual does not belong to a self-help group or maternal and child health topics have not been discussed at a meeting in the past three months, the variable equals zero. If the individual does not belong to an SC/ST, the variable is missing.	x	IV
Any ANC during pregnancy	A binary variable equal to one if an individual received antenatal care (ANC) during her most recent pregnancy and equal to zero if she did not receive antenatal care during her most recent pregnancy.		V
Three or more ANC visits during pregnancy	A binary variable equal to one if an individual received ANC more than three times during her most recent pregnancy and equal to zero if she received ANC zero, one, or two times during her most recent pregnancy.		V
Received full ANC check-up	A binary variable equal to one if an individual was weighed, had her blood pressure taken, and had her abdomen checked at least once during her most recent pregnancy and equal to zero if she did not undergo each of these checks at least once while she was pregnant.		V

Variable	Description	Midline only?	Main chapter
Receipt of 90 or more IFA tablets	A binary variable equal to one if an individual received 90 or more iron and folic acid (IFA) tablets during her most recent pregnancy and equal to zero if she received 89 or fewer IFA tablets during her most recent pregnancy.		V
Consumption of 90 or more IFA tablets	A binary variable equal to one if an individual consumed 90 or more IFA tablets during her most recent pregnancy and equal to zero if she consumed 89 or fewer IFA tablets during her most recent pregnancy.		V
Saved money for delivery	A binary variable equal to one if an individual saved money for her delivery and equal to zero if the individual did not save money for her delivery. This variable is defined for women who planned to deliver at a facility, women who planned to deliver at home, and women who did not plan for their deliveries.	x	V
Kept important telephone numbers on hand for delivery	A binary variable equal to one if an individual kept important telephone numbers handy, such as the numbers for the ASHA, hospital, and ambulance, before her delivery and equal to zero if the individual did not keep any of these telephone numbers handy. This variable is defined for women who planned to deliver at a facility, women who planned to deliver at home, and women who did not plan for their deliveries.	x	V
Identified transportation to health facility before delivery	A binary variable equal to one if an individual identified transportation to a health facility in case of an emergency before her delivery and equal to zero if the individual did not identify transportation to a health facility. This variable is defined for women who planned to deliver at home, women who planned to deliver at a facility, and women who did not plan for the deliveries.	x	V
Took all three of the above preparatory actions	A binary variable equal to one if an individual kept important telephone numbers handy, saved money, and identified transportation to a health facility in case of emergency before her delivery and equal to zero for women who did not make all three of these preparations. This variable is defined for women who planned to deliver at a facility, women who planned to deliver at home, and women who did not plan for their deliveries.	x	V
Delivery at a public facility	A binary variable equal to one if an individual delivered at any public sector health facility, including a government municipal hospital, government dispensary, community health center, primary health center, subcenter, or village clinic and equal to zero if the individual delivered elsewhere.		V
Delivery at a facility	A binary variable equal to one if an individual delivered at any health facility and equal to zero if the individual delivered at home or elsewhere.		V
Time spent at facility after delivery (hours)	A continuous variable indicating the number of hours an individual spent at a facility following her delivery. This variable is missing for all individuals who did not deliver at a facility. Values are trimmed so that any time that is three standard deviations above the mean time is set to three standard deviations above the mean.		V
Sought assistance at a public facility for complications related to pregnancy or delivery	A binary variable equal to one if an individual sought assistance for any pregnancy or delivery-related complication at any public sector facility and equal to zero if an individual reported any pregnancy or delivery-related complication but sought assistance elsewhere or did not seek assistance.	x	V
Time spent at public facility after delivery (hours)	A continuous variable indicating the number of hours an individual spent at a facility following her delivery, provided that the facility is public. This variable is missing for all individuals who did not deliver at a public facility. Values are trimmed so that any time that is three standard deviations above the mean time is set to three standard deviations above the mean.		V
Deliveries in which mother was examined before leaving facility (public facilities)	A binary variable equal to one if an individual delivered at a public facility and a doctor or nurse checked on her health before she left, and equal to zero if an individual delivered at a public facility but did not receive a check-up before leaving. This variable is missing in all cases in which an individual did not deliver at a public facility.		V
Deliveries in which child was examined before leaving facility (public facilities)	A binary variable equal to one if an individual delivered at a public facility and a doctor or nurse checked on her baby's health before she left, and equal to zero if an individual delivered at a public facility but no doctor or nurse checked on her baby before she left. This variable is missing in all cases in which an individual did not deliver at a public facility.		V

