Khushi Baby

Breaking through Stagnation: Testing Innovative Approaches to Engage Communities in Increasing Immunization Coverage

A Mixed-Methods Evaluation to Determine the Effects of a novel mHealth Platform for Maternal Child Health Tracking in rural Udaipur, India.

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Executive Summary

In India, 500,000 children under the age of five die annually from vaccine preventable disease. To address gaps in immunization delivery and uptake, it is requisite to identify those who are not receiving the complete and timely essential care needed during the entire continuum of pregnancy through infancy. Khushi Baby presents a novel, data-driven approach to tracking and motivating maternal and child health care at the last mile.

Khushi Baby is centered around providing the patient a new kind of health record. Patients receive a pendant, strung by black thread. The pendant design carries cultural symbolism, and has been traditionally worn by children for protection against evil eye. The pendant contains an unpowered Near Field Communication chip which digitally stores the patient's medical history. Frontline health workers can read and update the patient's health record with a simple scan of an Android application. Health workers can later sync the data to district health officials, who gain access to actionable reports on an analytics dashboard. Health workers can further connect back to patients by scheduling automated voice call reminders and educational messages in the local dialect.

The promise of the platform begins with the pendant. It represents a health record that is less likely to be lost, but more importantly one which may serve as a physical reminder for the mother to continue to regularly attend village-based health camps. The pendant may too act secondarily as a social symbol to catalyse awareness within these communities towards availing these services among otherwise health camp defaulters. The pendant also enables that the mother, who is prone to migrate during her period of maternity, to present her medical history to the health worker, no matter where she is, and no matter which health worker attends to her or her child. Near Field Communication facilitates a decentralized paradigm which allows data to remain digitized at the point of care.

Other digital platforms require that the nurses regularly synchronize their devices with a centralized server to avoid duplicating patient records at the point of care, and more importantly to avoid situations in which patient records cannot be retrieved. This overreliance on synchronizing assumes a level of connectivity that doesn't exist at the field level. The Khushi Baby platform has no such dependence on connectivity, as the most updated data, always remains with the patient.

At the camp level, the nurse is required to ask and match identifiers to align the patient with the correct health record. Most platforms require entry of a name or unique identifier, where entry may be error prone. Some require the patient's fingerprint be scanned. Yet biometric records will not necessarily produce an updated match if the system wasn't appropriately synced to begin with. The Khushi Baby platform requires no inputs on the part of the nurse when a returning patient comes to a health camp. The pendant is simply scanned. The patient then can giver her biometric to authenticate the record and provide consent to receive treatment and have the record updated accordingly. This helps ensure that a digital, auditable proof of the health interaction is available.

Khushi Baby seeks to add improvements in other aspects of the maternal and child health tracking process: biometric log-ins for the nurses, GPS based attendance tracking, input validations to ensure complete data entry (even when for example a treatment could not be provided), improved due list management, improved communication channels with WhataApp, and. data quality

checks on the backend. Instead of focusing on visualizations of the data coming in, our focus has been on presenting data for health officials in formats that can drive specific action for supply side gaps, underperforming nurses, and high risk patients. Instead of sending SMS reminders to a beneficiary population with low Hindi literacy (let alone low health literacy), a mix of automated and personalized phone calls are employed instead, specific to the patients progress in pregnancy or infancy. These inputs and more, have come after three years of closely working in the Udaipur District with hundreds of health officials and community members to bring together this end-to-end, iterative process of design, development, stakeholder engagement, and field research.

With 3ie's *Breaking through Stagnation: Innovations to Improve Immunization* grant we seek to evaluate the promise of the Khushi Baby approach. Specifically we seek to assess the functionality of the KB platform, and the comparative value add of the KB System against status quo paper-based tracking in Rajasthan on the criteria of patient record retention, data consistency, data validity, health worker attitudes and behaviours, and full immunization coverage completion using the framework of a cluster randomized controlled trial. The differential effects of the multifactorial components of the KB Intervention will also be assessed for their individual-level effects on improving full immunization coverage and timeliness among infants. A mixed methods approach will be employed to understand the process, gaps, and opportunities for a scalable and accountable maternal and child health tracking system.

This baseline report summarizes the intervention, evaluation strategy, and initial findings of Khushi Baby's work in Udaipur since 2016. 3283 pregnant women from 584 villages were enrolled into the study cohort and surveyed at baseline to assess socioeconomic status, health status, and maternal and child health awareness. 163 Auxiliary Nurse Midwives (ANMs) and 315 Accredited Social Health Activists (ASHAs) were surveyed at baseline to understand attitudes and behaviors towards health delivery at the village level. A separate baseline coverage evaluation survey was conducted with 1243 mothers with children age 12-23 months in 100 villages sampled from the same region to assess health indicators at baseline for the study area. Since deployment of the KB platform on February 9th, 2017 87 ANMs have become active users. Their efforts have enrolled over 6000 mothers and children combined, and allowed tracking of over 60,000 immunization events. Nearly 30,000 automated voice call reminders and educational calls have been both placed and received by beneficiaries.

The key takeaways of our preliminary research have helped better frame our objectives.

1. To work with a beneficiary population for which:
    - Over 80% of mothers have access to a mobile phone, yet less than 2% of mothers receive reminder messages through their pregnancy and the child's first year of life
    - Over 90% of mothers receive a paper Maternal Child Health card at registration, but less than 60% retain the card, needed to receive correct treatments, by the end of the child's first year of life
    - Less than 10% of mothers are aware of the number of required immunizations in their child's first year of life, and 20% know how many antenatal care checkups are needed

2. To empower frontline Auxiliary Nurse Midwives (ANMs)
    - who are otherwise known to manipulate data on paper records
    - who on average spend 2 hours to transfer their already collected data to a Data Entry Operator to upload into a central server
    - who must on average hand calculate 20 columns for month end reporting
    - who must carry 12-15 registers to the village-based camps, and manually flip through them to identify patients
    - who ask questions like "was your child born before or after Holi" to identify children with incomplete immunization cards who are unnamed or from other villages

3. To activate District Health Officials
    - who don't even know which ANMs conducted schedule camps for a given week
    - who have no means of verifying aggregated data, and who say "110/70 is our ANMs' favorite number"
    - who don't have a sense of supply side shortages compromising their ANM staff
    - who only see data after two months, by when it's already too late

After adding stability to the platform, Khushi Baby looks forward to moving into it's next phase of action – using data for decision making, and bringing more stakeholders of the health value chain into regular use. The next phase of evaluation will seek to directly compare the data quality of KB vs. existing government tracking systems and report back on user behaviors and satisfaction. We remain optimistic after hearing of reports of increased patient turnup and instances of mothers proudly owning their Khushi Baby necklace as a health record. We believe this collective effort represents the first steps of a long journey towards accountable maternal and child health care in rural India.

Abbreviations/Acronyms

Abbreviation	Definition
ANC	Antenatal Care Checkup / Antenatal Care
ANM	Auxiliary Nurse Midwife
ANMOL	ANM Online
ASHA	Accredited Social Health Activist
BCMO	Block Chief Medical Officer
BCG	bacille Calmette-Guerin (a vaccine for Tuberculosis)
BPM	Block Program Manager
CAG	Comptroller and Auditor General of India
CHC	Community Health Centre
CMHO	Chief Medical and Health Officer (District)
DEO	Data Entry Operator
3IE	International Initiative for Impact Evaluation
EDD	Expected Date of Delivery
EHR	Electronic Health Record
eVIN	Electronic Vaccine Intelligence Network
FIC	Full Immunization Coverage
FICT	Full Immunization Coverage and Timeliness
GAVI	Global Alliance for Vaccines Initiative
GOI	Government of India
HQ	Headquarter

KB	Khushi Baby
LHV	Lady Health Visitor
MCTS	Maternal and Child Tracking System
MO	Medical Officer
MCH	Maternal Child Health
MNCH	Maternal Neonatal and Child Health
MOEIT	Ministry of Electronics and Information Technology
MOHFW	Ministry of Health and Family Welfare
NFC	Near Field Communication
NFHS	National Family Health Survey
NGO	Non Governmental Organization
NHM	National Health Mission
OPV	Oral Polio Vaccine
OBC	Other Backward Caste
PENTA	Pentavalent Vaccine
PCTS	Pregnant Women and Child Health Tracking System
PHC	Primary Health Centre
PNC	Postnatal Care
RCH	Reproductive and Child Health
SC	Sub Centre
SC	Scheduled Caste
ST	Scheduled Tribe
UNDP	United Nations Development Programme
UNICEF	United Nations Children’s Fund
VHND	Village Health and Nutrition Day

1. Context and rationale for evaluation

According to the Ministry of Health and Family Welfare, India sees an estimated 500,000 children die annually of vaccine preventable disease.[6] Despite much progress over the past decade, still nearly 60,000 mothers die annually in India from preventable causes related to pregnancy and childbirth.[7]A large set of cost effective solutions exist to avert this unnecessary maternal, neonatal, and child mortality: immunizations, treatment of febrile illness, simple practices for newborn care, and micronutrient interventions for pregnant women stand out as successful interventions along the continuum of *ante-*, *intra-*, and *post-* natal care. Increasing coverage of these essential services therefore requires a priority.[8]

High IMR and MMR in India is further concerning in the context of unreliability in tracking and surveillance mechanisms used to generate these estimates. In the state of Rajasthan, 2.3 Million mothers registered during pregnancy were lost to follow-up in the state e-health registry between 2011-2016 according to a report from the Comptroller and Auditor General of India.[9] Without first knowing which children (and mothers) are being missed, strategies to drive behavior change for better uptake of essential maternal and child health services would likely be ineffective.

Consider the case of Udaipur, a medium focus district for immunization coverage improvements in southwest Rajasthan.[10] Annual Health Survey data (AHS 2012-13, Registrar General of India office) presented full immunization coverage rates of 79.8% in rural areas for those children 12-23 months of age.[11] On the contrary, the reputable National Family Household Survey conducted in 2014 found just 37.2% of children in rural areas fully immunized in the same district (NFHS-4).[12] For the entire district of Udaipur, Rajasthan's Pregnant Woman and Child Tracking System (PCTS) showed 44.5% as fully immunized in 2013.[13] Differences in denominators, sampling strategies, and data quality might have resulted in such a wide range of estimates. Ultimately, the outcome is great uncertainty regarding the extent of the problem at hand at the District level. Deficits in data quality noted at the State and District level must ultimately percolate from the grassroots level - the Villages, where mothers and children are tracked, and where failure to account for mothers and children results in the aforementioned estimates of infant mortality.

1.1 Process

To derive the discrepancies in key health indicators above, one must first understand the process of maternal child health tracking in rural India. Protocols described by the National Health Mission and the Rajasthan Ministry of Health and Family Welfare outline that newlywed couples (i.e. women who may soon enter pregnancy) should be identified by the Accredited Social Health

[6]Mission Indradhanush <http://www.missionindradhanush.in/about.html>
[7]Unicef India. Maternal Health. <http://unicef.in/Whatwedo/1/Maternal-Health>
[8]Horton, S and Levin, C. Chapter 17. <https://www.ncbi.nlm.nih.gov/books/NBK361909/>
[9]Goswami R. 2.3 million pregnant women in Rajasthan 'missing' between 2011 and 2016. Hindustan Times. May 1, 2017.
[10] Medium focus district label was provided under the Mission Indradhanush campaign Phase II, a national campaign to improve child immunization coverage.
[11]Annual Health Survey 2012-13
[12]National Family Household Survey 2014
[13]PCTS

Activist (ASHA) and given a serial number known as the Eligible Couple number. During pregnancy, each mother attends a Maternal and Child Health camp in her village, and she receives a MAMTA card as a personal record for her pregnancy and her child's upcoming infancy. The Auxiliary Nurse Midwife (ANM), who services a Subcenter Catchment area of an average 5000 individuals in plain and 3000 in tough terrain, is expected to see the mother four times during pregnancy and provide antenatal care checkups (recording any signs of high-risk), maternal vaccines, and iron folic acid tablets and deworming medications. During these visits, the ANM is expected to fill the mother's MAMTA card and her own Reproductive Child Health (RCH) register (a log of all patient data from the camp) with the same data. By month's end, the ANM is expected to calculate the total number of key health indicators that took place at her camps: the number of registrations, vaccinations performed, etc in central government mandated Forms 6-8 under the National Health Mission (NHM). The ANM also turns in her linelist report from the RCH register showing the individual details of each mother (and child) who attends the camp to the sector level Data Entry Operator (DEO).

The Data Entry Operator enters this linelist report into the Pregnant Woman and Child Tracking System (PCTS), a platform developed by the Government of Rajasthan. After copying values into the web portal for a given patient, the PCTS portal returns an ID for the mother or child known as the PCTS ID. These IDs, along with a due list of the next month's expected patients, is to be presented to the ANM by the DEO or Lady Health Visitor (LHV). The ANM is expected to write the PCTS ID on the Mother or Child's MAMTA card at the next camp checkup. ANMs are salaried government staff, but still are evaluated on the basis of reaching performance targets for various health indicators from registrations to antenatal care checkups to immunizations given. Primary Health Centers are mandated to have supervisory staff to conduct household spot checks for up to 10% of the beneficiary population to confirm whether mothers and children have indeed received services.

1.2 Gaps

Our observations from three years of field experience in rural Udaipur have shown us gaps in not only in the process of delivery of services but also in the process of data collection (Sherpa 2016).[14] These shared observations have also been documented in a gap analysis of the PCTS system by the Columbia Earth Institute for the district of Dausa, Rajasthan (Songara et al. 2014).[15] Generalizability of these gaps is likely to extend throughout India where similar protocols are in place, as per national standards.

At the field level, we have observed ANMs not filling their RCH Registers with all the required 130 columns of the RCH Register spanning from antenatal care to delivery to postnatal care to child registration and child immunization. In some cases, the ANMs do not understand the data to fill. In other cases, ANMs neglect filling the data. Notably, this has particularly been observed in past obstetric history of the mothers during antenatal care. In some cases, ANMs deliberately falsify data. This has in particular been noted for Blood Pressure values, Blood Sugar values, and Urine Test Results, all of which have been seen to be manipulated at the point of care. ANMs have

[14] Sherpa, D. A Study on Developing an mHealth Solution as an Alternate Recording and Reporting System for Auxiliary Nurse Midwives in Udaipur District of Rajasthan. Thesis. 2016.
[15] Columbia Earth Institute. Pregnancy Child Tracking and Health Services Management System (PCTS) Gap Analysis Rajasthan. 2015.

been observed to fill outdated registers with outdated columns or in personal diaries instead of the standard issue RCH Register. ANMs have also been observed to call patients who have migrated to record whether they have availed services from another camp, without physical verification - and then to translate that second hand data into their reports.

At the field level, we have further observed ANMs not appropriately filling the patient's MAMTA card. In particular, child immunizations are marked as complete with semi-filled dates and also without dates. Mother's ANC details are rarely recorded in full during antenatal care checkups. The PCTS ID, used to link the mother to child, is rarely written on patients' MAMTA cards. It has been further observed that some ANMs will keep the patients' MAMTA cards with themselves. The ANMs may continue to fill these MAMTA cards as proof of completing care to the patients, irrespective of their actual attendance to a health camp, in order to meet incentivized volume-based health targets. Mothers too, do not always retain their MAMTA cards. Although 92.6% of mothers are estimated to receive MAMTA cards during pregnancy (National Family House Survey, 2014),[16] as low as 59.5% of cards are retained by the completion of the child's first year of life (Annual Health Survey 2012-2013).[17] In the case that the card is lost, oral history is used to determine the treatment required for the visit and for back-filling data. Mothers, who have been observed to have both poor literacy and health literacy (Nagar 2016),[18] may not remember dates accurately enough to convey full information in such scenarios for data to be accurately recorded. The end result is guesswork to provide patient-specific care.

At the primary health center level, the way data is entered into the portal also influences how the ANM collects data at the field. For example, consecutive antenatal care checkups cannot be entered unless they are 56 days apart. As a result, ANMs have been seen to manipulate the date of the antenatal care visit to meet these input validations on PCTS. On the other hand, the portal also inappropriately excludes data in certain scenarios. For example, mothers may not accurately remember their Last Menstrual Period (LMP Date), which is used to calculate the Expected Date of Delivery (EDD). If the actual Date of Delivery entered exceeds the Expected Date of Delivery, it is rejected and the record cannot be created unless the actual Date of Delivery is adjusted to fall within the listed bounds.

At the primary health center, the ANM is also required to summarize the frequencies collected in her register in Forms 6-8, but does so by hand-tabulating cumulative frequencies. In this step the ANM may manipulate data so that the cumulative number of patients in the linelist and in the summarized Forms 6-8 match in number. But further differencing analysis on PCTS reveals that linelist data and Forms 6-8 data mismatch on many key health indicators. This difference can be attributed to deliberate mis-entry of health columns, misentry of repeated ID columns in Forms 6-8 leading to records being rejected, or from patient migration causing duplicated records. Mis-entry of data may also be attributed to DEOs through human error, and to LHVs/MOs who do not take steps to verify the data accuracy before upload.

[16] National Family Household Survey 2014

[17] Annual Health Survey 2012-13

[18] Nagar R. Tying Community Engagement with Appropriate Technology at the Last Mile: A Cluster Randomized Trial to Determine the Effectiveness of a Novel, Digital Pendant and Voice Reminder Platform on Increasing Infant Immunization Adherence among Mothers in Rural Udaipur, India. Thesis. 2016.

Altogether, these procedural gaps contribute to uncertainty both in the higher level health indicators and local patient-specific records alike. As we see it, the current approach to tracking maternal and child health is overdue for radical change. This change begins with holding the entire system accountable.