Variable	Description	Midline only?	Main chapter
Infant died within one month of birth	A binary variable equal to one if an individual reported that her child died less than one month after birth and equal to zero if the individual reported that the child is still alive or died one or more months after birth. This variable is missing for all children younger than one month of age.		V
Nothing applied to cord or umbilicus	A binary variable equal to one if nothing was applied to the cord after cutting and tying and nothing was applied to the umbilicus after the cord dropped off and equal to zero if anything was applied to either the cord or the umbilicus.		V
Health worker placed child unclothed on mother's chest/abdomen in skin-to-skin contact	A binary variable equal to one if any health worker placed the child unclothed in skin-to-skin contact on an individual's chest or abdomen and equal to zero if the child was not placed in skin-to-skin contact.		V
First bath delayed by two or more days	A binary variable equal to one if an individual delayed bathing her child for two or more days after delivery and equal to zero if the individual bathed her child one day or less after delivery.		V
Breastfed child within one hour of birth	A binary variable equal to one if an individual reported that she breastfed her child within one hour of giving birth and equal to zero if the individual waited more than one hour to breastfeed her child.		V
Child exclusively breastfed for six months (excluding water) (ages 6–11 months)	A binary variable equal to one if an individual reported that she did not feed her child anything other than breast milk and water for six months after the child was born and equal to zero if an individual reported that she fed her child anything other than breast milk within six months of delivery. This variable is defined for individuals whose children were ages 6 to 11 months at the time of the survey.		VI
Child exclusively breastfed in past 24 hours (ages birth–5 months)	A binary variable equal to one if an individual reported that she had fed her child only breast milk in the past 24 hours and equal to zero if an individual had fed her child something other than breast milk in the past 24 hours. This construct is defined for individuals whose children were younger than six months old at the time of the survey.		VI
Child currently receiving any solid or semisolid food (ages 9–11 months)	A binary variable equal to one if an individual reported that her child eats any solid, semisolid, or soft foods and equal to zero if an individual did not report any solid, semisolid, or soft foods in her child's diet. This variable is defined for individuals whose children were ages 9 to 11 months at the time of the survey.		VI
Child currently receiving any solid or semisolid food (ages 6–11 months)	A binary variable equal to one if an individual reported that her child eats any solid, semisolid, or soft foods and equal to zero if an individual did not report any solid, semisolid, or soft foods in her child's diet. This variable is defined for individuals whose children were ages 6 to 11 months at the time of the survey.		VI
Child began receiving solid or semisolid foods by age 6 months (ages 6–11 months)	A binary variable equal to one if an individual reported that her child began eating solid or semisolid food by age 6 months and equal to zero if an individual did not begin feeding her child solid or semisolid food before age 6 months. This variable is defined for individuals whose children were ages 6 to 11 months at the time of the survey.		VI
Child received cereal-based foods in previous day (ages birth–11 months)	A binary variable equal to one if an individual reported that her child had consumed porridge, bread, roti, chapati, rice, or khichdi in the past 24 hours and equal to zero if the child had not consumed any of these cereals within the past 24 hours.		VI
Child received cereal-based foods in previous week (ages birth–11 months)	A binary variable equal to one if an individual reported that her child had consumed porridge, bread, roti, chapati, or khichdi in the past seven days and equal to zero if the child had not consumed any of these cereals within the past week.		VI
Child received baby food in the previous day (ages 6–11 months)	A binary variable equal to one if an individual reported that her child had eaten commercially fortified baby food (such as Cerelac or Farex) during the previous day or night and equal to zero if an individual reported that her child had not eaten any baby food during the previous day or night. This variable is defined for individuals whose children were ages 6 to 11 months at the time of the survey.		VI

Variable	Description	Midline only?	Main chapter
Child received fruits or vegetables in the previous day (ages 6–11 months)	A binary variable equal to one if an individual reported that her child had eaten any vegetables during the previous day or night and equal to zero if the individual reported that her child had not eaten any vegetables during the previous day or night. This variable is defined for individuals whose children were ages 6 to 11 months at the time of the survey.		VI
Child received daal in the previous day (ages 6–11 months)	A binary variable equal to one if an individual reported that her child had eaten any daal during the previous day or night and equal to zero if the individual reported that her child had not eaten any daal during the previous day or night. This variable is defined for individuals whose children were ages 6 to 11 months at the time of the survey.		VI
Child received meat or egg in the previous day (ages 6–11 months)	A binary variable equal to one if an individual reported that her child had eaten any meat, chicken, fish, or egg during the previous day or night and equal to zero if the individual reported that her child had not eaten any of these foods during the previous day or night. This variable is defined for individuals whose children were ages 6 to 11 months at the time of the survey.		VI
Dietary diversity index (foods fed in the past 24 hours)	A discrete variable from zero to six depending on how many of six types of food an individual reported that her child had consumed during the previous day and night. One point is assigned for consumption of each of the following groups: • Cereals, such as bread, rice, chapati, and khichdi • Daal • Fruits and leafy green or yellow vegetables • Other fruits and vegetables (such as potatoes) • Meat, chicken, fish, or eggs. An additional point is assigned if an individual reported adding oil, ghee, or butter to the food that she gave her child on the previous day. This variable is set to missing for children younger than age 6 months.	x	VI
Food frequency index (foods fed in past 7 days)	A discrete variable from zero to eight. The index increases by one point for every food group from which a child has received food in the past seven days. If the child received food from a specific group four or more times in the past seven days, this index increases by an additional point. The types of food used to define the index were: • Cereals, such as bread, rice, chapati, and khichidi (up to 2 points) • Daal (up to 1 point) • Fruits and leafy green or yellow vegetables (up to 2 points) • Other fruits and vegetables (such as potatoes, up to 1 point) • Meat, chicken, fish, or eggs (up to 2 points) This variable is set to missing for children younger than age 6 months.	x	VI
Child stunted	A binary variable equal to one if the child's height was more than two standard deviations below the mean for his or her gender and age (in months) and equal to zero if the child's height was not below this threshold. The World Health Organization (WHO) reference population was used to determine the distribution of height for age.	x	VI
Child wasted	A binary variable equal to one if the child's weight relative to his or her height was more than two standard deviations below the mean for his or her gender and equal to zero if the child's height was not below this threshold. The WHO reference population was used to determine the distribution of height for age.	x	VI
Child underweight for age	A binary variable equal to one if the child's weight was more than two standard deviations below the mean for his or her gender and age (in months) and equal to zero if the child's height was not below this threshold. The WHO reference population was used to determine the distribution of height for age.	x	VI