1.3 Purpose

The purpose of this evaluation is to rigorously investigate the merit of a novel, culturally-tailored, data-vigilant, mHealth platform for rural maternal and child health tracking in India: Khushi Baby. Specifically, this evaluation seeks to address the knowledge gap in the effectiveness of a systematic multi-stakeholder, multi-component intervention on: improvement in MCH data reliability, MCH data retention, and critically, improvement in data-driven engagements for patient care and delivery of health services to last-mile communities.

Khushi Baby is not the first mHealth intervention concerning health workers to be rigorously evaluated in India (Bokrum et al. 2015), nor the first mHealth intervention to make use of a culturally-relevant wearable for infant health data storage (Marcus et al. 2009, 30-5). Khushi Baby is also not the only solution that digitally replaces the standard RCH. The Government of India, with the technical support of UNICEF India, launched ANM Online (ANMOL) as part of its National Health Strategy. ANMOL, a tablet-based digital solution designed to replace the RCH register, was launched with 10,000+ ANMs in Andra Pradesh in 2016 without any prior process or impact evaluation. For such system implementations of ANMOL, significant funding has been invested on the part of the Government of India and implementing partners (at least 20,000 tablets have been purchased across multiple states). Despite the agencies involved, the project has been noted to be stalled in the field due to technical and managerial issues. In spite of these delays, funding allocations are still being made in the form of advanced market commitments to tablets for ANMs in the tens of thousands.

ANMOL is just one of many policy commitments made towards improving MCH data tracking in rural India.[19] Uttar Pradesh developed an application for ASHAs and ANMs known as mSehat for tracking MCH offline on smartphones. Gujarat and Rajasthan both have built significant State Electronic Health Registries (eMAMTA and PCTS respectively). National standards for Electronic Health Registries for MCH data have also been established in the form of the Maternal and Child Tracking System (MCTS). The broader banner of Digital India has resulted in the registration of over 1 Billion Indian citizens with biometric identification, in part to manage and assess the reach of social welfare schemes throughout India. Indeed the nexus of health and digitization campaigns in India presents a unique opportunity to reexamine and reimagine the way MCH data is tracked and acted upon.

While Khushi Baby cannot be simply compared head-to-head with ANMOL, nor can it immediately be integrated into existing Government EHR frameworks such as PCTS, this timely evaluation aims to uncover the procedural requirements for a sustainable, impactful last-mile MNCH tracking platform and thereby highlight opportunities for improvement of status quo systems to drive evidence-informed policy change.

[19] Ministry of Health and Family Welfare, Government of India. Healthcare for All - Three Years of Transforming India. 2017.

Khushi Baby advances a key technological paradigm for MNCH tracking based on principles of decentralization and locally-appropriate design. Other platforms which seek to digitally replace the RCH (in some form) on a mobile device such as ANMOL, Medic Mobile, mSehat, Dimagi's Commcare, claim to be functional offline to cater to rural areas where ANMs serve. However, should a patient migrate from one village to another, as is common for mothers entering the last trimester of pregnancy, then these aforementioned systems require that all health workers have their mobile devices synchronized with a central server at the same time before going to the field for the health camp. Given that ANMs work in rural areas with limited or intermittent connectivity, such a dependence becomes untenable in the field (Bokrum et al. 2015). When mothers migrate to another health worker, their record becomes duplicated. Unique IDs to even look up mother data in the form of large numbers of names with multiple spellings do not always pull-up a match even when the patient record is on the local mobile device. Khushi Baby's approach changes this because the most up-to-date health record remains with the patient, and can be scanned by any ANM to retrieve that patient's history at the point of care, without any dependence on connectivity to a centralized database.

Given the realities of the field, critical skepticism should be applied to any intervention that claims to move the needle on MNCH outcomes without intimately disentangling the intermediate processes required to drive impact. In positing a systematic information we seek to comprehensively assess the capabilities our system seeks to unlock beyond just our framework for a patient-centric, decentralized record. The KB platform additionally strives to empower ANMs know which children missed their measles vaccines and which mothers are at highest risk of pregnancy complications before visiting her camp; to empower the ANMs to be able to identify the unnamed child in front of her at the VHND camp and know which vaccines to give at the point of care; to give District health officials insight into which ANMs are conducting camps in the first place, which ANMs are low on specific supplies, and which ANMs are under suspicion for collecting data with poor quality; to improve coordination between health workers within the District by informing LHVs, BCMOs, and ANMs of high risk patients and supply-side failures. Last but not least, our platform seeks to educate patients through systematic reminders and educational voice messages in the local dialect so that they may adhere to the schedule of the camps and understand the value of the services being provided.

Ultimately, "breaking through stagnation for infant immunizations" for us means rising up to meet all of these challenges, throughout the continuum of pregnancy through infant care, to drive behavior change for both patients AND health workers who make up the health system in rural India. Our undergirding hypothesis is that better data - actionable and accountable - can bring about better prevention and better care for mothers and children at the last mile.

2. Objectives of the evaluation

2.1. Intervention/programme

Khushi Baby is a multi-component, multi-stakeholder systemic intervention for maternal and child health tracking and engagement. This composite intervention comprises of a technological solution, along with a process for adaptive development, design, deployment, stakeholder engagement and monitoring carried out by the Khushi Baby team.

At it's core the Khushi Baby system provides patients with a wearable, digital health record - the KB Pendant. The KB Pendant can be read and updated by an ANM using a tablet device via the KB App at the health camp. The ANM syncs data (over cellular 2G) after the camp to populate the KB Dashboard, which provides District health officials with data for decision-making. Health officials may also use the KB Dashboard to schedule automated voice-calls from a library of audio files in the local dialect of *Mewari* . A detailed summary of the intervention as it relates to each involved stakeholder follows below. To appreciate the workflow of the intervention see Supplemental Figure 1, 2a, and 2b. To appreciate the key differentiators of the system in relation to prior approaches see Supplemental Table 1.

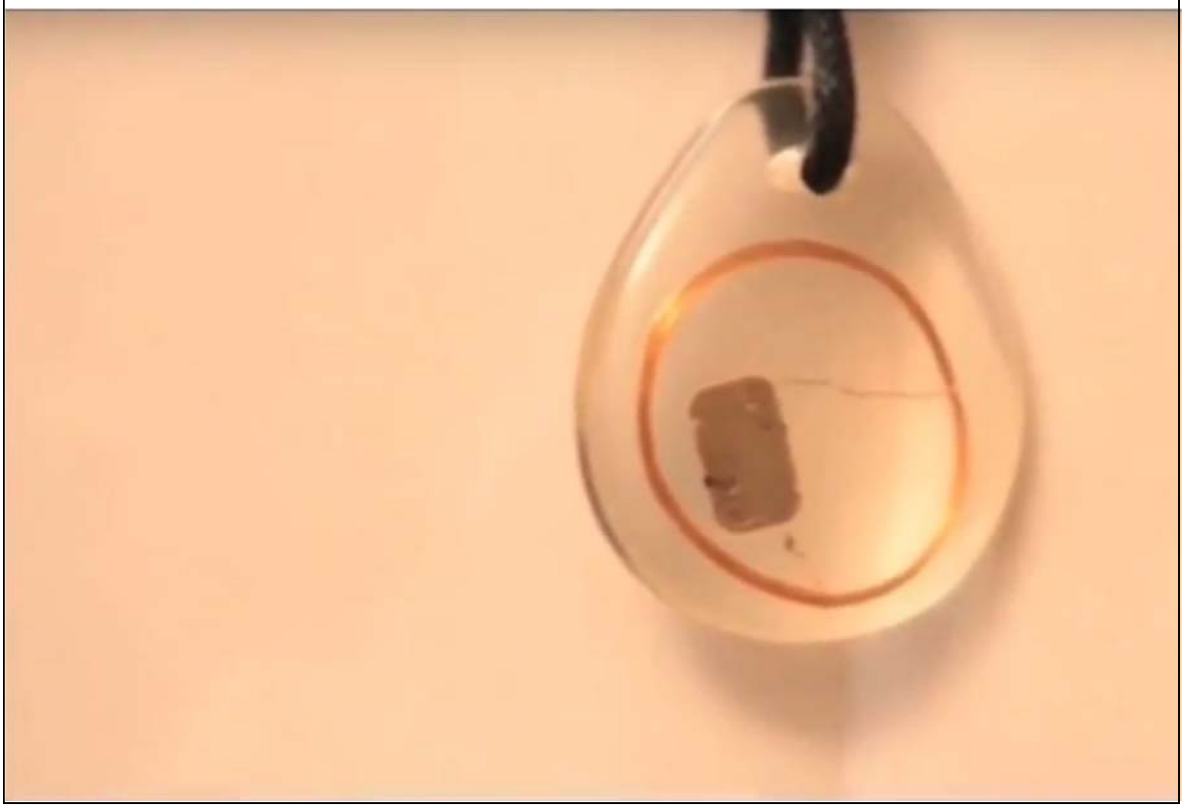
2.1.1 Mothers and Children

Mothers and children, the key beneficiaries of the intervention, receive the KB Pendant - a patient-centric, wearable, digital health record.

Mothers receive the KB Pendant for themselves or for their child at the VHND camp from the ANM. All mothers who attend one of 354+ KB Treatment group camps (including those who were never included in the KB Enrollment Treatment Sample) are eligible to receive the KB Pendant, while supplies last (at least until the end of 2017). Mothers have full right to refuse the Pendant. Mothers also continue to receive the MAMTA card, and by protocol the MAMTA card is still required by the MOHFW to be updated by the ANMs.

The KB Pendant is unpowered, durable, waterproof, and houses a Near Field Communication (NFC) chip inside its hard plastic encasing, which stores 868 bytes of data. KB Pendants come in two data formats: one for the mother, and one for the child. This storage capacity is used to store the essential contents of the government-issued MAMTA card either during pregnancy or infancy. Pregnancy information includes content for prior pregnancy complications, past illnesses, up to four antenatal care checkups, and medications given. Child information includes content for weight, vaccinations through five years of life, breastfeeding, and illness for up to ten checkups.

Figure 1. The Khushi Baby Pendant



The KB Pendant also allows for storage of the digital template of the mother's fingerprint (biometric) on both the mother and child's tag. The biometric template can be matched against the beneficiary's live thumbprint to authenticate the recorder's owner, without need of internet connectivity. The Pendant data is immutable to third party applications, and can only be accessed by an authorized ANM, with the KB App, after the mother has given her consenting thumbprint[20].

The KB Pendant has relevant features of cultural symbolism. The soft yet durable black wax cotton thread used for the KB Pendant is similar to black thread worn traditionally by children for protection against *buri nazar* or evil eye. The mother and child's Pendant are the same except for the fact that the mother's Pendant is tied with a longer thread.

[20] The ANMs can override the requirement for the mother's biometric to unlock the mother or child's KB Pendant but must give a reason for the override, which is tracked on the KB Backend

Figure 2. Child wearing Traditional Amulet with Black Thread (Kaala Dhaaga)

The child's Pendant is tied in a manner so that it sits at the superior aspect of the sternum. This ensures the Pendant is not long enough for the pendant to be put into the baby's mouth or for the thread to double over causing asphyxiation. The thread is therefore also short enough to give enough slack for the child to move his/her neck without discomfort.

It is intended for mothers to keep their KB Pendant throughout the duration of their pregnancy and bring their KB Pendant to the child's first immunization camp (scheduled for 42 days after birth). When the child is registered to receive his/her KB Pendant, concurrent with the Pentavalent 1 vaccination, the mother's KB Pendant may be scanned and directly linked onto the child's KB Pendant. Features are being built into the application so that in the future, mothers who return for repeat pregnancies may scan their original KB Pendant, to avoid data entry on the part of the ANM.

It is intended for the child to keep the KB Pendant at least through the first 18 months of life, and up to the first 5 years of life, so that all vaccinations given can be maintained with the child. Beyond five years of age, it has yet to be determined what will be done with the KB Pendant. Opportunities include using the KB Pendant as proof of immunizations for entry into school and initializing a

new record that can capture an expanded medical history of the original KB Pendant. Other alternatives include recycling the KB Pendants for future beneficiaries. Finally, should either the mother or child ever lose their tag, a new one can be replaced by the ANM using the KB App, using the last available backup on the ANM's tablet.

Besides the Pendant, mothers and/or their spouses (depending on who has the mobile phone) are also recipients of KB Voice Call Reminders, provided they give their accurate phone number, at the VHND camp to the ANM, and the ANM accurately enters the phone number into the KB App. KB Voice Call Reminders currently being sent can be see in Table 1 below.

Voice reminders come in two varieties: Automated and KB Call Center. Automated Voice Calls are scheduled on the KB Backend, having taken initial inputs from the CMHO, by the KB Team.[21] These voice calls are sent according to specific rules for specific patient groups at specific times depending on the audio file selected. KB Call center calls on the other hand are manual calls made by the KB team[22] from the KB HQ. These individualized calls are made to mothers falling into three categories: those due for delivery, those mothers who are at high risk per NHM criteria, and those mothers who have dropped out.[23]

The content gathered and disseminated on these manual calls is not strictly prescribed, but broadly can be defined as follows. For mothers Due for Delivery, the KB team seeks to gather information on: delivery outcome, delivery location, delivery complications, infant death, receipt of incentives at the time of delivery, and receipt of KB Pendant and/or KB Voice Calls (automated). Beyond this reporting, the KB Team seeks to elicit the broader story of the mother's current pregnancy. On this phone call, the KB Team takes steps to encourage the mother to: take IFA medications as prescribed by the ANM, deliver at the hospital in coordination with the ASHA, to collect incentives for hospital based delivery, attend to best practices for PNC care as per the ASHA/ANM, and bring the child for immunizations. For High Risk Mothers, the KB team seeks to: inform the mothers to go to referral care, understand whether they have completed any checkups at higher care facilities, and to assess their pregnancy status (delivery outcome if applicable). For Dropout Mothers, the KB Team takes steps to understand reasons for dropout, to record any delivery outcomes, and to encourage the mother to return to the camp site.

[21]Currently, the KB Core Project Staff manages the Automated Voice Calls. The team observes which calls are listened for 90% of the duration and which patient groups need to be considered at the field level. The strategy moving forward is to empower the CMHO and BCMOs to have more accountability over call rule reminders, after initial performance data is obtained and after these health officials have been successfully onboarded to the KB Dashboard on the whole.

[22]The team operating the KB Call center comprises of KB Core Project Staff headed by one the study's Co PI, who formulate objectives for each call and templates on Google Sheets for data entry. One female call specialist, who is fluent in Mewari, places calls to respective mothers using the KB Dashboard generated lists of patient IDs (50-200) for a given week.

[23]Dropout Mothers = if(Today Date - Updated at Date > 56 days) & ANC period not complete: the mother has not received a consecutive checkup during her pregnancy period within a two month specified time frame
Dropout Child = if(Today Date - last required vaccine Updated Date > 56 days): the child is two months or more past due on a required vaccine.