Variable	Description	Midline only?	Main chapter
Immunization card available (ages 6–11 months)	A binary variable equal to one if an individual reported having an immunization card or a Mother-Child Protection (MCP) Card on which her child's vaccinations are written and the observer saw the card and equal to zero if an individual did not have an immunization card or the observer did not view the card. This variable is defined for individuals with children ages 6 to 11 months.		VII
Child did not receive DPT3 due to a lack of time	A binary variable equal to one if an individual reported that her child did not receive all three diphtheria, pertussis, and tetanus (DPT3) vaccinations because of a lack of time and equal to zero if an individual's child did not receive DPT3 but for a different reason. This variable is defined for individuals whose children were ages 6 to 11 months and did not receive DPT3.	x	VII
Child did not receive DPT3 because child was absent from the home	A binary variable equal to one if an individual reported that her child did not receive all three diphtheria, pertussis, and tetanus vaccinations because the child was away from home at the time of immunization sessions and equal to zero if an individual's child did not receive DPT3 but for a different reason. This variable is defined for individuals whose children were ages 6 to 11 months and did not receive DPT3.	x	VII
Child did not receive DPT3 because immunization session was held at an inconvenient time	A binary variable equal to one if an individual reported that her child did not receive all three diphtheria, pertussis, and tetanus vaccinations because the immunization sessions were held at an inconvenient time and equal to zero if an individual's child did not receive DPT3 but for a different reason. This variable is defined for individuals whose children were ages 6 to 11 months and did not receive DPT3.	x	VII
Child received DPT1 (ages 6–11 months)	For individuals who produced an immunization card, a binary variable equal to one if the card indicated that her child had received the first diphtheria, pertussis, and tetanus vaccination and zero if it did not. For individuals who did not produce a card, a binary variable equal to one if the individual reported that her child had received DPT1 and equal to zero if she reported that the child did not. This variable is defined for individuals whose children were ages 6 to 11 months.		VII
Child received DPT3 (ages 6–11 months)	For individuals who produced an immunization card, a binary variable equal to one if the card indicated that her child had received the third diphtheria, pertussis, and tetanus vaccination and zero if it did not. For individuals who did not produce a card, a binary variable equal to one if the individual reported that her child had received DPT3 and equal to zero if she reported that the child did not. This variable is defined for individuals whose children were ages 6 to 11 months.		VII
Child fully immunized, except for measles (ages 6–11 months)	For individuals who produced an immunization card, a binary variable equal to one if the card indicated that her child had a full course of vaccinations (with the exception of measles) and zero if it did not. For individuals who did not produce a card, a binary variable equal to one if the individual reported that her child had received a full course of vaccinations (with the exception of measles) and equal to zero if she reported that the child did not. This variable is defined for individuals whose children were ages 6 to 11 months.		VII
Child received DPT3 by age 4 months (ages 6–11 months)	A binary variable equal to one if an individual produced an immunization card indicating that her child had received DPT3 within four months of birth, equal to zero if the child did not receive DPT3 or received DPT3 after reaching age 4 months, and missing if an individual did not have an immunization card. This variable is defined for individuals whose children were ages 6 to 11 months.		VII
Child received DPT3 (ages 12–23 months)	For individuals who produced an immunization card, a binary variable equal to one if the card indicated that her child had received the third diphtheria, pertussis, and tetanus vaccination and zero if it did not. For individuals who did not produce a card, a binary variable equal to one if the individual reported that her child had received DPT3 and equal to zero if she reported that the child did not. This variable is defined for individuals whose children were ages 12 to 23 months.	x	VII
Child received measles vaccination (ages 12–23 months)	For individuals who produced an immunization card, a binary variable equal to one if the card indicated that her child had received the measles vaccination and zero if it did not. For individuals who did not produce a card, a binary variable equal to one if the individual reported that her child had received a measles vaccine and equal to zero if she reported that the child did not. This variable is defined for individuals whose children were ages 12 to 23 months.	x	VII

Variable	Description	Midline only?	Main chapter
Child fully immunized, including measles (ages 12–23 months)	For individuals who produced an immunization card, a binary variable equal to one if the card indicated that her child had a full course of vaccinations and zero if it did not. For individuals who did not produce a card, a binary variable equal to one if the individual reported that her child had received a full course of vaccinations and equal to zero if she reported that the child did not. This construct is defined for individuals whose children were ages 12 to 23 months.	x	VII
Uses any modern method of contraception	A binary variable equal to one if an individual currently uses any modern method of contraception, including a daily or weekly birth control pill, an IUD, injectables, male sterilization, female sterilization, or condoms, and equal to zero if the individual does not use any of these methods.		VIII
Condom use	A binary variable equal to one if an individual currently uses condoms for contraception and equal to zero if an individual does not use condoms. This variable also equals zero if an individual reports using male or female sterilization for contraception.		VIII
Pill use	A binary variable equal to one if an individual currently uses a daily or weekly pill for contraception and equal to zero if an individual does not use a contraceptive pill. This variable also equals zero if an individual reports using male or female sterilization for contraception.		VIII
IUD use	A binary variable equal to one if an individual currently uses an IUD for contraception and equal to zero if an individual does not use an IUD. This variable also equals zero if an individual reports using male or female sterilization for contraception.		VIII
Sterilized (tubal ligation)	A binary variable equal to one if an individual or spouse has had a procedure to make them sterile and zero is neither has had such a procedure.		VIII
Female sterilization	A binary variable equal to one if an individual reports that she has undergone sterilization and equal to zero if the individual has not undergone sterilization.		VIII
Contraceptive pill use	A binary variable equal to one if an individual reports that she uses a daily or weekly pill for contraception and equal to zero if she does not use a daily or weekly contraceptive pill.		VIII
Condom use	A binary variable equal to one if an individual reports that she uses condoms for contraception and equal to zero if she does not use condoms.		VIII
Unmet need for spacing	A binary variable equal to one if an individual reports that she does not use a modern method of contraception, is not currently pregnant, can physically become pregnant, and would prefer to wait 24 or more months before becoming pregnant again and equal to zero if the individual is currently using a modern method of contraception, is currently pregnant, cannot get pregnant, would prefer to get pregnant in the next 0 to 23 months, or does not want any more children. Note that unmet need for spacing is zero if unmet need for limiting is one.	x	VIII
Unmet need for limiting	A binary variable equal to one if an individual reports that she does not use a modern method of contraception, is not currently pregnant, can physically become pregnant, and would prefer not to have any more children, and equal to zero if the individual is using a modern method of contraception, would prefer to have another child, cannot become pregnant, or is currently pregnant. Note that unmet need for limiting is zero if unmet need for spacing is one.	x	VIII
Any unmet need	A binary variable equal to one if an individual reports that she has an unmet need for spacing or limiting and zero if she reports no unmet need.	x	VIII