Table 1. Currently Active KB Voice Call Reminders

English Script	Patient Group	Call Rule	Call Time (IST)
General Monthly ANC Checkup Reminder: “Hello! Make sure you come to the Anganwadi center at least four times during your pregnancy for a routine ANC checkup. During your check up, the ANM will check the status of your pregnancy and give you necessary medicine, vitamins and vaccines that will help you and your child grow healthy. Thank you”	All Mothers	1 week before Camp	18:00:00
General Child Vaccination Reminder: “Hello! Immunizations are important for your child’s health because they give them the strength to fight against diseases. It is essential that your child gets all of the necessary vaccines. Your child is due for his/her next vaccine. Please bring your child to the immunization camp. Thank you.”	All Children	1 week after camp	18:00:00
General Mother IFA Reminder: “Hello! It’s important to remember to take the IFA tablets given to you by the ANM so that you and your child can be healthy. Thank you!	All Mothers	1 week before Camp	19:00:00
General Breastfeeding Message “Hello! It is important to share with you that from birth to the age of 6 month baby should be feeded exclusively on mother’s milk, no honey, no Ghutti, not even water. Mother’s milk prevent your baby from many diseases. So remember only mother's milk to baby up to six months of age”	All children	1 week after camp	19:00:00
Day before camp for pregnant women ANC reminder: “Hello! It is important to come for routine ANC check ups during your pregnancy. During your check up, the ANM will check the status of your pregnancy and give you necessary medicine, vitamins and vaccines that will help you and your child grow healthy. Please come to the immunization camp tomorrow. Thank you.”	All mother	Day before camp	19:30:00
Day of camp for pregnant women ANC reminder: “Hello! It is important to come for routine ANC check ups during your pregnancy. During your check up, the ANM will check the status of your pregnancy and give you necessary medicine, vitamins and vaccines that will help you and your child grow healthy. Please come to the immunization camp today. Thank you.”	All mother	Day of camp	8:00:00
Child immunization and checkup - One day before Camp: “Hello! Immunizations are important for your child’s health because they give them the strength to fight against diseases. It is essential that your child gets ALL of the necessary vaccines. Your child is due for his/her next vaccine. Please bring your child to the immunization camp tomorrow Thank you.”	All due children	One day before camp	20:00:00
Day of camp for children due for immunization: “Hello! Immunizations are important for your child’s health because they give them the strength to fight against diseases. It is essential that your child gets ALL of the necessary vaccines. Your child is due for his/her next vaccine. Please bring your child to the immunization camp today. Thank you.”	All due children	Day of camp	7:30:00

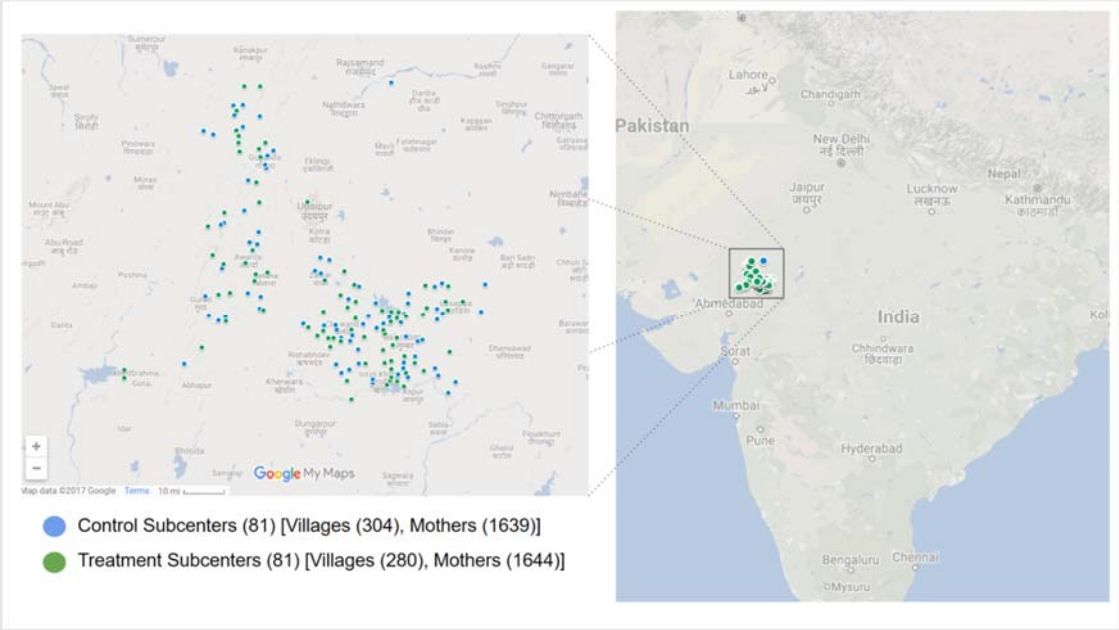
English Script	Patient Group	Call Rule	Call Time (IST)
Thank You - Camp Attendees “Hello. Vaccines help protect your child from many life-threatening diseases. Thank you for bringing your child to the immunization camp today. Thank you.”	All children and mother	Camp day	17:30:00
High risk mothers: “Hello! From your recent checkup by the ANM, it is necessary that you talk to your ASHA sister and go with her to the nearest doctor at the hospital to have a checkup”	High Risk mothers	One day after camp	9:30:00
High risk children: “Hello! From the recent immunization camp with the ANM it has been discovered that your child needs more care. Please visit the hospital with your ASHA to have a checkup with a doctor. Thank You”	High Risk children	One day after camp	9:00:00
Pendant reminder for all: “Hello! The Pendant given to you or your children by ANM at the camp need to be brought again to the next camp. Thank You”	All mother and children	Day of camp	7:00:00

2.1.2 ANMs

ANMs are the primary end user of the Khushi Baby System. ANMs receive an Android Tablet[24] with the KB App installed. The KB app functions to assist the ANM in her responsibilities at every stage of her workflow on VHND.

ANMs assigned to the 81 Treatment Subcenters (n=87) were selected to participate in the intervention for the purpose of this evaluation, as per the sampling criteria outlined in Section 3.2.1. Each ANM is assigned to a Subcenter (SC) which caters to the population health of 5000 individuals.

Figure 3. Map of KB Intervention

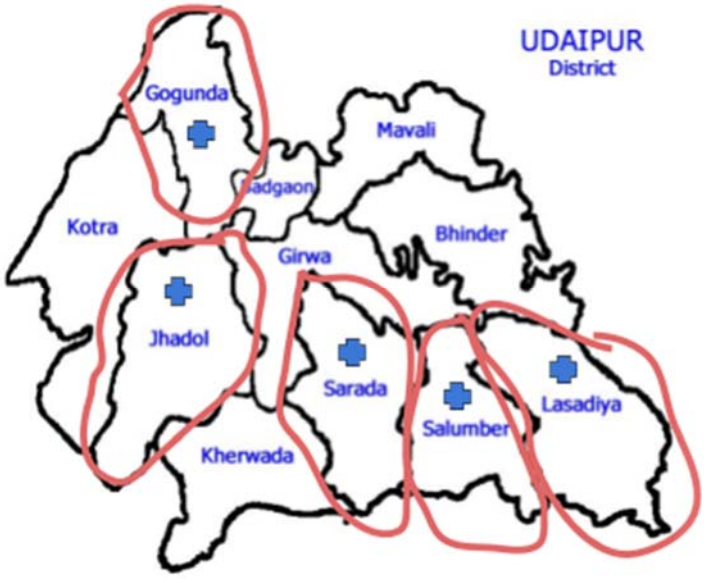


The study area covers over 6600 sq km and a perimeter of 465 km in the Udaipur District.

Engagement with the ANMs had started well before the randomization and roll-out of the trial with user-centered design exercises in the process of developing the application. These exercises spanned from April 2016 through December 2016 in anticipation of the first roll-out (Sherpa 2016).

[24] To date, three separate tablets have been trialed in the field: MorphoBT1, MorphoBT2 (MorphoTablet), and DataMini. Plans are in place to transition all ANMs to either the MorphoBT2 or DataMini to ensure greater hardware stability moving forward.

Figure 4. Map of Intervention Blocks



Five Intervention Blocks were chosen with the support of the CMHO: Gogunda, Jhadol, Sarada, Salumbar and Lasadiya.

ANMs who were ultimately selected into the Treatment group were given multiple levels of training. A two day training was conducted at the Block Office (12-27 ANMs per session). This training included lecture-based presentations, group-trainings, one-on-one trainings, ANM interviews, and role-play activities. Trainings continued at the SC-level, where KB Monitors would train the ANMs on the system to backfill pre existing records in their RCH register. This process involved creating necklaces for patients not in front of the ANM, and physically labeling those KB Pendants with the names of the intended beneficiaries. The day (or a few days) after the backfilling exercise, the ANM would have her first camp. She would handle returning patients as already registered patients on the KB system - simply scanning their KB Pendant and updating the data for the current visit. For new camp attenders, new KB Pendants were created from scratch, but at least in this manner, not every patient was a new patient.[25]

ANMs would receive support from KB Monitors, who would visit them on average once a month for one of their 4-6 camps conducted. KB monitors would assist in syncing and in any support required in the field, especially in the early days of the roll-out. ANMs would also be trained by KB Monitors with each major feature release at the Block level. Plans are to continue this level of in-field supervision until December 2017[26], by which time primary responsibility for monitoring is to be transferred to the ANM Supervisors, the LHVs.

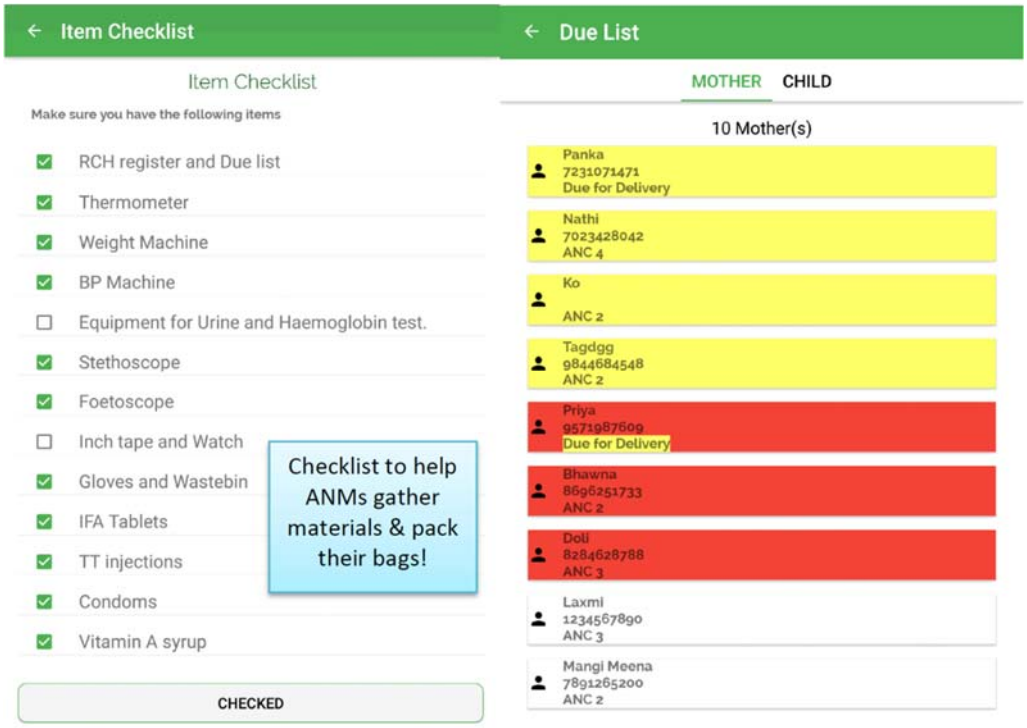
[25] A birth rate of 33/1000 roughly translates to an expected 3 new mothers and 3 new infants coming for registration for any given camp for a total patient panel of 24 for a given camp day

[26] Down/up-sizing of KB Monitor team will be with respect to funding available to continue KB system (beyond scope of this evaluation)

ANMs who were resistant to adoption were given special attention by the KB Core Staff. Trips would be made to have one-on-one conversations with the ANM after phone call attempts were unsuccessful. When possible KB Core Staff would be accompanied by the BCMO or CMHO. Help of local elected village representatives were also recruited to motivate ANMs to use app. Couple of ANMs who created significant disturbances were released from an obligation to use the KB App. No incentives were paid to ensure adoption, but mandate was obtained by the CMHO. Social incentives via vis the KB WhatsApp Group could be argued as a means to ensure compliance. The effectiveness of this strategy (and its implementation as well) has yet to be fully explored.

Before leaving for the health camp, the ideal ANM logs-in and verifies a pre-camp checklist of supplies. This ANM also checks the patient due lists and calls the ASHA to personally visit households of the listed high risk and dropout mothers. Upon reaching the camp, the ANM takes a selfie in front of the health camp to confirm her attendance.[27]

Figure 5. Pre-camp Preparation with KB App



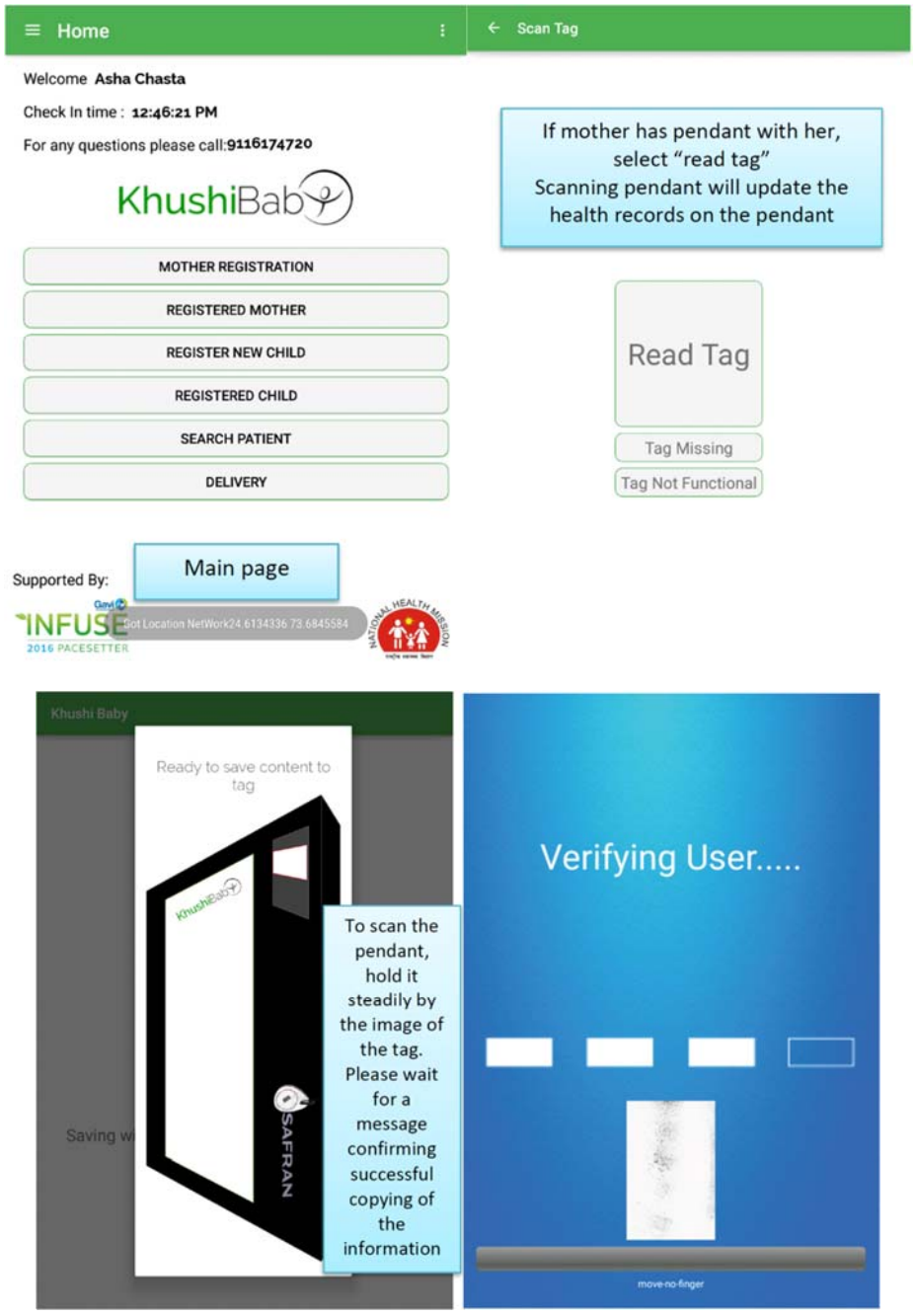
Due Lists include color-coded patient records to indicate statuses: high-risk, drop-out, outdated record. Mothers' phone numbers displayed to coordinate with ASHA.

At the camp, the ANM may register new pregnant women and new children coming for their first pentavalent immunization using the KB app. The ANM may also use the KB App to scan returning

[27] The selfie captured is not actually uploaded to the KB Backend upon sync, but the GPS and timestamp for the photo are captured and saved to track attendance.

patients' KB Pendants in order to view their past medical history, and scan again to update their health record for the current visit.

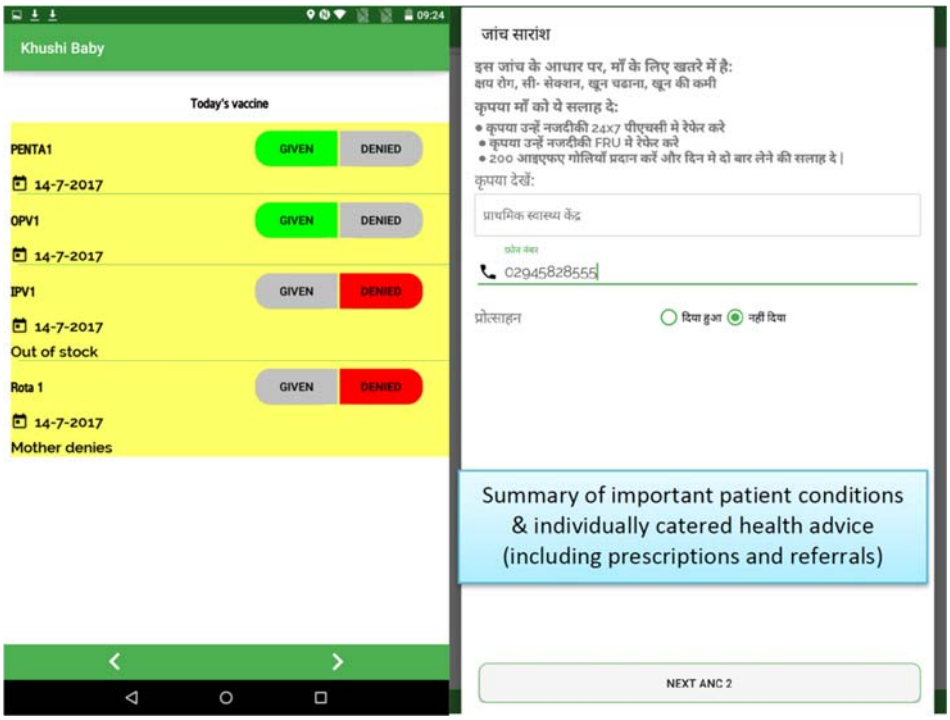
Figure 6. KB App Process to Address New and Returning Patients at VHND Camp



Returning mothers or children have their KB Pendant scanned (bottom right) and their live thumbprint verified (bottom left) for their record to be displayed the ANM. The process takes less than 5 seconds.

While filling the patient's history, the ANM is prompted by the KB App to include details of failed health deliveries such as tests not performed or vaccinations not given. Instead of otherwise leaving values blank, ANMs must select reasons why the services were denied to continue forward. Based off the summative details entered, the KB App provides the ANM with a checkup summary screen outlining the care plan for the patient moving forward. On this screen the ANM can make a patient referral for higher level care as well.