Table D.2. List of other variables used in analysis

Variable	Definition
Muslim	A binary variable equal to one if an individual identifies as Muslim and equal to zero if the individual does not identify as Muslim.
Scheduled caste/scheduled tribe	A binary variable equal to one if an individual identifies as being from a scheduled caste or scheduled tribe and equal to zero if the individual is not from a scheduled caste or scheduled tribe or is not Hindu.
No schooling	A binary variable equal to one if an individual reports having attended school and equal to zero if the individual did not attend school.
Age of target female: 15 to 20	A binary variable equal to one if the respondent is age 15 to 20 and equal to zero if the respondent is not in this age range.
Age of target female: 21 to 25	A binary variable equal to one if the respondent is age 21 to 25 and equal to zero if the respondent is not in this age range.
Age of target female: 26 to 30	A binary variable equal to one if the respondent is age 26 to 30 and equal to zero if the respondent is not in this age range.
Age of target female: 31 to 35	A binary variable equal to one if the respondent is age 31 to 35 and equal to zero if the respondent is not in this age range.
Age of target female: 36 or older	A binary variable equal to one if the respondent is age 36 or older and equal to zero if the respondent is not in this age range.
Number of children: 1	A binary variable equal to one if an individual has given birth to one child (this includes children who do not live with her now, children from previous marriages, and children who are no longer alive but excludes stillbirths), and equal to zero if an individual has given birth to more than one child.
Number of children: 2	A binary variable equal to one if an individual has given birth to two children (this includes children who do not live with her now, children from previous marriages, and children who are no longer alive but excludes stillbirths), and equal to zero if an individual has given birth to more than two children or has given birth to only one child.
Number of children: 3	A binary variable equal to one if an individual has given birth to three children (this includes children who do not live with her now, children from previous marriages, and children who are no longer alive but excludes stillbirths), and equal to zero if an individual has given birth to more than three children or has had two children or fewer.
Number of children: 4 or more	A binary variable equal to one if an individual has given birth to four or more children (this includes children who do not live with her now, children from previous marriages, and children who are no longer alive but excludes stillbirths), and equal to zero if an individual has given birth to fewer than four children.
Wealth quartile	A set of binary variable equal to one if the wealth index of the woman is in the first, second, third, or fourth quartiles of this variable's distribution and zero if the wealth index is not in the given quartile. We used principal components analysis on the baseline data to compute a wealth index for each household using a number of household characteristics—the same ones used in the National Family Health Survey (NFHS)—likely to reflect poverty (such as the number of household members per room, the material from which the residence was constructed, and ownership of various durable goods). The coefficients from the baseline principal components analysis were used to estimate the wealth index for each woman at midline. The midline sample was divided into wealth quartiles based on the distribution of the baseline wealth index across women.
Rural	A binary variable equal to one if an individual resides in a rural location and equal to zero otherwise.
Literate	A binary variable equal to one if an individual identifies as literate and equal to zero if the individual is not literate.
Husband attended school	A binary variable equal to one if an individual's husband ever attended school and equal to zero if the individual's husband did not attend school.
Last child male	A binary variable equal to one if the last child an individual gave birth to (the focal child for this analysis) is or was male and zero if this child is or was female.
Most marginalized	A binary variable equal to one if an individual was SC/ST or Muslim, in the lowest quartile of the wealth distribution, and was illiterate and zero if all three conditions did not hold.
Least marginalized	A binary variable equal to one if an individual was non-SC/ST, non-Muslim, in the highest quartile of the wealth distribution, and was literate and zero if all three conditions did not hold.

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APPENDIX E: COMPARISON OF ANANYA DATA AND EXTERNAL DATA SOURCES

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To determine the extent to which the Ananya evaluation data align with those from external data sources in Bihar, Appendix E examines the trend in key outcomes using these external data sources. The external data sources available for this analysis included the following data sources: (1) the National Family Health Survey (NFHS-3) 2005–2006; (2) the District-Level Health Survey (DLHS-3) 2007–2008; and (3) three rounds of the Annual Health Survey (AHS-1) 2010-2011; AHS-2, 2011–2012; AHS-3, 2012–2013).[87] We identified key health outcomes that were available in multiple external data sources as well as the Ananya data, and summarized the trend in these outcomes (Table E.1).

For most outcomes, the Ananya data are consistent with the trends in external data sources. Specifically, they are consistent with an increasing trend in some outcomes (antenatal care check-ups, facility delivery, immediate breastfeeding, and exclusive breastfeeding) and a flat trend in others (iron and folic acid [IFA] tablets and, more recently, DPT3).[88] The increasing trend in many outcomes also suggests that it is important to account for underlying trends in our impact analysis, which we have done by using a comparison group design.

The outcomes for which our data are not consistent with external data are complementary feeding (feeding of solid or semisolid foods) and family planning (use of modern methods and permanent methods). Complementary feeding for children 6 to 11 months old is lower in the Ananya surveys (65 percent at baseline and 63 percent at midline) than in the older NFHS-3 (68 percent) and DLHS-3 (71 percent) surveys.[89] The reason for these lower levels in the Ananya data and the statistically significant decline in nonfocus districts between the Ananya baseline and midline (see Chapter VI) is not clear. As described in Chapter VI, we suggest further consultation with experts and field investigation to better understand these findings.

Family planning outcomes display an initial increasing trend in external data sources that then flattens out; however, levels are substantially higher than in the Ananya data. This is likely because of an important difference in samples—external data sources include all women of reproductive age, whereas the Ananya data include women who gave birth in the previous year. The Ananya sample therefore excludes many women who have been sterilized and who would appear in surveys of all women of reproductive age. The higher rate of use of permanent methods in other surveys drives much of the differences in overall contraceptive rates between our survey and others. Indeed, if we restrict the sample in the 2005–2006 NFHS to women who gave birth in the previous year in Bihar, use of permanent methods and overall contraceptive use

[87] Round 3 of the AHS was conducted in 2012–2013, after the Ananya baseline. However, it collected data on health outcomes for the period 2009 to 2011; therefore, it can be considered as approximately contemporaneous with the Ananya baseline. Other AHS rounds also collected data on outcomes for the three-year period prior to the survey.

[88] There are some slight differences in the definitions of these outcomes or the sample across surveys, as indicated in the notes to Table E.1, but these are unlikely to lead to large differences in the estimates. Regardless of these small differences, the trends are broadly consistent across surveys.

[89] The numbers reported by NFHS-3 and DLHS-3 are based on feeding of solid or semisolid foods *with continued breastfeeding*. With this additional restriction, the Ananya numbers for feeding of solid and semisolid foods are even lower (64 percent at baseline and 59 percent at midline). There was also a slight difference in the questions—the Ananya surveys asked about whether the child is fed solid or semisolid foods, whereas the NFHS and DLHS surveys asked when this feeding began. However, this slight difference is unlikely to lead to large differences in the results.

is much lower; for example, overall contraceptive use halves (AHS microdata are not available to make this comparison).

Overall, the Ananya data are therefore broadly consistent with a continuation of the trends found in external pre-Ananya data sources. The differences in findings for family planning can largely be attributed to differences in samples, but the differences for complementary feeding might require further investigation.

Table E.1. Key outcomes in external data sources and Ananya data, Bihar (percentages)

Outcome	NFHS 3 (2005–2006)	DLHS 3 (2007–2008)	AHS 1 (2010–2011)[g]	AHS 2 (2011–2012)[h]	AHS 3 (2012–2013)[i]	Ananya baseline (2012)	Ananya midline (2014)
Received ANC three or more times	17	26	34	34	37	28	35
Consumed 90 or more IFA tablets	10	6[a]	10[a]	10[a]	13[a]	12	15
Delivered at a facility	22	28	48	52	55	62	73
Breastfed child within 1 hour of birth	4	16	30	35	37	45	48
Child exclusively breastfed for 6 months, child more than 6 months old	n.a.	12[b]	29[b]	30[b]	31[b]	43[c]	49[c]
Child exclusively breastfed in past 24 hours, child ages birth to 5 months old	28	38	n.a.	n.a.	n.a.	n.a.	78
Currently receiving any solid or semisolid food, child 6–11 months old	68[d]	71[d]	n.a.	n.a.	n.a.	65	63
Received DPT3, child 12–23 months old	46	54	79	80	82	n.a.	82
Uses any modern method of contraception	29[e]	29[e]	34[e]	38[e]	37[e]	13[f]	15[f]
Uses any permanent method of contraception	25[e]	27[e]	29[e]	31[e]	31[e]	7[f]	8[f]

[a]Definition used 100 tablets.

[b]Children 6–35 months old.

[c]Children 6–11 months old.

[d]Includes continued breastfeeding.

[e]All ever-married women of reproductive age (15–49).

[f]Ever-married women of reproductive age (15–49) who gave birth in the previous year.

[g]Data cover the period 2007-2009.

[h]Data cover the period 2008-2010.

[i]Data cover the period 2009-2011.

ANC = antenatal care; IFA = iron and folic acid tablets.

n.a. = not available.