Figure 7. KB App Patient Data Collection and Checkup Summaries



ANMs can reference the vaccines due for today (left), as calculated by NHM-specific algorithms based on age and history of prior vaccine receipt. For each vaccine, the ANM must mark given or denied. The last step prior to saving the data is a checkup summary (right) where high risk flags and action steps are displayed. Note all screens are presented in Hindi for ANMs

Steps have been put into place to reduce redundancies of data collection for VHND camp specific processes to reduce the burden on the ANM. Considering all fields that can be inputted during a mother or child record (196), only 54 (28%) require keyboard input, most of which are numerical entries. Each new mother requires 8 screens of data entry, and each new child requires 5 screens of data entry. Returning mothers and returning children both require 4 screens of data entry. Dates, checkboxes, buttons, auto-calculations, combined with the removal of redundant fields in the RCH register, reduce the barrier to entry for frontline nurses when picking up the KB App.

Most keyboard input fields are numerical values for measurements, and ID information (where the full keyboard is used), is only entered once at the time of registration.

Table 2. Tabulation of KB App fields requiring human entry

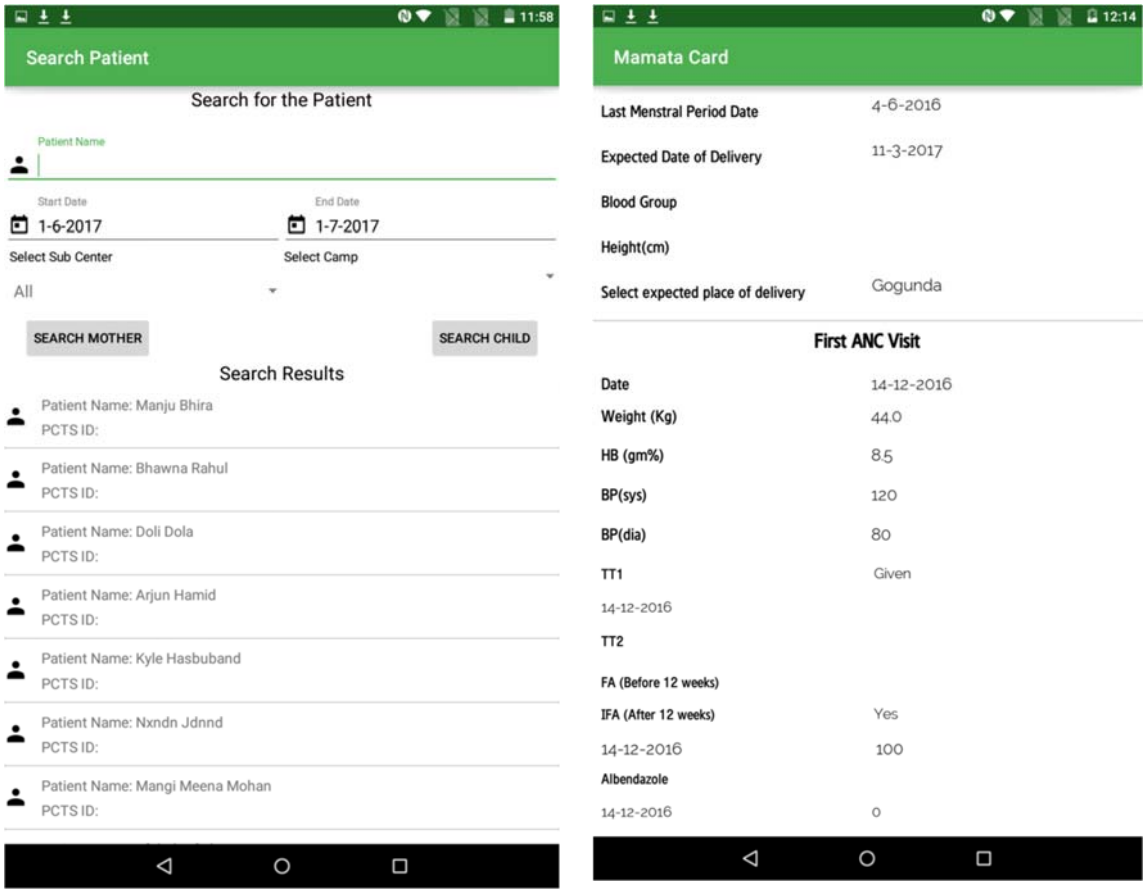
Process	Fields Inputted[28]	Fields Inputted with Keyboard	Details
Mother Registration (Screens = 4)	Min: 6+0+3+1 = 10	5+0+1+0 = 6	Selecting an LMP Date auto-fills Weeks Pregnant and Expected Date of Delivery Fields. Referral Center field has auto-suggest when typing from database of locations.
	Max:13+8+9+4 = 34	7+6+1+1 = 15	
Child Registration (Screens = 1)	Min: 2	0	Up to 11 fields of child registration's first screen fields can be auto-filled if the mother's KB Pendant is scanned
	Max:13	9	
ANC Checkup (Screens = 4)	Min: 1+(6+2+0) = 9	0+0+0+0 = 0	During the first ANC, the ANM has the opportunity to maximally backfill data for the mother's past 3 ANCs, should they have already been conducted elsewhere. The only typed inputs are numerical (with the exception of referral facility).
	Max: 4+4*(13+7+5) = 104	3*(6+3+2) = 33	
Child Checkup (Screens = 4)	Min:0+1+1+1 = 5 Max:29+7+10+1 = 52	0+0+1+0 = 1 0+0+3+0 = 3	During the first child visit, the ANM may record all vaccines previously administered to the child. All dates for vaccinations are autofilled when the vaccine is selected as given.
Retrieval of Mother or Child Data (Screens = 2-3)	Min: 1+0	0+0= 0	At the very minimum, the ANM must scan the KB Pendant (1 step). The ANM is recommended to then verify the biometric fingerprint (if available). If the tag is unavailable, a reason is selected, a search is performed, and the patient to backup is selected
	Max: 1+1+2 = 4	0+0+1 = 1	
Log-In (Screens = 1-2)	Min: 1+0 = 1	0+0 = 0	Log-in can be performed with user/pass or with the ANM's biometric fingerprint
	Max: 2	2	

Despite having the KB App as an RCH register replacement, the ANMs are still required to maintain paper logs, both for the mother and in their RCH registers to be submitted to the DEO as per State Mandate. The CMHO of Udaipur has instructed the relevant block officers to permit

[28]"**+**" separates screens in the app, "( )" indicate modules that may be repeated

these nurses to record details in their monthly indicators and RCH register on the last days of the month, away from the camp site. To expedite this process the KB App allows ANMs to search patients seen by date of camp, location of camp, and name of the patient. This allows the ANM to expeditiously and accurately prepare her reports based off already saved and structured data.

Figure 8. Patient Search on Khushi Baby



The Patient Search feature[29] (left), with auto-suggest search, allows ANMs to later backfill their entire month's panel of patients into the paper systems (right), reducing the need to do so in the field. Such double-work in the field has crippled previous mHealth pilots (Bokrum et al 2015).

Beyond the KB App, ANMs also are also recipients of KB Voice Call Reminders and participants on the KB WhatsApp Groups for intrablock coordination. While automated KB Voice Call Reminders are sent individually to the ANMs, WhatsApp Group communication takes place in a channel with other ANMs, LHVs, BPMs, BCMOs, and KB Monitors. ANMs may use the KB App

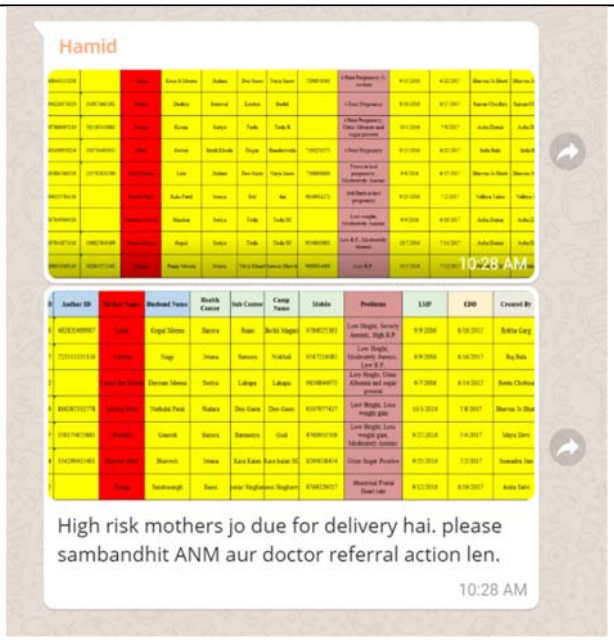
[29]The same feature allows ANMs to browse for Patients with lost tags who exist in the local database.

helpline to contact for technical support and on the other hand, KB Monitors connect with the ANMs the day before the camp to ensure preparation and understand logistical changes (if any).

Table 3. Automated Voice Messages for ANMs from KB Dashboard

English Script	Patient Group	Call Rule	Call Time (IST)
ANM Syncing: Hello! I am calling you from Khushi Baby helpline centre. It seems you have forgot to sync your tablet. Please go to activated network area and sync your tablet. In case of any support please contact at our helpline number. Health department and Khushi Baby appreciates your field effort	ANMs	On the day of camp: Syncing ANM tablets: Automated + Manual call	15:00:00
CMHO Message: Hello! I am Chief Medical and Health Officer Of Udaipur Dr Sanjeev Tak, its my pleasure talking with you. In order to improve maternal, child health indicators with adding robustness in immunization reporting, Khushi Baby organization is working. This is to inform you that please assist work with the system in the specific block and give all efforts to help advance the Khushi Baby initiative.	ANMs	A day before camp: Initial Phase of roll out: CMHO Voice message	17:00:00

Figure 9. WhatsApp Messages for High Risk Mothers



KB Monitors paste KB Dashboard reports into the WhatsApp Group alerting concerned ANMs with the highest risk mothers in their catchment area.

2.1.2 ASHAs

Although ASHAs are not the primary beneficiary nor end user, they still play an important part in disseminating the KB Intervention within the communities. 259 ASHAs are involved in villages with camps serviced by ANMs using the KB App and villages in which families are receiving automated voice call reminders.

Generally, ASHAs play a critical role in ensuring camp turnup within villages, accompanying mothers to the hospital for deliveries, and liaising with the ANM to bring to attention any high risk mothers or children. ASHAs are expected to make 10 home visits daily to fulfill their duties. ASHAs and also play a key role in the village panchayat.

ASHAs interface with the KB platform in multiple ways. First, ASHAs coordinate with ANMs who are using the KB App Due List feature. Second, ASHAs help tie the KB Pendant on the child at the camp site. In doing so, ASHAs help answer questions about the meaning of the KB Pendant. Third, some ASHAs themselves wear the KB Pendant in the village to help market the importance of attending the VHND camp. Finally, ASHAs are supplemented in their efforts to go door-to-door by the KB Voice Call Reminder Calls, which also encourage mothers to turn up to the health camp.

ASHAs were not given special training or incentives with regards to their role within the intervention. However, they continue to receive incentives on a per patient basis for each mother or child they successfully recruit to the VHND camp and hospital for delivery.

2.1.3 LHVs, DEOs, BPMs, BCMOs, and CMHO

Lady Health Visitors, Data Entry Operators, Block Chief Medical Officers, and the Chief Medical and Health Officer make up the cadre of stakeholders broadly responsible for overseeing health delivery within the Udaipur District. These stakeholders receive access to the KB Dashboard (See Figure 2), which provides both standardized reports and analytics. Additionally these stakeholders are added to the KB WhatsApp Groups in which they can coordinate with ANMs and also view KB Reports in a summarized format on a weekly basis.

The aforementioned stakeholders selected to participate in the Khushi Baby intervention were included on the basis of working within the five administrative blocks in which the Khushi Baby system has been rolled out: Jhadol, Gogunda, Lasadia, Sarada, and Salumbar. These stakeholders oversee ANMs who work in both Treatment and Control groups. In total, 38 LHVs, 38 DEOs, 5 BCMOs, 5 BPMs, and the CMHO are involved with the KB Intervention.

Trainings are given to each specific stakeholder on use of the KB Dashboard for their specific role. DEOs are responsible for uploading patient data into the PCTS web portal. They are shown how to access the mother and child line-listed data in the KB system to expedite the process of data entry by using copy/paste. LHVs, BCMOs, and BPMs are given trainings on how to use actionable reports that can be filtered by geography, time period, and ANM: ANM Camp Attendance, Supply Side Failures, and High Risk Mother and Child reports. These stakeholders also learn how to Search Patients and view patient-specific details.The CMHO is given trainings

on how to use the KB Dashboard as well with a focus on summary indicators, live map, and programmable voice features. The CMHO's voice message was recorded to send to all ANMs encouraging them to use the KB system. Inputs from all the above stakeholders was incorporated in an adaptive design loop for the sake of the KB App and KB Dashboard. An Action Plan report has also been developed for these stakeholders to log their data-driven engagements from the KB Dashboard.

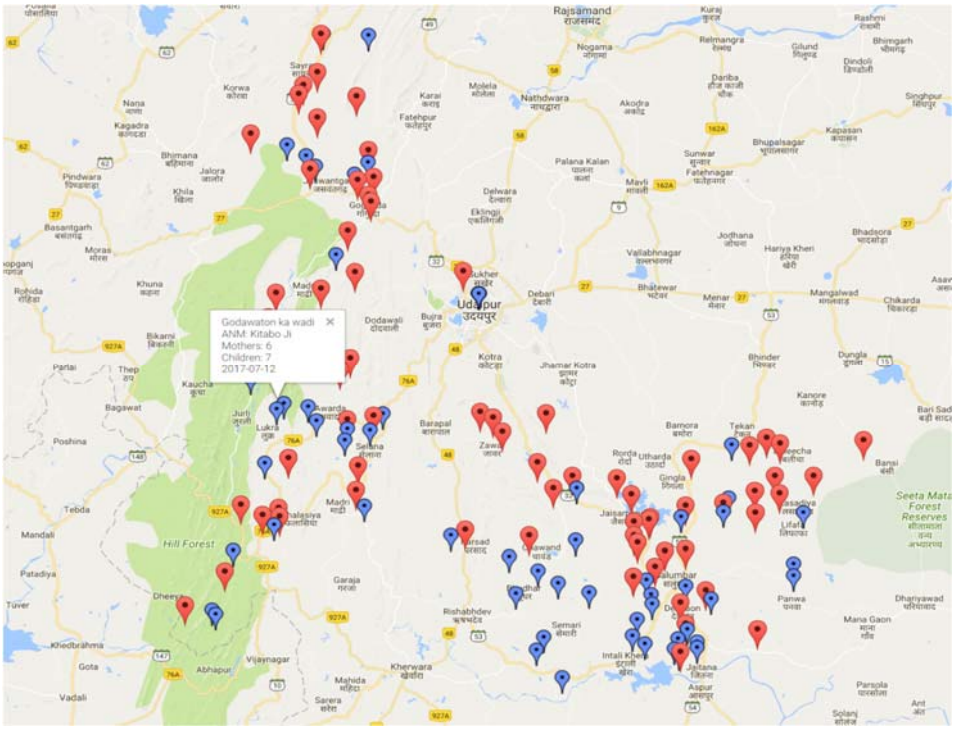
To date, the KB Dashboard is still under revision for particular reports and discrepancies. For this reason, it has yet to be fully rolled-out among the stakeholders. Each stakeholder will require approximately 4-5 trainings for integration into their weekly workflow. No extra incentives are given. Until then, the primary mode of dissemination of reports and action items has been via WhatsApp Groups, taking the data from the KB Dashboard itself. Reports from the KB Dashboard are also to be used at month end meetings with ANMs and Supervisory staff.

Figure 10. Supply Side Failure Report

Health Center	Sub Center	name	Mobile Number	01-06-20	05-06-20	08-06-20
Gogunda	Patiyan	Asha Chasta	978			IPV 2
Padrada	Jhadoli	Deepika	941	IPV1, Rota 1	DTP Booster, Vita2	IPV1, Rota 1, DTP Booster, Vita2, IPV 2
Padrada	Punawali	Dharna	916	BCG, IPV1, Rota 1		DTP Booster, IPV1
Padrada	Suwawaton Ka Guda	Geeta Meena	889	IPV 2, IPV1, Vita2		
Gogunda	Chhali	Lali Kumari	941			IPV1, Rota 1
Nandeshma	Majawari	Manju Mahtma	961			IPV1, Rota 1
Nandeshma	Obra Kalan	Parmila Rawal	978			IPV1, Rota 1, IPV 2, Rota 2
Bhanpura	Diyan	Rekha Lohar	800	IPV1, Rota 1		IPV 2, IPV1, Rota 1
Nandeshma	Rawaliya Kalan	Sangeeta	810			BCG, IPV1, Rota 1
Padrada	Tarpal	Susheela	979	IPV1		IPV1
Padawali	Vaas	Usha Bahan	772			
Bhanpura	Ghanawal	Vandana Kumari	889	IPV1, Rota 1		IPV1

This report, available both on the KB Dashboard and sent on the WhatsApp groups, indicates which vaccines were denied to patients because of lack of availability on VHND camp. The concerned BCMO and BPM are expected to coordinate with Vaccine Stock monitors.

Figure 11. Live Map of VHND Camps Conducted



The KB Dashboard seeks to bridge one critical gap in knowledge: which ANMs are conducting camps according to schedule. Spatial and tabular reports allow the CMHO and BCMO's to follow-up accordingly.

2.2. Cost of the intervention

Intervention costs include: costs for technology and costs for operations. Details of itemized ingredient costs are being compiled.