APPENDIX F: INTIMATE PARTNER VIOLENCE ANALYSIS

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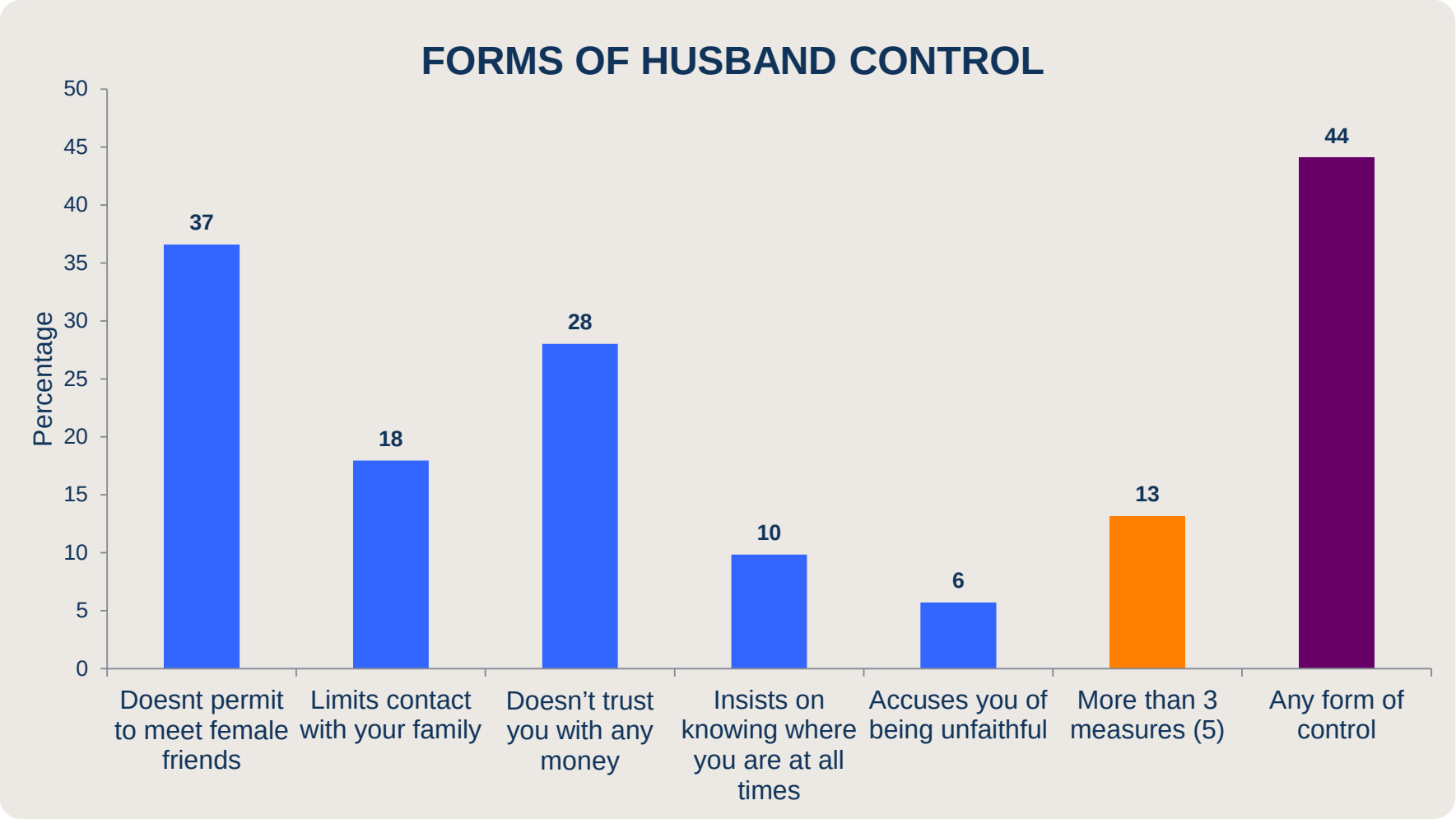
Key questions

- **What is the incidence of IPV**
- **What is the association of marginalization status with the prevalence of IPV?**
- **What is the association between IPV and program outcomes?**

INTIMATE PARTNER VIOLENCE: INCIDENCE

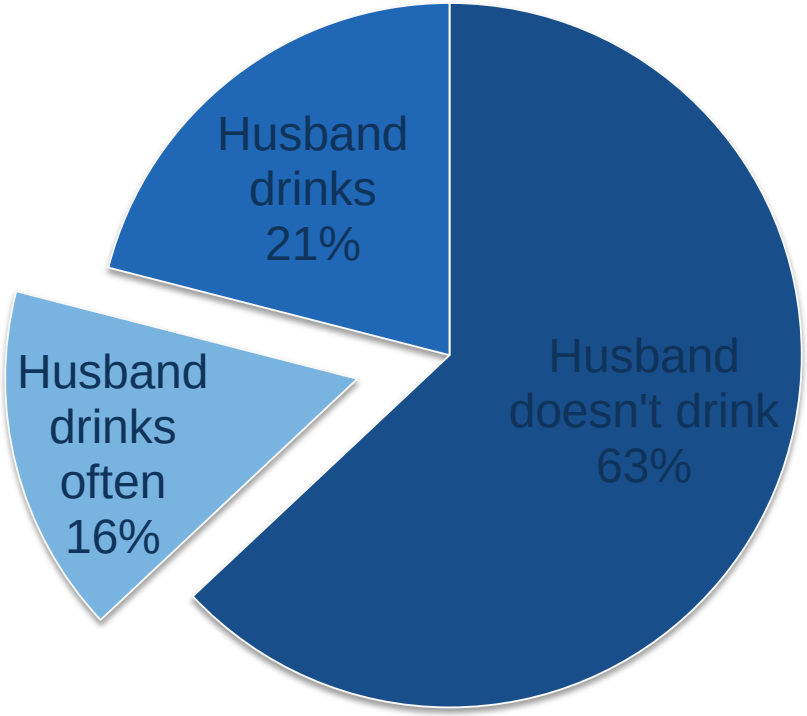
What is the incidence of IPV?



Notes: Overall N=10884

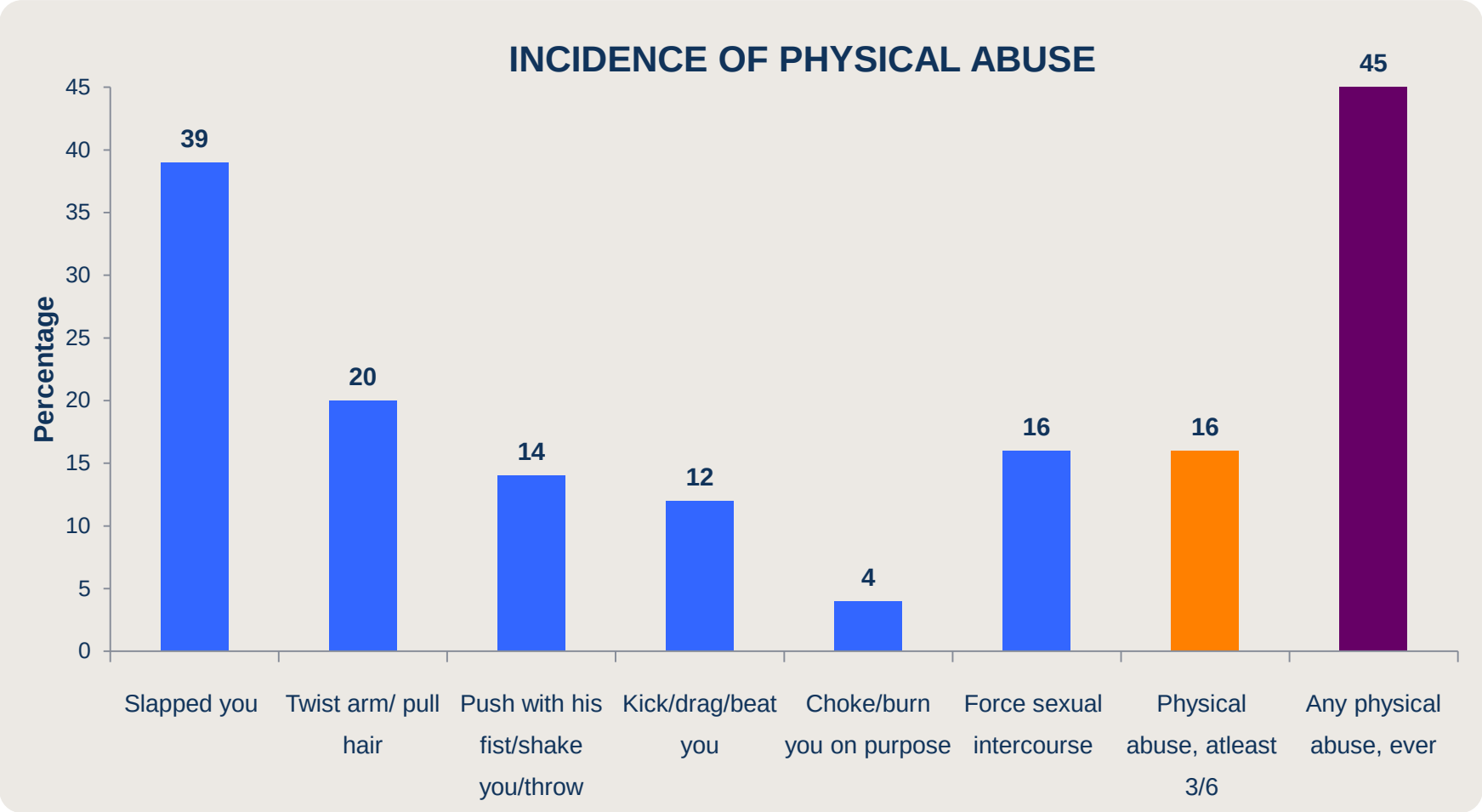
What is the incidence of IPV: Alcohol use

Midline data



Notes: N=11,151.

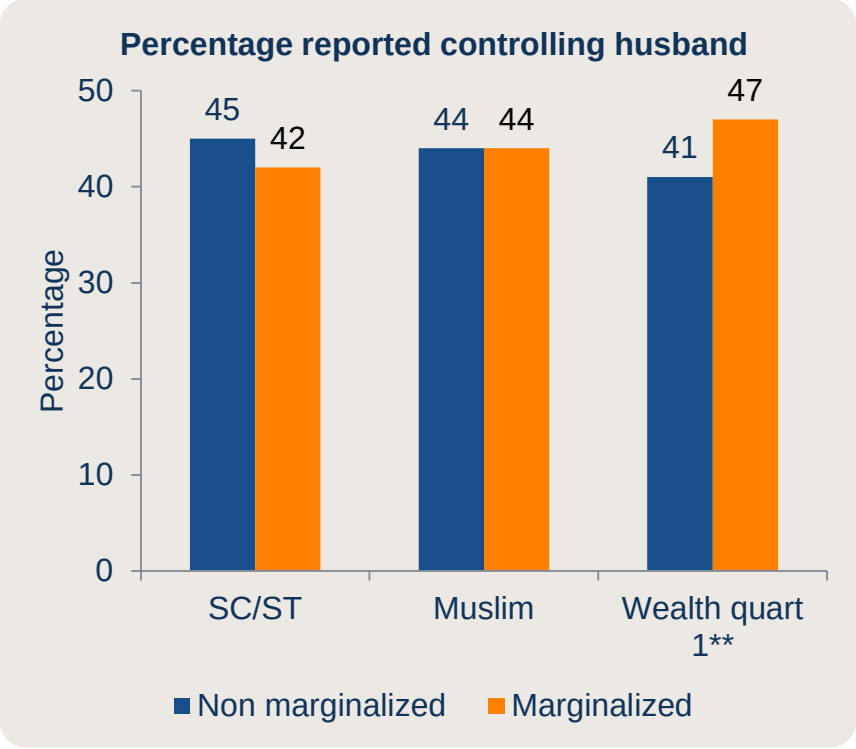
What is the incidence of IPV: Physical abuse