Costs for technology include amount paid for: design of software, software development for KB Application and KB Dashboard (upfront), documentation of software, hardware (KB Pendants, Tablets, SIM Cards, and WIFI services to upsync the data), and hosting (Twilio for voice services, Heroku for server space).

Costs for Operations include amount paid for: Core Staff Salaries, Support Staff Salaries, Training Sessions, KB Monitor Salaries for the part of intervention support to ANMs, LHVs, DEOs, and Medical Officers, Local Travel for in-field monitoring, KB HQ Office (rent, utilities, furnishings, food, supplies), Courier Services, Consultancies for Legal and Financial compliance, Materials for Dissemination / Marketing including Annual Reports and Diagrams on LucidChart, and Team Building activities.

Along with costs, total beneficiaries served by the Khushi Baby system are also being tracked via the KB Dashboard and the Voice Call Logs which detail how many beneficiaries have received a KB Voice Call Reminder or Educational Message.

2.3. Monitoring plan of the intervention

The monitoring plan of the intervention will take place in accordance with the log frame outlined below. In summary, we will track multiple inputs: software, hardware, human resources, and overall funding. Outputs of interest will include: registrations, trainings, and voice calls placed. Outcomes of interest will relate to our key evaluation questions, and in particular focus on data quality, timeliness, and actionability. Impacts of interest will be monitored through follow up of child health immunizations.

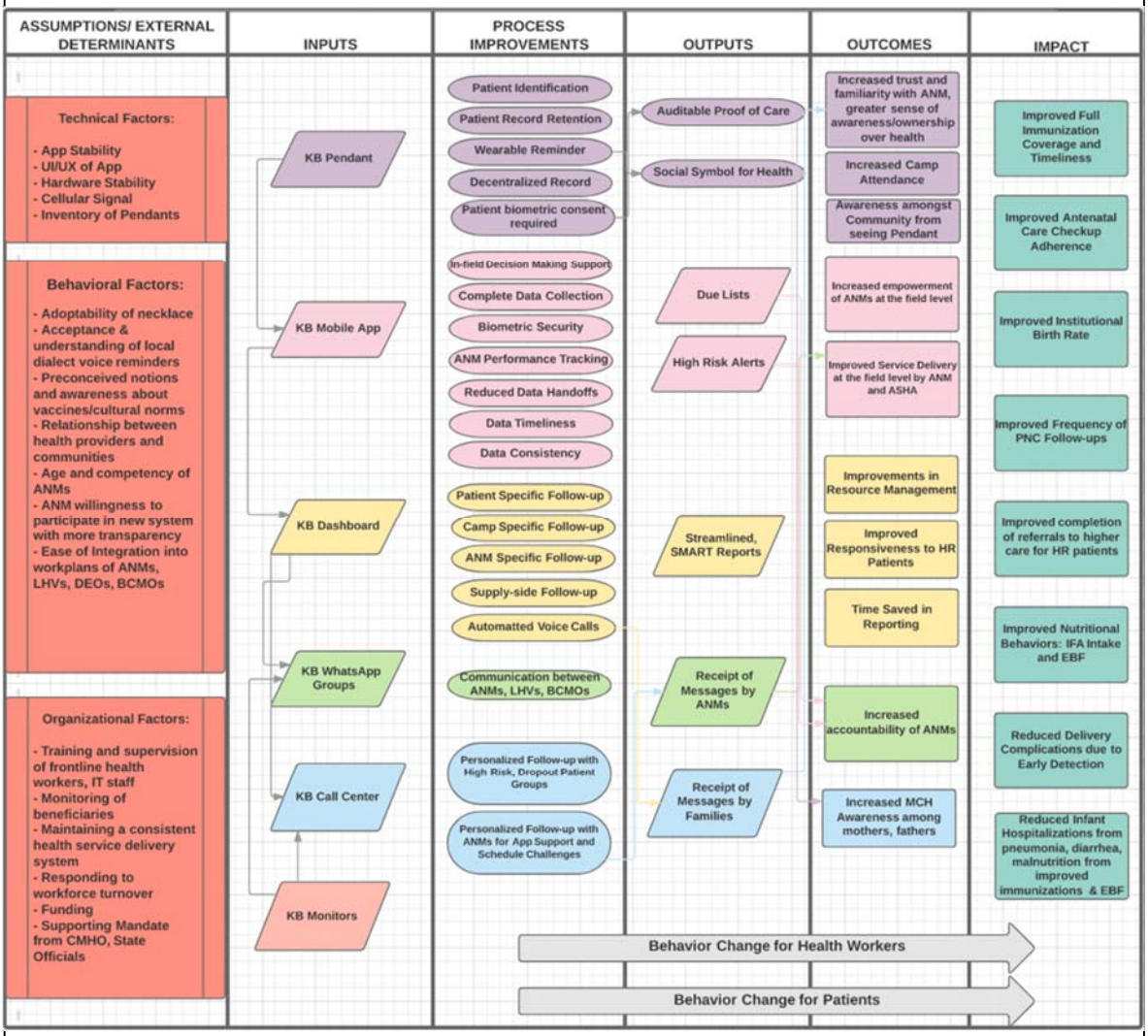
Data sources will come from in-field observation on the part of the KB Monitoring team, and critically from remote data collection on the KB Backend when ANMs sync. Data quality, being a primary outcome measure will both be assessed and protected via vis the design of the KB application and supporting technologies. Automated Testing Frameworks are being developed for the KB Backend data to ensure correspondence and completeness of data as per system requirements. Data collected from the field outside of the KB system by Monitors is done with the help of the SurveyCTO tool, which also allows collection of time and GPS related information that can be verified/back checked.

Table 4. Monitoring Plan

	Narrative Summary	Indicators	Means of Verification	Assumptions
Impact	10% Increase in Immunization Completion and Timeliness	Proportion of children finishing vaccines through measles in the first year of life	Comparison of immunization completion against KB Intervention received. Data sources include: KB Backend, KB Call History Logs, Midline HH Surveys, Baseline HH Surveys	Sufficient sample size to detect difference
Outcomes	• Improvement in time to collect data • Improvement in retention of patient data • Improvement in completeness of patient data • Improvement in consistency of patient data • Improvement in validity of patient data • Increase in data-driven engagements	• Time to sync data from field to backend • Proportion of Patient Cards vs. KB Pendants retained at midline • Proportion of Patient records with corresponding Backend record • Calls made to mothers, ANMs for specific action	• KB Backend • Midline Exercise • Midline Exercise • Weekly Impact Tracker and KB Backend	Culture change among ANMs to use KB System properly and truthfully Sustainable Funding
Outputs	• 81 ANMs active on the KB App • 38 LHVs, 38 DEOs, 5 BCMOs, 5 BPMs trained on KB Dashboard and on WhatsApp Groups • 5000 mothers, 5000 children receive KB Pendants • 30,000 Voice Call Reminders sent to families • Participation in Month-end District Health Society Meetings	• # and Frequency of Nurses Syncing Data • # and Frequency of Trainings conducted • # of Patients registered • # Voice Calls Placed and Received • Number of Month End Meetings Attended	• KB Backend, Fabric.io Daily Active Users • Weekly Impact Tracker • KB Backend • KB Backend • Meeting Notes/SEEP	Stable App Stable Reports Govt Willingness
Activities	• Deployment of Khushi Baby App with ANMs in 5 blocks of Udaipur for 1 year • Deployments of Khushi Baby Dashboard and WhatsApp groups with LHVs, DEOs, BCMOs, BPMs in 5 blocks of Udaipur for 6 months • Deployment of the KB Dashboard Voice Call Reminders and Educational Calls • Field Level Monitoring and Reporting • Field and Block level training and support • KB Call Center for remote support for ANMs and individualized follow-up with concerned patients • Stakeholder Engagement at District, State, and Central Govt			
Inputs	**Technology** • Necklaces - 10,000 • Tablets - 90 • Software Development: 3000+ man-hours **Human Resources** • 15 KB Monitors • 4 Core Project Management Staff • 4 Interns + 7 Volunteers (part-time) **Funding**			

2.4. Theory of Change (ToC)

Figure 12. Theory of Change



The Khushi Baby platform's theory of change centers on using data for action for better care provision and uptake. Each element of the system has been designed to drive a chain of impact.

The Khushi Baby Pendant first and foremost is a durable health record and one that is more likely to be retained than a paper record, as demonstrated in our first randomized trial (Nagar 2016). It helps ensure that the mother and child receive the appropriate services for their given past medical history at current and future visits. These patients are able to visit any ANM using the KB application, even in areas with no connectivity, and still have accurate care provided, as facilitated by the KB App interface. In our midline survey (to be completed by end of August 2017), we will be measuring medical record retention (KB necklace vs. MAMTA card), data syncing time, and data quality (measuring number of validated fields and hand-offs). We will also obtain qualitative

user feedback from health workers and administrators on how the app and dashboard respectively have affected their workflow, and on how the Khushi Baby system can be improved.

The KB Pendant may lead to secondary effects as well. In particular, the KB Pendant may act as a social, campaignable symbol for health[30]. The same black thread used by the KB Pendant is fashioned after the black thread or *kaala dhaaga*, traditionally worn to protect the child from *buri nazaar*, or evil eye (Bhasin et al. 2007, Jain et al. 2005). Mothers and their children wearing the KB Pendant (as well as the ASHA), after coming to the camp, may have indirect effects on increasing awareness among camp defaulters, and thereby draw them in to participate in this new form of social incentive. The act of providing the KB Pendant may at the point of care build trust and familiarity between the ANM and patient by providing the ANM with an educational prop in the KB Pendant by which she can relay the importance of health records and the services availed at the camp. In particular, the idea of preventative services such as vaccines may prove difficult to convey as the beneficial effects do not manifest in supranormal conditions. However, by using a traditional symbol of prevention, the role of the vaccines may be better accepted by mothers who otherwise see their infants come down with at most a slight fever after immunization. Finally, with the KB Pendant being worn daily, it serves as a constant reminder of the health camp, and the importance of availing MNCH services.

The KB App provides clinical in-field decision making support to the nurses, facilitates faster and more accurate identification of camp attendees, motivates comprehensive and accurate data collection, and presents due-lists to maximize the opportunity for pre-camp preparation and coordination with the ASHA. These features serve to improve the delivery of services and to minimize dropouts. The largest intended effect is to incite behavior change on the part of the ANM, so that she can act against patient-specific details to provide the best care. In our ANM interviews at baseline, the majority of ANMs noted that their biggest pain points with the status quo system include spending too much time looking for records, having to carry around a bulky logbook, and doing hand calculations. By standardizing her process and saving the ANM time from referencing logbooks or looking up ID numbers, the KB app can facilitate a stronger, more detailed dialogue with the mother to improve the mother's awareness and future adherence.

The KB Dashboard serves to provide health officials throughout the chain of command in the District with specific, actionable, and timely analytics to improve community-wide health provision and uptake. The data are presented in a manner so that the health officials and supervisors may directly pick up the phone and call the concerned ANM - whether it's to address supply side shortages, low camp turn-up, poor data quality, management of high risk patients, or issues of attendance and KB app use. Over time, data is intended to be used proactively, to identify patterns associated with MNCH outcomes early on. In turn, the KB Dashboard seeks to drive behavior change among health managers, and allow them to use data to drive behavior change among the frontline health workers downstream. Finally, the KB Dashboard allows for automated voice call reminders and education in the local dialect, to increase the awareness and adherence of health behaviors among mothers and fathers alike during the MNCH period. Automated messaging systems (voice and/or SMS based) have been tested in various contexts/regions with

[30]Preliminary work has shown that our pendant has generated significant community discussion ($H=8.8796$, $df=2$, $p=0.0118$), had strong satisfaction among users ($\chi2=26.039$, $df=4$, $p<0.0001$), and resulted in increased visibility within families (grandmothers: $\chi2=34.023$, $df=2$, $p<0.0001$, fathers: $\chi2=34.588$, $df=2$, $p<0.0001$) - all properties of an effective awareness campaign surrounding immunization (Venkat 2016).

fair success and are deployed by systems like Dimagi's Commcare, Magpi, and Medic Mobile among others (Gibson et al. 2017).

The theory of change model is undergirded by not just the technological intervention, but more importantly by how the intervention is implemented. The logistics, operations, capacity building, stakeholder engagement, and human relationships developed through the partnership between the KB team and government health care agents is the necessary foundation for the intervention's intended outcomes and impacts.

2.5. Evaluation questions

Our Pre-Analysis Plan, completed in June 2016 prior to extended work with ANMs, presented an evaluation framework which sought to primarily assess the effect of the Khushi Baby System on outcomes of adherence to antenatal care coverage, institutional delivery, and timely immunization coverage against a pure status quo control, using a cluster-randomized approach with intent-to-treat analysis. Peripherally the PAP suggested a process analysis for qualitative understanding as well.

Evaluating the impact of any intervention on aforementioned health behavior outcomes requires trusting the data source. For child immunizations, data comes in multiple (problematic) forms: whether the infant has a scar on the left shoulder (specific, but not sensitive for the BCG vaccine), the mother's oral recall of her and her child's past medical history (confounded by poor health literacy and recall), the Birth Certificate of Hospital (suggestive but not confirmatory of the child having received BCG, HepO, and OPV vaccines), the MAMTA card (which may be unfilled, lost, or kept by the ANM), the ANM's RCH register (fraudulently backfilled, confounded with poor patient identification processes), and PCTS backend (where data discordance has been observed against the RCH register linelist).

The methodology of referencing the mother's health card (filled by the ANM) and taking an oral history, may be the current standard of practice. Gold standards to confirm this data via antibody titers are infeasible due to resource and cultural constraints. Without accountability of the data source, the current standard practice for evaluation, as we see it, is not only grossly inadequate but critically misleading in light of the observed deficits.

As a result we have been prompted to reevaluate our evaluation framework itself, heavily focusing on the process this time. The result has been an approach that serves as a meta-evaluation to understand intervention vs. status quo data data quality, a priori to concerns of whether or not the intervention can change health behavior outcomes.

In evaluating this theory of change and the potential of the KB System to provide value, we are investigating the following guiding questions:

Q0: Does the KB system function robustly

- Q0A: does the technology platform work?
- Q0B: Is the system adopted by the intended stakeholders?
- Q0C: Is the system timely?
- Q0D: Is the data retained within the system or lost?

Q1: Can the KB system improve the quality of data collected for rural maternal and child health care? We will compare KB against the existing paper based tracking system, but the differences may also be applicable to other mHealth systems such as ANMOL should they prove to be as deficient in accountability over their data.

Q2: Given that the KB system works, and results in higher data quality, does the data generate value or remain unused? Specifically, does the KB system generate differentiating data-driven engagement for better health care delivery and community engagement? And in what way does it generate change among health workers?

Q3: Does the KB system (social engagement of Pendant, voice call reminders throughout pregnancy and infancy, data-informed engagement of ANM, ASHA, health admin) trigger behavior change among mothers so that the child fully vaccinated through measles (opv 1-3, penta 1-3, measles) and if so, what elements of the KB System may play a significant role?

3. Methods

3.1. Evaluation Design & Timeline

The following Evaluation Framework (Table 5) has been conceived tologically gauge the system's value add, beginning with functionality and ending with effectiveness towards health behaviors. The functionality of the system and the reliability of data serve as both process outcomes and preconditions to the final intended impacts on health outcomes.

Table 5. Evaluation Framework

Outcomes / Objectives	Design	Analysis Framework
KB System Functionality	Longitudinal	Key Performance Indicators
Patient Record Retention	cRCT (stepped wedge)	Logistic Regression on binary outcome
Data Completeness	cRCT (stepped wedge)	Logistic Regression on proportion outcome
Data Consistency	cRCT (stepped wedge)	Logistic Regression on binary outcome
Data Validity	cRCT (stepped wedge)	Qualitative Process Mapping
Use of Data for Action	Longitudinal	Key Performance Indicators
Health Worker Attitudes and Behaviors	Pre-post Treatment vs. Control	Descriptive Stats / Cross Tabulation, Qualitative Feedback
Full and Timely Immunization (FICT)	Prospective Cohort of Treatment Group	Logistic Regression to assess effects of various intervention components

Note: For Evaluation Timeline, see Supplemental Figure 3

3.1.1 KB System Functionality

Khushi Baby proposes a novel technological intervention in the context of remote, rugged settings for the purpose of this impact evaluation. This technology platform in its current form has never undergone previous testing at the scale of the current deployment. Should the technology platform be rendered non-functional at any point during this process, there would be nothing left to evaluate. Therefore, assessing the technology platforms functionality is a prerequisite for subsequent outcomes. Also of note, the Khushi Baby intervention, as a technology platform, is one that is not traditionally fixed from the onset of a formal evaluation. Instead, the platform is forced to adapt to feedback from the field, to standards set by stakeholders, and outstanding deficits hindering the system's normal functioning. Therefore, assessing the technology platform's functionality requires ongoing, longitudinal follow-up.

All 87 ANMs, working in the study's 81 Subcenters operating the KB platform (Treatment Subcenters), will be included in this follow-up. Follow-up data on Key Performance Indicators will be captured remotely via automated data collection tools and from weekly reports made by the KB Monitoring Team. The analysis framework comprises descriptive, longitudinal data on Key Performance Indicators, which include: frequency of defective KB Pendants, frequency of defective Tablets for ANMs, frequency of KB App crashes, and total time required to sync data for records created from the field to the KB backend. Specific hypothesis testing will not be performed. Trends in data will be qualitatively described with respect to operational milestones. Milestones could include deployments of new KB App modules, ANM block level trainings, tablet replacement drives, and KB Backend deployments.

Table 6. Key Performance Indicators for Khushi Baby Platform

Key Performance Indicator	Data Source
KB Pendant Defects	KB App - KB Backend
Tablet Defects	KB Field Monitors
App Crashes	KB App - Fabric.io Backend
Total time to sync	KB App - KB Backend

3.1.2 Patient Record Retention

The hallmark of a maternal and child health tracking system begins with patient awareness of their own medical history. Medical history informs approaches to management. Medical history is captured in a health record for the patient to avoid challenges of poor recall and poor health literacy. Without a copy of the patient record with the patient, data is not effectively retained by the system, which must by principle accommodate for patient and health worker migration alike. Patient record retention is also a prerequisite to assessing any downstream outcomes of interest in the context of evaluating the intervention. Therefore, we will evaluate whether the mother having the Khushi Baby Pendant (instead of the the status quo paper MAMTA card) significantly increases the probability of the patient retaining her record[31], independent of confounders, and if so, by how much.

Mothers who will assist in this analysis will be selected from the Enrollment Sample (see 3.2.1), from both treatment and control groups. Mothers will be included in the analysis if two criteria are met: they report that they have attended one MCH camp since Enrollment[32] and they report having received an MCH record for their respective group. Mothers in Treatment subcenters will need to have received a Khushi Baby Pendant, and mothers in Control subcenters will need to have received a MAMTA card. A midline sample of the Enrollment Sample in each group will be

[31] Given that the mother is generally the primary caregiver, the mother and child record are both provided to the mother during village-based MCH camp

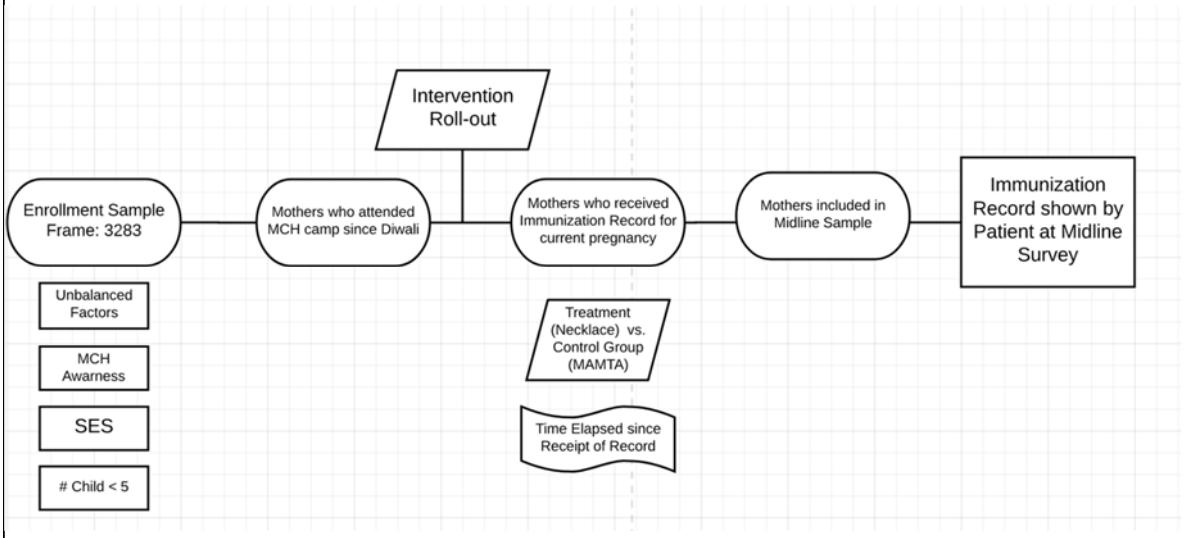
[32] Proxied by asking whether the mother has attended a camp since Diwali, a major festival and mental landmark for the required recall, during the midline survey

approached at the household level during the midline exercise until the required sample sizes have been reached.

Sample size requirements for midline analysis have been determined using the following criteria for a 2-sample Z-test for proportions: alpha = 0.05, power = 0.80, assumed true population proportion of retention of Treatment = 0.90, assumed true population proportion of retention of Control = 0.8.[33] To adjust for the clustered design which introduces homogeneity in the Enrolled Sample (thereby underrepresenting the Sample Frame of the 162 Subcenters included), a design effect of two is applied. The sample size requirements therefore are 394 mothers who meet the inclusion criteria in both Treatment and Control. This sample will be selected from the Enrollment Sample using a systematic sampling approach until the target number of respondents have been reached at the household level.

Mothers approached at the household level will be asked to show their MCH record, which will be coded as a binary outcome. Mothers will also be asked about the time that has elapsed since receipt of the record. A logistic probability regression model on this retention outcome will be constructed to include the following factors: individual factors of the mother collected at baseline, study group, and time elapsed since receipt of the record. The causal relationship between Treatment group on the retention outcome will be assessed, after accounting for confounders, for both statistical significance and effect size.

Figure 13. Schematic for Patient Record Retention Logistic Probability Model



The figure above describes the Midline sample selection process for the Patient Record Retention outcome. Patient Record Retention will depend on: treatment vs. control group, unbalanced factors between treatment and control, MCH Awareness and SES Indices of the mother, the number of children the mother has under the age of five, and the time elapsed since receipt of the record.

[33] These figures have been derived from Khushi Baby's first RCT in rural Udaipur from 2015-16

3.1.3 Data Completeness

Data completeness refers simply to the proportion of required fields of information present on the Patient Record. Mothers who have MAMTA cards of KB Pendants with incomplete information may not receive the specific care they need from the ANM, or for that matter essential reminders from the KB Voice Call System to encourage future follow-up.

Data completeness must be defined in relation to the type of patient: mother or child. For the mother, 20 required fields include Identification fields at the time of registration, and checkup information for the first antenatal care checkup which takes place at the time of registration. For the child, 12 required fields include identification fields at the time of registration, status of any due vaccines recorded with their dates (or explicitly marked as not received as opposed to left null), status of any pneumonia or diarrhea in the past two weeks (true or false), and the breastfeeding status of the mother.

Two outcomes will be considered in this analysis: mother data completeness and child data completeness. Mother data completeness is defined as a proportion and will measure the total number of required fields among all mothers which are non-null (completed) over the total number of required fields among all mothers. The corollary is true for child data completeness.

Study Group (Treatment vs. Control) will be used as the independent variable, and a 2 Sample Z test will be performed to see what proportion of total records in each group and for each Patient Group are marked as complete. Given that the Treatment and Control groups were clustered, to account for the homogeneity introduced by clustering, a design effect of two will be applied when considering the required sample size. For an alpha of 0.05, power of 0.8, and expected True Population Proportion “Complete” for Treatment at 0.75, and True Population Proportion “Complete” for Control at 0.5, the required sample size per Patient Group (mother and child) and per Study Group is 110.

It is likely that this sample size will not be reached for the Mother group, as most mothers from the Enrollment Sample were not introduced to the KB Pendant during their pregnancy. Therefore few mothers will have KB Pendants with their antenatal care history recorded. Instead the vast majority of mothers received the KB Pendant when registering their child (due to the delay in intervention roll-out from the time of the Enrollment exercise). That being said, analysis for the mother outcome can draw from the entire KB Backend which serves as a proxy for the Mother’s record completeness.[34] The proportion of complete required fields among the group of KB Backend mothers (out of total mothers on the KB Backend) would be compared to the proportion of complete required fields among those Control Mothers from the Enrollment Sample, visited during the Midline Exercise, who present their MAMTA card at the time of survey. Mothers without their MAMTA card will be excluded from the analysis frame.

For the child outcome, comparison of the record completeness will be derived from household data collected during the Midline Exercise for both Treatment and Control groups in the

[34]Drawing from the Backend Data could introduce sources of confounding due to unmeasured covariates in the Treatment Group derived from the backend. That being said, the clustered randomization procedure assigned Treatment vs. Control at the SC level, so exposure to the Treatment would be similar for Mothers within the same SC, even if those mothers were not part of the original Enrollment Sample

Enrollment Sample. Again, any children who are missing their Patient Record altogether will be excluded as completeness cannot be verified.

Unadjusted odds ratios will be calculated to assess the increase in likelihood of a required field being complete for each patient, for each Study Group. Furthermore, a logistic probability regression model on this data completion outcome will be constructed to include the following factors: ANM education, ANM years worked, Patieng Group, and time elapsed since receipt of the card by the mother . The causal relationship between Treatment group on the data completion outcome will be assessed, after accounting for confounders, for both statistical significance and effect size.

Table 7. Minimum Required Fields[35]

Group	Required Fields
Mother	Name, Husband Name, Age, Phone Number, Village, Date of Registration / ANC 1, Last Menstrual Period (LMP), Total Number of Pregnancies, HIV Status, Total IFA Tablets Given, ANC 1 Weight, ANC 1 Hb, ANC 1 Sys BP, ANC 1 Dias BP, ANC 1 Urine Albumin Status, ANC 1 Urine Sugar Status, ANC 1 Blood Sugar, ANC 1 Fundal Height, TT1 Status (Date Given or 'not Given'), TT2 Status (Date Given or 'not Given')
Child	Sex, Mother name, Date of Birth, Birthweight, Date of Registration, BCG Status (Date Given or 'not Given'), HepB0 Status (Date Given or 'not Given'), OPV0 Status (Date Given or 'not Given'), Pentavalent 1 Status (Date Given or 'not Given'), Exclusive Breastfeeding Status of Mother, Any past history of pneumonia (yes/no), Any past history of diarrhea (yes/no)

3.1.4 Data Consistency

Data consistency for our purpose is defined as presence of the patient record in all places where the data is saved or retrieved. Specifically, our concern is whether Patient Records in the field have a corresponding record in the Backend Database (“Forward Match”), and vice-versa, whether patients registered in the Backend Database have a corresponding record on their person (“Backward Match”).

In order to determine whether a match is present between two data sources, in this case the Patient Record and the Backend record, a unique ID is required. For the purpose of this analysis Unique ID criteria can be fulfilled if the record to be matched has either a PCTS ID, AADHAAR ID, or KB Registration ID (only applicable for KB Pendants). The PCTS ID is uniquely generated by the PCTS backend for each new mother registration on the basis of their eligible couple number (a serial number given by the ASHA line-listing the pregnant women in a given village) geography, and time of registration. The PCTS ID however, cannot be generated until the line-listed report of mothers has been entered into the PCTS portal by the DEO at the end of the month. The DEO has until the 10th of the following month to make any changes to the updated Patient Record.

[35]The majority of required fields are mandatory for the patient to be created on the app-side; some fields such as Phone Number, TT2, and Fundal Height are not required for mother, and BCG Status, HepB0 Status, and OPV0 Status are not required in the creation of the Child from the user interface.

We will measure two outcomes for data consistency for both Mother and Child records: Forward Match Proportion (FMP) and Backward Match Proportion (BMP). FMP is assessed by starting with a denominator of Patient Records. For each patient record, the Unique ID will be taken, and used to search in the Backend Record. For Treatment, the KB Registration ID will be taken by scanning the KB Pendant to be searched against the KB Backend. For Control, the PCTS ID and/or AADHAAR ID will be taken and searched against the PCTS Backend. Cards without either ID present will automatically be categorized as a non-match. The proportion of matches will be calculated for each Study Group and for each Patient Group.

Conversely, for BMO, the total proportion of patients, who are identified from the Backend first, who have corresponding unique IDs on the corresponding Patient Record at the household level, will be calculated.

Selection of the sample for FMP for midline analysis will involve a systematic sampling from the Enrollment Sample. Households will be visited until the target sample size is reached. Patients without their Patient Record will be excluded. FMP may not be possible to calculate for Mothers in the Treatment Group, as many of them never received the KB Pendant (only their children did once the intervention was rolled out). FMP will be calculated for children records in the Treatment Group and Control Group.

For BMP, the sample frame will be the KB Backend and PCTS Backend for control and treatment respectively, again using a systematic random sample. Here both Mother and Child Groups will have their BMP calculated. Assuming an alpha of 0.05, power of 0.80, True Population FMP Child for Treatment of 0.90, and True Population FMP Child for Control of 0.50, 34 Children Records will need to be evaluated for Treatment and Control during the Midline Exercise. The same assumptions hold true for BMP Mother Treatment/Control, and BMP Child/Treatment and Control. Unadjusted odds ratios will be calculated to assess the increase in likelihood of a Patient Record having a corresponding Backend Record due to the effect of Study Group. We will run logistic probability regression on this data consistency outcome; in this case the outcome will be a proportion. We will account for the following factors in the model: ANM Education, ANM years worked, Patient Group, and time elapsed since receipt of the patient record. The causal relationship between Treatment group on the data consistency outcome will be assessed, after accounting for confounders, for both statistical significance and effect size.

3.1.5 Data Validity

Data validity aims to assess to what degree the data collected reflects the patient's' true medical histories. Data validity can be compromised if ANMs manipulate data, if instruments to record data function improperly, or if data is misentered by the ANM or DEO. Unfortunately, means to confirm already entered data are limited. Data input validation techniques can be used to flag data points which cannot be accurate. Similarly, statistical methods can be used to flag outliers or clustered patterns that warrant further investigation. The difficulty in the data-driven approach is to assess whether a value in the normal range is in fact an accurate representation. Given the numerous fields that are collected, some fields may be valid while others may not.

Our approach to assess data validity will be qualitative and focus on ANM behaviors. We will conduct camp level observations for each of the 81 Treatment and 81 Control ANMs. These observations will examine the data recording processes conducted at the field level according to protocols. Known areas of concern will be quantified - for example, instances of the ANM entering urine test values without conducting a urine test or BP values without taking the mother's BP (See Supplemental Table 5).

Qualitative process mapping will also be conducted via key informant interviews with LHVs, DEOs, BPMs, BCMOs, and the CMHO. Through this process, gaps in data quality arising in both Control and Treatment arms will be examined. Ten percent of each respective group of stakeholders will be included for the key informant interviews. Interviews will continue until thematic saturation.

Finally, descriptive analyses will be performed on the KB Backend dataset for fields prone to manipulation - BP, birthweight, and urine sugar and albumin and for fields prone to duplicacy - PCTS ID and phone number. Fields prone to manipulation will be assessed for their distributions and variances and fields prone to duplicacy will be assessed for the number of duplicates present.

3.1.6 Use of Data for Action

Data may be timely, retained, consistent, and of good quality, but ultimately value of data is only achieved when data is used for specific actions. We aim to assess use of data for action within the key informant interviews mentioned above. We further aim to assess use of data for action by tracking engagements specific to the Treatment Group on a weekly basis. Key indicators to be tracked longitudinally include:

1. WhatsApp Group Messages for Specific Actions,
2. Number of Trainings given to ANMs, LHVs, BCMOs, and DEOs,
3. Number of Automated Voice Call Reminders Placed and Received by Pregnant Women,
4. Number of Automated Voice Call Reminders Placed and Received by Mothers of Newborns (bifurcated by sex of the child),
5. Number of calls to an ANM placed by the BCMO/LHV for equipment issues,
6. Number of calls to an ANM placed by the BCMO/LHV for Medication or Vaccination Stock-outs,
7. Number of Calls to an ANM placed by a BCMO/LHV for High Risk Mothers,
8. Number of Calls to an ANM placed by a BCMO/LHV for High Risk Children,
9. Number of KB Call Center calls placed and received by mothers due for delivery,
10. Number of KB Call Center calls placed and received by High Risk mothers or mothers with high risk children's,
11. Number of KB Call Center calls placed and received by Dropout Mothers, or mothers with children who are dropouts,
12. Number of Supervisory Sessions held at low performing camps, and
13. Number of Focus Groups held with poor performing ANMs.

Specific hypothesis testing will not be performed. Trends in data will be qualitatively described with respect to operational milestones. Milestones could include deployments of new KB App modules, ANM block level trainings, tablet replacement drives, and KB Backend deployments.

3.1.7 Health Worker Attitudes and Behaviors

Health worker attitudes and behaviors are thought to mediate both the outcomes relating to data and health behavior change on the part of the mother (Swider et al 2002, Rahman et al 2008). Health Worker Behaviors will be captured in the ANM Camp Observation Checklist Survey for all 81 Treatment and 81 Control ANMs.[36] Health Worker Attitudes will be captured at baseline and at Endline with separate ANM Baseline and ANM Endline surveys. Descriptive statistics will be performed on qualitative indicators without hypothesis testing. Difference-in-difference for proportion of ANMs who rate record keeping as the hardest part of their job from baseline to Endline for Treatment vs. Control may be assessed as an ad hoc analysis, depending on if ANM turnover is negligible. Open ended audio responses will be taken for select questions in the ANM Baseline and Endline Surveys and assessed qualitatively for thematic generation.

3.1.8 Full and Timely Immunization Coverage

We had initially set out to measure the effect of our intervention (designed to improve community engagement) on improving full immunization coverage and timeliness (FICT) among infants using a cRCT design with intent-to-treat analysis. Given the limitations of trusting the data available in the control group and the limitations in making comparisons between outcome data between two distinct sources, we are now limited to seeing the effects of the intervention within subgroups of the Treatment group, in which our data quality can be traced and maintained.

The prospective cohort to be followed for the revised FICT analysis will be based off the entire Enrollment Sample of mothers in the Treatment group (1644 Mothers). Inclusion will require that the Enrolled mother must have at least one child who has been registered in the KB System at a Treatment camp. Exclusion criteria include: any mother with children who have already received PENTA 1 before registration in the KB System, any mothers who have had children die before the 180 day endpoint, and any mothers who have migrated. Sample size calculations to determine effect sizes of the intervention specific variables were not conducted *a priori*.