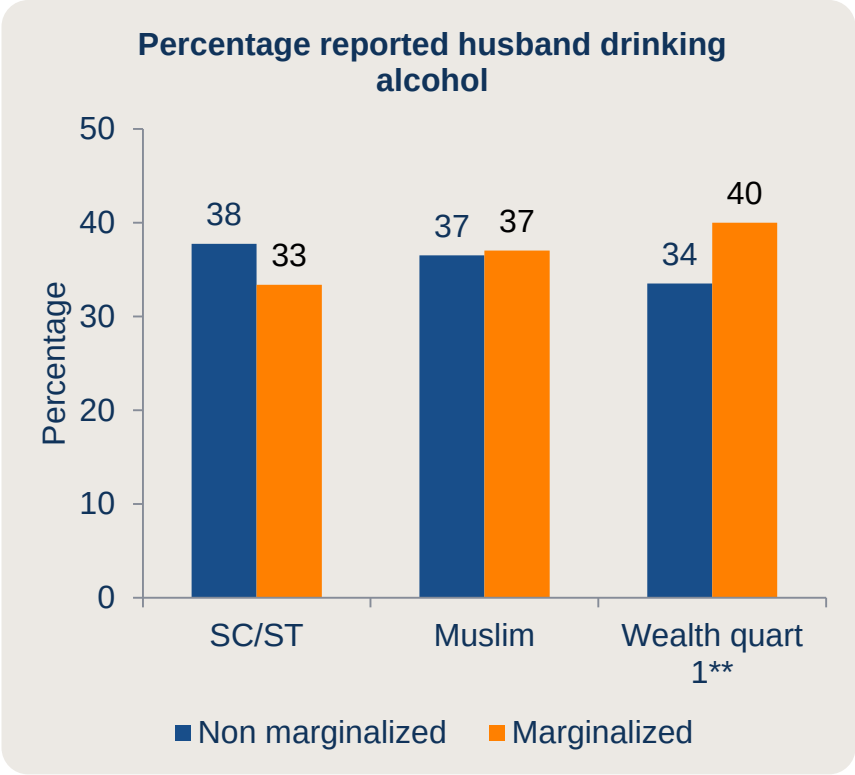


Note: N=11,151

What is the association of marginalization status with the prevalence of IPV?

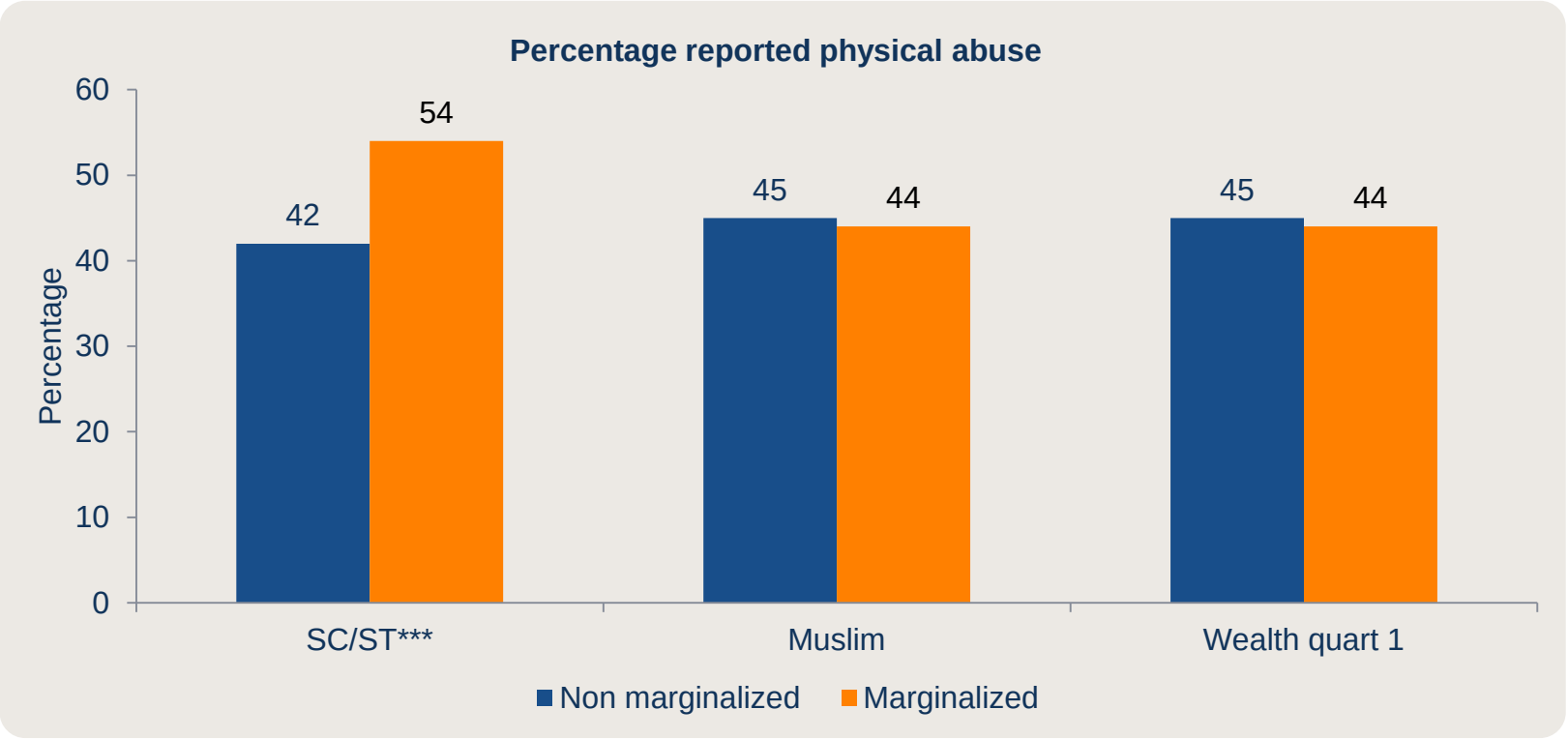
Poorer families have higher prevalence of a controlling husband and drinking alcohol





Note: SC/ST N=10883, Muslim N= 10883, Wealth quart1 N =5971 */**/***=adjusted difference significant at the 10/5/1 percent level.

SC/ST have higher prevalence of husband physical abuse



Note: SC/ST N=10883, Muslim N= 10883, Wealth quart1 N =5971 */**/***=adjusted difference significant at the 10/5/1 percent level.

What is the association between IPV and program outcomes?

Mixed results for correlations between IPV and outcomes

- No consistent patterns (except odd scattered findings) in correlations between Husband control/husband drinking alcohol and outcomes such as
  - Facility delivery
  - More than 2 home visits
  - Complementary feeding
  - Exclusive breastfeeding
  - Family Planning
- Some indications of correlation between physical abuse and
  - Lower facility delivery (71% vs 75%)
  - Less exclusive breastfeeding (60% vs 67%)
  - More likely to initiate CF at 6 months (43% vs 38%)
- Severe physical abuse/ forced intercourse more highly correlated with use of permanent methods of family planning (10% vs 7% for severe physical abuse/ sexually abused).

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