Full Immunization Coverage and Timeliness can be divided into two endpoints: children who have received BCG, OPV 1-3, PENTA 1-3, and Measles by 1 year of age (FICT1) and children who have received BCG, OPV 1-3, PENTA 1-3 by 180 days (FICT2).

Variability in intervention delivery and uptake of the intervention can be measured through various indicators: number of KB Voice Calls received, type of KB Voice Calls received (specific automated calls or specific manual calls), and whether the KB Pendant had ever been lost. Differences in confounders measured at baseline and midline, from both mother and ANM survey

[36]ANM Camp Observation Checklist Survey is also used for assessing Data Validity and Use of Data for Action Outcomes

exercises, would also be applicable to understanding the FICT1 and FICT2 outcomes (Supplemental Figure 4).

A logistic regression model will be used to assess the differential effect of the components of the KB Intervention (Type and Number of Automated Voice Calls, Type and Number of the Individualized Manual Calls, and Retention of the KB Necklace) on the probability of the outcomes (FICT1 & FICT2) after data collection in the Endline Survey Exercise. We will consider the following confounders: mother-specific variables (e.g., MCH Awareness[37], number of childer under 5), ANM-specific variables (e.g., education), AHSA-specific variables (e.g., frequency of ASHA visits, number of PNC visits), KB necklace retention, voice-call variables (e.g., number of voice calls, types of voice calls), block, and cancelled camps.

3.2. Primary quantitative and qualitative baseline surveys

3.2.1. Sampling

Enrollment Sample

Selection of Clusters

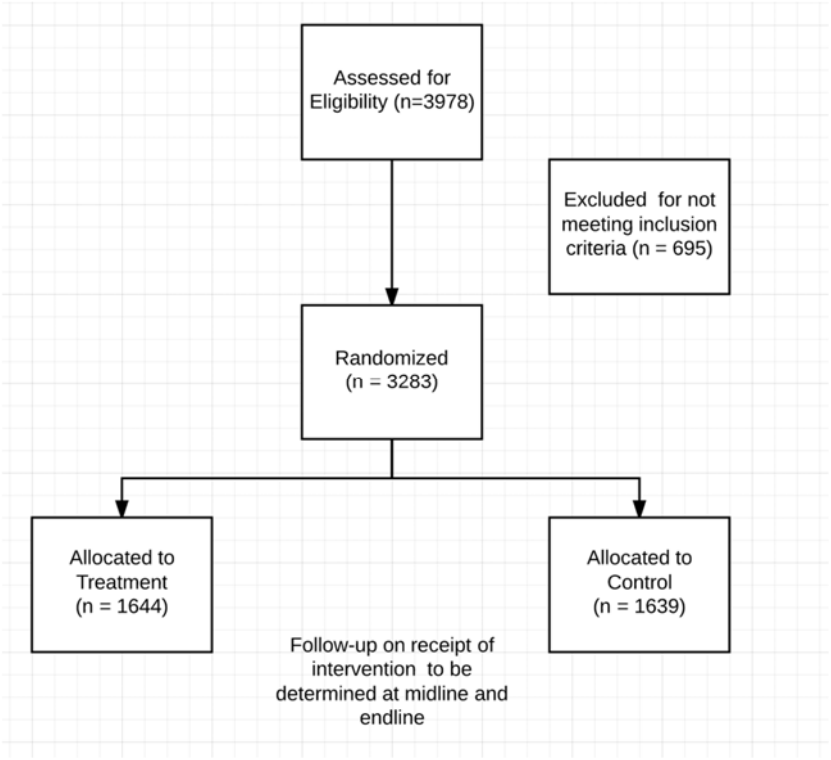
In Udaipur there are 627 SCs across 12 administrative Blocks. SCs where Khushi Baby 1.0 had been rolled out in 2015-16, and SCs with other interventions such as E-Jan Swasthya, another mHealth pilot were excluded. The SCs were further narrowed by the CMHO who allotted 5 administrative blocks from which we could select our Treatment group. Of the remaining 252 SCs, 162 were selected using a random number table. The list of 162 was approved by the CMHO in August 2016. The 162 SCs were randomized to the KB Intervention and Control groups using a stratified randomization with blocking. Randomization was stratified on baseline full immunization coverage (FIC), as determined by PCTS for the 2015-16 Financial Year across three levels: “high performing SCs” had a reported FIC of 90%+; “mid performing SCs”:60-90%; and “low performing SCs”: below 60%. Randomization checks were performed to ensure balance on the stratification factor. Randomizations were run until the difference in the stratification factor was no longer statistically significant between arms. The 81 SCs randomized to Treatment were then scoped by the KB Monitoring Team to gather ANM contact details. ANMs who were subject to retire or transition were excluded.

Selection of Beneficiaries to Follow

For each Control and Treatment SC, pregnant women lists were obtained from ANMs (“linelisting”). Each mother in the line-list was visited at the household and individually invited to participate. This census based approach was used in order to avoid selection bias from sampling within SCs, and to ensure enrollment of mothers from all villages serviced by the SC. The target for enrollment per SC was 20 pregnant women. If the target could not be reached by recruitment of mothers on the linelist, mothers in the same village but not on the original linelist were invited to enroll. Mother who had already delivered were excluded. Mothers not available at the household at the time of visit had their households revisited once.

[37] Post hoc analysis using Endline MCH Awareness Index will also be considered in the regression model

Figure 14. Selection and Assignments of Beneficiaries for the Enrollment Sample



Baseline Coverage Evaluation Sample

Of the 162 SCs chosen for the study, 50 Treatment and 50 Control SCs were selected using a random number generator procedure on STATA. Linelistings were obtained for all children age 12-23 months from each of the 100 selected SCs.

As per 30 Cluster Sampling Guidelines from the WHO, a required sample size of 13 respondents were required per SC (level of clustering), in order to have 95% CI, 5% margin of error, with an assumed true population baseline of Full Immunization Coverage of 70% (WHO 2005). Systematic random sampling was conducted within the SC linelistings to determine which households to visit, and the process was repeated until the target number of 13 was reached in each SC. Post hoc analysis shows 12.43 respondents were achieved per SC on average.

ANM Stakeholder Sample (Baseline / Endline)

All ANMs serving the 81 Treatment and 81 Control Subcenters were selected for the ANM Stakeholder Sample (at Baseline). 166 ANMs in total were surveyed: 88 Treatment and 78 Control. While ANM: Subcenter generally should be 1:1 in ratio, the discrepancy can be attributed to ANM turnover and differences in SC size.

ASHA Stakeholder Sample (Baseline / Endline)

A convenience sample of 2 ASHAs was attempted for each of the 81 Treatment and 81 Control SCs. Each SC has approximately 4-5 Villages serviced, each of which has an ASHA.

ANM Camp Observation Checklist

All ANMs serving the 81 Treatment and 81 Control Subcenters will be included in this sample to assess the ANM workplans with and without the KB App for sake of monitoring Health Worker attitudes, behaviors and data validity.

Midline Samples

Control

The original Enrollment Sample frame for Controls (1639) was systematically sampled to achieve a target greater than 394 for the purpose of the Patient Record Retention Outcome. This same cohort will be used for the purpose of FPM and Data Completeness outcomes, both of which require a smaller sample size. BPM Outcome will systematically PCTS backend respectively, with exclusion criteria to avoid double counting a given respondent for both FPM and BPM outcomes.

Treatment

All Treatment households will be revisited at midline to continue midline variables required (and those variables missed at baseline), for the Endline analysis on FICT outcomes. This midline sample will also be used for Patient Record Retention, FPM, and Data Completeness outcomes. Mother Data Completeness and BPM outcomes will systematically sample from KB Backend Datasets as described earlier.

Endline Samples

The endline sample consist of all Treatment households from the Enrollment Sample to gather data relevant for FICT, Patient Record Retention, and FPM outcomes. The endline control sample will consist of all Control households from the Enrollment Sample to gather data for Patient Record Retention and FPM Outcomes. If midline analysis shows significance for FPM, only FICT and Patient Record Retention will be assessed at endline.

ANM Stakeholder Survey (Baseline/Endline)

Key Informant Interviews were conducted for all Treatment and Control ANMs for Baseline. All nurses in the sample frame were included for stakeholder interviews at baseline, and will be included at endline (n = 163). Treatment nurses will be included for ongoing observation and supportive supervision. Open-ended questions were posed, with surveyors selecting multiple answers corresponding to the complete response provided. Voice recordings were also collected for certain questions.

ASHA Stakeholder Sample (Baseline/Endline)

Key Informant Interviews were conducted for ASHAs. A convenience sample of 2 ASHAs per subcenter was collected for pre- and post-intervention interviews (n = 315). Open-ended questions were posed, with surveyors selecting multiple answers corresponding to the complete response provided. Voice recordings were also collected for certain questions.

LHV, DEO, BPM, BCMO Sample

Key Informant Interviews were conducted for LHVs, DEOs, BPMs, BCMOs. In total, 38 LHVs, 38 DEOs, 5 BCMOs, 5 BPMs, and the CMHO are involved with the KB Intervention but also oversee

areas with Control SCs. 5 LHVS, DEOs, BCMOs, and BPMs (one from each administrative block) and the CMHO will be taken for a key informant interviews

3.2.2. Survey instruments

Enrollment Survey

The purpose of the Enrollment Survey is to select the cohort of mothers to be followed for our analysis on the effects of the KB Intervention on various outcomes. The Enrollment Sample, derived from the Enrollment Survey is used to assess outcomes for: Data Retention, Data Completeness, Data Consistency, and Full Immunization Coverage and Timeliness. The Enrollment Survey collected important baseline indicators regarding mother SES, mother MNCH awareness, and past medical history which could serve as relevant covariates in models for the aforementioned outcomes.

Baseline Coverage Evaluation Survey

The purpose of the Baseline Coverage Evaluation Survey was to assess the health indicators for the average mother in the Control and Treatment groups respectively.

ANM Baseline and Endline Stakeholder Survey

The purpose of the ANM Baseline Survey was to assess behaviors and attitudes to the data collection process for maternal and child health tracking, and for the work they perform in general. Structured questionnaires were deployed to assess: challenges, motivations, workflows, work conditions, as well as individual factors of the ANM such as familiarity with mobile phone and years spent in training.

ASHA Baseline and Endline Stakeholder Survey

The purpose of the ASHA Baseline Survey was to assess behaviors and attitudes towards maternal and child health tracking from the perspective of the ASHA who plays a key role in recruiting mothers to the camps and in coordinating with the ANMs. Structured questionnaires were deployed to assess: challenges, motivations, workflows, work conditions, as well as individual factors of the ASHA.

LHV, DEO, BPM, BCMO Key Informant Interview (pre-Endline)

The purpose of this survey is to assess the behavior change among health workers and officials in response to the KB system. Semi-structured survey will be conducted with free response questions to be collected in the form of audio. In addition, KB Core Staff will have the opportunity to deviate from survey questions and follow-up on observations or indications highlighted by the Stakeholder.

3.2.3. Survey implementation

Surveys were conducted by the team of KB Surveyors and Monitors, who were contracted from A to Y Manpower Agency. Recruitment of KB Monitors with requirements of prior experience conducting field work and surveys on smart devices. The native village of the interviewees was also taken into account and selection was in part made to ensure that geographic distribution of KB Monitors would be optimized.

Enrollment and Baseline Coverage Evaluation were conducted in parallel by a team of 335 Surveyors (with 6 Supervisors). A team of 4 Core Project Staff supervised the training and appointed the Supervisors. A two day training session was held at the Vishwas Sansthan foundation. Presentations on field work, research objectives, and ethics were conducted. Trainings were conducted at the large-group, small group, and individual level. Roleplays for specific situations were also performed for the large-group setting. Field Plans, Study Protocols, and Process Measures for the Baseline Coverage Evaluation and Enrollment Exercises can be found in the Appendix.

The Baseline Survey Exercises were implemented in a campaign mode, with surveyors conducting household interviews for 2-3 weeks at a time before taking a day off. The initial two days of the survey launch was reserved for survey piloting and modification. After approval, the main phase of the Survey Exercise would commence. Daily surveyors would meet at the Vishwas Sansthan center to submit their individual tracking sheets, which were appropriately aggregated centrally and compared against the upsynced data from their tablet devices from which the Survey CTO responses were collected. Core Project Staff conducted back-checks and spot-checks throughout the process to ensure data quality at the point of collection. Core project staff assessed and flagged missing data, duplicated data, and misentered data during a data cleaning process which was concurrent with the survey exercise.

The ANM Baseline, ASHA Baseline, and ANM Camp Observation Survey Exercises were conducted by a separately contracted team of 17 KB Monitors. These monitors were hired on the basis of prior field work and geographical allocation to take up responsibilities extending beyond surveying into full-spectrum monitoring and evaluation at the field level. The ANM Baseline exercise was conducted by Core Staff and KB Monitors during the training session (after piloting the survey with non-study ANMs), with follow-up or missed surveys at the block and subcenter level. The ASHA Survey Exercise and ANM Camp Observation Checklist Survey Exercise were both conducted at the camp level. ANM Camp Observation Checklist Surveys were also conducted on off-camp days with a follow-up to complete camp-specific questions on Camp Days. KB Monitors would report daily microplans according to the KB Monitor in charge for the Block on the KB Monitors WhatsApp Group to the Core Project Staff. Weekly meetings would take place at KB HQ to go over the Surveyor Tracking Sheets. Beyond these Survey exercises, the KB Monitors were dually responsible for providing supportive supervision to the ANM Staff, noting significant camp experiences, providing extra trainings, engaging with community members and health staff, obtaining details for daily logistics, following up with particular cases of technological failure, and assisting in delivery of intervention components to the ANM. Back-checks and spot-checks were conducted by Core Project Staff on a random basis. Data quality was assessed for duplicates, improper entries, and missing values to inform revisits with the use of advanced Excel functions such as pivot tables and filters.

Midline surveys of the Enrollment Sample will be conducted by the KB Monitoring Team. Additional surveyors may be recruited for the process of the Endline Survey Exercise for the additional volume of household visits. KB Core Project Staff will be responsible for collecting the Key Informant Interviews with LHVS, DEOs, BPMs, BCMOs, and the CMHO.

3.2.4. Techniques of qualitative data analysis

Formal Analysis software was not used to transcribe and code the qualitative data (primarily collected during the ANM Baseline Survey). For the purpose of the Baseline Analysis, representative quotes, sufficient in detail and description were selected and organized according to themes. Approximately 20% of the sample of ANM voice messages (163 ANMs surveyed, with 5 audio free response questions) were examined, transcribed, and categorized. This sample was randomly selected and the process was continued until saturation was reached. Corrupted audio files or messages without less than 10 seconds of voice were discarded during the selection process.

3.3. Secondary data

3.3.1. Administrative data

Administrative Data was used from PCTS to determine the strata for the randomization procedure.

ANM Diaries and the RCH Registers were used to identify mothers in the Enrollment and Baseline Coverage Evaluation Samples.

3.3.2. Secondary survey data

Not Applicable

3.4. Ethics

Describe the measures taken to ensure ethical research across each stage of the evaluation process, including but not limited to IRB approval and having explicit means for reporting and redressing ethical violations (See Appendix).

IRB approval from CORT Vadodara was obtained in July 2016. Oral consent was obtained from all study participants at the beginning of each survey process. Signed consent forms were also obtained for the Enrollment Survey and Baseline Coverage Evaluation Surveys (See Appendix). KB Monitoring team has been instructed on code of conduct in the field and on how to report any adverse events to the Core Management team should any event occur as a result of the KB Pendant or Voice Call from the Intervention. Study participants are given the phone number of the PI and have the ability to withdraw their participation at any time.

3.5. Limitations of data collection and challenges faced

Obtaining an accurate baseline coverage estimate of full immunization proved challenging; the full immunization coverage estimate obtained from our baseline study is far from and much lower than the estimated true population parameter value, suggesting that there was poor oral recall of which immunizations were given among mothers surveyed. In addition, because such a large number of villages (548) needed to be covered in the enrollment process, there was some confusion among surveyors with the entry of survey geography codes into the SurveyCTO app. The survey codes had to be readministered and training of surveyors was readjusted to avoid such an incident in the future.

Aside from these data collection issues, coordinating the baseline exercises in the field was difficult, as there were multiple survey exercises going on at once. The team had to keep organized by keeping detailed tracking sheets and meeting with the monitors every evening for 2-5 hours to review what work was done.

Lastly, there were some physical barriers and communication barriers that posed a challenge during this baseline exercise. Firstly, many of the pregnant women in our catchment area (roughly 20-30%) resided with their parents during pregnancy; at times, this proved difficult as those surveyed were sometimes shy to respond with others around or would be influenced by the presence and input of others in the household. Moreover, it was difficult for surveyors to speak with the pregnant women alone as many households would not allow for a private interview without another household member present. Lastly, getting to respondents' homes was a challenge in itself, as surveyors often had to traverse difficult terrain and walk 4-5 km at a time.

4. Findings from the baseline surveys

4.1. Description of the quantitative sample

Baseline Coverage (Mothers)

Table 8. Baseline Coverage Survey Results by Treatment and Control

Baseline Indicators for Mothers	Treatment (n = 631)	Control (n = 612)
Percentage of mothers able to reproduce their MAMTA card (pregnancy and infant immunization card)	52.5%	49.2%
Percentage of mothers who did not have their MAMTA card (all had received it in the past)	90.0% ·37.4% lost the card ·56.7% reported that the ANM, Anganwaadi worker or ASHA had their card	92.5% ·42.6% lost the card ·52.9% reported that the ANM, Anganwaadi worker or ASHA had their card
Percentage of mothers who reported completing at least 4 ANC visits	17.4%	16.2%
Percentage of mothers who reported having received at least 2 Tetanus shots	86.8%	89.8%
Percentage of mothers who reported seeking care at a higher facility during pregnancy	16.8% [38]	16.2% [39]
Percentage of mothers who were within 1 km of their usual immunization camp	55.2% (95.0% attend the camp by walking)	68.1% (95.3% attend the camp by walking)
Percentage of mothers who reported going hungry at least once during pregnancy	5.0%	4.0%

[38]Reasons for hospitalization included vomiting (22.1%), pain in genitals (17.3%), anemia (15.4%), edema (6.7%), cramps (6.7%), and bleeding (1.9%). For the most part, mothers attended the CHC (48.1%) or PHC (17.3%) for follow-up care. Mothers also sought care at private hospitals (13.4%), the Udaipur District Hospital (10.6%), at the subcenter (7.7%) and at private clinics (5.8%).

[39]Reasons for hospitalization included vomiting (28.9%), pain in genitals (21.7%), anemia (14.4%), edema (11.3%), and cramps (8.3%). For the most part, mothers attended the CHC (37.1%) or PHC (27.4%) for follow-up care. Mothers also sought care at private hospitals (13.4%), the Udaipur District Hospital (10.3%), at the subcenter (6.2%) and at private clinics (4.1%).

Proportions mentioned as +/- 5% according to 30 Cluster Sampling Guidelines from WHO.

Baseline Indicators for Mothers	Treatment (n = 631)	Control (n = 612)
Percentage of mothers who reported having a home live birth for their past pregnancy	14.8% [40]	13.0% [41]
Percentage of mothers who reported feeding the baby with colostrum	88.4%	90.7%
Percentage of mothers who had their newborns taken to the hospital	14.5%	11.2%
Percentage of mothers who exclusively breastfed until at least 6 months of age	53.2%	51.8%
Percentage of mothers who reported that their child received full immunization (BCG, 3 doses OPV, 3 doses PENTA, Measles). Note: HepB0 was not asked.	25.4%	22.7%

[40]The majority of these mothers delivered in the CHC (44.7%) or the PHC (20.7%) or the District Hospital (13.6%).
[41]The majority of these mothers delivered in the CHC (42.9%) or the PHC (27.2%) or the District Hospital (10.2%).

Enrollment (Mothers)

3978 Mothers were interviewed across 584 villages spanning 5 administrative blocks of Udaipur during our enrollment exercise. Given the delay in KB app development, we then decided to exclude mothers interviewed with children under the age of four months, resulting in 3283 enrolled mothers. Their demographic profile can be characterized from the entire visited sample as follows.

The average age for the respondent was 25.1 +/- 4.0 years with a range from 18 to 46 years old. The median age for the head of household was 35. The household age reflected a bimodal distribution centered at approximately 30 and 60 years of age. The range varied from 19 years old to 95 years old.

Of 3283 respondents, 74.3% claimed they had not completed studies beyond the 5th grade, with the remaining 25.7% claiming completion of grades 6 and beyond. Their husbands had a wider range in educational attainment, with about a quarter never having attended school, a quarter attending primary school (1st-5th), a quarter attending secondary school (6th-8th), and the remaining quarter attending school beyond 9th grade.

Of the enrolled sample, 99.7% stated they had a house. This too reflects protocols to conduct enrollment exercises at the household level. Those homeless and migrant families may have in turn been left out - a reflection of selection bias. Of those responding homeowners, the majority of roofs were constructed from tile (61.6%). Respondents also had roofs that contained elements of straw/thatch (36.6%), concrete (20.7%), and stone (19.0%). Less than 4% of homeowners had roofs that contained elements of metal. The walls of these house were in majority “kuccha”, or made from earth-based materials (52.8%), whereas only 33.9% of walls considered “pakka” or sturdy and made from stone or cement. A majority of respondents claimed they had access to sufficient water (89.1%), yet at the same time, the vast majority of respondents admitted to open defecation (87.1%).

A majority of respondents did have electricity in their home (79.9%), and of these respondents the prevalent source of electricity was from kerosene (95.6%). A majority of respondents also stated that there was a mobile phone at their home (83.9%), with the ownership of the mobile leaning towards the husband (61.1%) over the respondent/mother (29.9%).

With respect to income, the majority of respondents were self-employed agricultural laborers (79.6%). Other sources of income included “other labor” (59.2%), regular daily wage (20.3%), self-employed non-agricultural labor (12.4%), agricultural labor (9.8%), and a few members also mentioned their pension as a source of income (0.5%). When asked which income source contributed greatest to their financial standing, the majority of respondents replied with self-employed non-agricultural labor (63.3%). The majority of respondents (81.4%) claimed that their income varied considerably on a four point scale. The majority of of respondents also claimed that they had no monthly savings on a four point scale (57.7%). Median monthly savings were reported to be 1000 of those who did report savings. Despite the given economic standing, the vast majority of respondents reported owning a bank account (92.5%). The median amount of land owned by the respondent was reported to be 2 bighas (1618 sq meters each).

With respect to the mother's health and prior medical history, the median number of children under the age of five in the household per respondent was 1 with a range from 0 to 7. A vast majority of mothers claimed to have had received a Tetanus shot (91.3%). 83.0% of respondents claimed to have had received Iron Folic Acid tablets.

The vast majority of mothers did claim to be informed about regular health camps (96.3%), primarily by the ASHA (85.9%), but also by other health workers (20.9%), the ANM (11.9%), and someone else in the community (7.2%).

When considering the respondent's/mother's health awareness, 98.0% of respondents agreed that the mothers should go to Antenatal Care Camps during pregnancy. Yet only 21.2% of respondents stated that mothers should attend at least 4 ANC visits.

The reasons for attending the camp during pregnancy were varied: 86.9% mentioned to ensure good health, 23.2% mentioned the need to get food or other incentives, 14.7% mentioned a government mandate, 6.5% mentioned the fact that neighbors also attended, and 7.3% did not know why they were attending ANC camps.

When asked reasons for bringing child to the camp during infancy, responses were varied: 85.9% mentioned the betterment of the child's health, 18.6% mentioned the need to get materials for food, 15.4% mentioned their reason for coming was due to the government mandate, 5.9% mentioned the fact that other mothers were attending, and 8.2% did not know why they were bringing their child.

Mothers had a poor understanding of what diseases vaccinations help to protect: 48.2% mentioned polio, 39.2% mentioned protection from tetanus, 22.8% mentioned protection from measles, 11.9% mentioned protection against jaundice, 10.9% mentioned protection against pertussis, and 3.0% mentioned protection against diphtheria. 38.5% of respondents did not know any diseases that were prevented by vaccinations.

When considering the appropriate dosing for the vaccine preventable diseases, only 8.3% of respondents knew that at last two tetanus doses were required for their pregnancy. Less than 1% of respondents knew that two measles doses were required for their child. Just 0.2% of mothers accurately described the number of required doses for oral poliovirus. 4.6% of mothers accurately described the need for three doses of vaccine against pertussis for the child. 10.7% of mothers accurately described their child needing 3 doses of vaccination against diphtheria in the first year of life. 10.8% of mothers accurately described the need for a one-time vaccination against TB.

Despite high levels of phone ownership, only 1.1% of respondents reported ever having received an SMS for ANC, PNC, and Immunization-related services.

Key takeaways can be summarized as follows:

- Respondents were of low socioeconomic status, with poor levels of education, income, and shelter with a majority working as self-employed agricultural laborers
- High Mobile Phone Ownership vs. Low levels of Health Reminders Received
- High Rates of being informed about camp vs. Low Awareness about number of shots for each child or number of ANCs needed

For outcomes comparing data retention between MAMTA Card and KB Necklace, confounders related to mother demographics may be relevant. For this reason, survey results below are bifurcated for treatment and control group assigned mothers. The data suggests adjustment in the final analysis for the above outcome may be required for unbalanced factors including: *electricity at home, income bracket, land ownership, self-ownership of the mobile phone, roof type, latrine type, and ownership of various fixed assets.*

Table 9. Enrollment Sample Descriptive Statistics

Question / Variable (SES)	Answers	Overall (n=3283) Number (% / Standard Deviation)
Average respondent age (mean (sd))	*Numerical*	25.13 (4.0)
Education level of mother (grade levels completed)	*Never attended*	1822 (55.5)
	1-5	617 (18.8)
	6-8	420 (12.8)
	9-10	227 (6.9)
	10-12	135 (4.1)
	Graduate	46 (1.4)
	Post-graduate	12 (0.4)
	Diploma	3 (0.1)
	Don't know	1 (0.0)
Do you own a house?	*Yes*	3274 (99.7)
	No	9 (0.3)
If yes, what material is your roof made from? (select all that apply)	*Concrete/cement*	681 (20.7)
	Metal/asbestos sheets	115 (3.5)
	Straw/thatch/sod/bamboo/mud	1203 (36.6)
	Tile	2021 (61.6)
	Stone	625 (19.0)
	Other	4 (0.1)
Do you have access to sufficient water?	*Yes*	2926 (89.1)
	No	357 (10.9)
What kind of latrine do you use? (select all that apply)	*Jungle/field*	2861 (87.1)
	Private, indoor, with water	226 (6.9)
	Private, indoor, no water	109 (3.3)
	Private, outside, water	162 (4.9)
	Private, outside, no water	49 (1.5)
	Public	9 (0.3)
Do you have electricity at home?	*Yes*	2623 (79.9)
	No	659 (20.1)

Question / Variable	Answers	Number (% / Standard Deviation)
Do you have a mobile phone at home?	*Yes*	2753 (83.9)
	No	530 (16.1)
If yes, who owns the phone?	*Self*	824 (29.9)
	Husband	1683 (61.1)
	Father-in-law	147 (5.3)
	Mother-in-law	41 (1.5)
	Brother-in-law	42 (1.5)
	Sister-in-law	5 (0.2)
	Son/daughter	3 (0.1)
	Other	6 (0.2)
	Refuse to Answer	0 (0.0)
	Don't know	2 (0.1)
Which income source contributes the greatest to your financial standing?	*Self-employed (non-agriculture)*	2078 (63.3)
	Self-employed (agriculture)	1043 (31.8)
	Agricultural labor	162 (4.9)
Monthly savings	*Numerical*	Median: 1000, IQR = 500-2000
Do you own a bank account?	*Yes*	3036 (92.5)
	No	233 (7.1)
	Don't know	12 (0.4)
Does your family own any land?	*Yes*	3060 (93.2)
	No	190 (5.8)
	Refuse to answer	2 (0.1)
	Don't know	31 (0.9)
If yes, how much land (in bighas)?	*Numerical*	Median: 2, IQR: 1-3
Number of children under 5 in the household	*0*	1015 (30.9)
	1	1590 (48.4)
	2	627 (19.1)
	3	40 (1.2)
	4	8 (0.2)
	5	2 (0.1)
	7	1 (0.0)

Awareness and Health Status Questions	Answers	Number (% / Standard Deviation)
Did you ever receive a tetanus (TT) shot?	*Yes*	2999 (91.3)
	No	273 (8.3)
	Don't know	8 (0.2)
	Refuse to answer	3 (0.1)
Have you received iron folic acid (IFA) tablets during your pregnancy?	*Yes*	2725 (83.0)
	No	557 (17.0)
Do you get informed about regular health camps?	*Yes*	3163 (96.3)
	No	92 (2.8)
	Don't know	24 (0.7)
	Refuse to answer	1 (0.0)
	Other	3 (0.1)
If so, is there someone who primarily informs you of these camps? (select all that apply)	*ANM*	391 (11.9)
	ASHA	2819 (85.9)
	Other health worker	685 (20.9)
	Someone in community	235 (7.2)
	No	94 (2.9)
	Other	26 (0.8)
	Refuse to answer	3 (0.1)
Should mothers attend to ANC camps?	*Yes*	3218 (98.0)
	No	15 (0.5)
	Don't know	47 (1.4)
	Refuse to answer	3 (0.1)
How many ANC camps should a mother visit during pregnancy?	*1*	142 (4.3)
	2	937 (28.5)
	3	1063 (32.4)
	4	696 (21.2)
	5	179 (5.5)
	Don't know	206 (6.3)
	Other	56 (1.7)
	Refuse to answer	4 (0.1)

Awareness Questions	Answers	Number (% / Standard Deviation)
Why is it important to attend ANC camps? (select all that apply)	*In order to ensure good health*	2790 (86.9)
	The government requires it	473 (14.7)
	Because neighbors also go	209 (6.5)
	To get food/incentives	746 (23.2)
	Other	15 (0.5)
	Don't know	233 (7.3)
Why is it important to bring your child to camp during infancy? (select all that apply)	*In order to ensure good health*	2765 (85.9)
	The government requires it	494 (15.4)
	Because neighbors also go	190 (5.9)
	To get food/incentives	598 (18.6)
	Other	32 (1.0)
	Refuse to answer	1 (0.0)
	Don't know	265 (8.2)
What diseases do vaccinations help protect? (select all that apply)	*Tuberculosis*	318 (9.7)
	Diphtheria	99 (3.0)
	Pertussis (Whooping Cough)	357 (10.9)
	Polio	1582 (48.2)
	Tetanus	1288 (39.2)
	Measles	730 (22.2)
	Jaundice	391 (11.9)
	Other	20 (0.6)
	Refuse to answer	11 (0.3)
	Don't know	1264 (38.5)
How many doses of the tetanus vaccine are needed during pregnancy?	*1*	2999 (91.3)
	2	273 (8.3)
	Refuse to answer	3 (0.1)
	Don't Know	8 (0.2)
Have you ever received an SMS for ANC, PNC or immunization-related services?	*Yes*	36 (1.1)
	No	3247 (98.9)

Table 9 Continued. Perceptions of requirements for achieving protection from vaccine preventable disease

How Many Vaccines are required to protect your child from:	**BCG**	**Diphtheria**	**Pertussis**	**Polio**	**Tetanus**	**Measles**	**Hepatitis**
0	1 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
1	355 (10.8)	302 (9.2)	231 (7)	105 (3.2)	44 (1.3)	11 (0.3)	5 (0.2)
2	735 (22.4)	648 (19.7)	304 (9.3)	82 (2.5)	27 (0.8)	14 (0.4)	6 (0.2)
3	472 (14.4)	350 (10.7)	151 (4.6)	45 (1.4)	7 (0.2)	4 (0.1)	2 (0.1)
4	74 (2.3)	54 (1.6)	21 (0.6)	5 (0.2)	3 (0.1)	1 (0)	1 (0)
5	71 (2.2)	24 (0.7)	7 (0.2)	0 (0)	0 (0)	0 (0)	0 (0)
6	14 (0.4)	10 (0.3)	0 (0)	1 (0)	0 (0)	0 (0)	0 (0)
7	1 (0)	3 (0.1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
8	1 (0)	2 (0.1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
12	1 (0)	1 (0)	1 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Don't Know	795 (24.2)	456 (13.9)	508 (15.5)	544 (16.6)	533 (16.2)	525 (16)	523 (15.9)
Refuse to Answer	20 (0.6)	20 (0.6)	21 (0.6)	21 (0.6)	21 (0.6)	22 (0.7)	23 (0.7)
Did not know diseases are vaccine preventable	743 (22.6)	1413 (43)	2039 (62.1)	2480 (75.5)	2648 (80.7)	2706 (82.4)	2723 (82.9)

ANMs

ANMs, the key end user of the platform, can be characterized as follows as per our survey exercise in Udaipur: of the 163 ANMs surveyed, about 36% are 12th pass, over half conduct 3-4 village-based camps per month, 51% travel more than 30 minutes to reach their furthest camp, 50% travel by foot to the camp, 99% have access to a mobile phone, 47% have access to a smart phone, 66% do not use mobile apps (i.e. Facebook, Whatsapp, Paytm, Video Calling, Gmail) with about 32% responding their experience with mobile apps involves Whatsapp. Of the respondents, 56% stated they have consistent access to cellular connectivity, with 42% of respondents stating they have access most of the time, and 12% without access at all.

When asked how an ANM defines her role in the community, the overwhelming majority of respondents answered with “Health Care Provider,” with “Social Worker,” “Educator,” and “Coordinator with ASHA” as other responses. Among an ANM’s various responsibilities in the community, holding immunization camps each month is an important aspect of the role. As the expectation is to coordinate and conduct the weekly immunization camps, of the surveyed respondents, the median number of hours spent weekly at the camp by the ANM was 6 hours (IQR=5-6). About 91% of respondents said they felt they spent enough time with their patients with 9% asserting otherwise.

When it came to how the ANM respondents defined their duties outside of the camp withFacility Based Care and preparation of reports being the most popular responses, followed by coordination with the ASHA, Special government programs, Data collection, Training and education, and Community Mobilization were the most noteworthy functions given by respondents. Beyond the more readily visible duties, ANM respondents also listed the following duties: family planning services, vasectomies, hysterectomies, conducting deliveries, assisting iodine check ups (thyroid), DOTS therapy for TB, Malaria prevention and follow up, adolescent health care, patient care at the subcenter, referrals to the district hospital, AADHAAR registration, household level pregnancy education, tobacco cessation and birth control assistance (namely copper IUDs).

When asked about how the ANM ensures that all listed women and children come for services, the use of a “Due List” appeared to be the preferred methodology of respondents, which they would use as a resource for the personalized phone calls they would have the ASHA make to the due patients. When asked how the ANM manages a situation where the patient comes to the camp without a MAMTA card, they must refer to the RCH/SDR register, and send the mother away to bring the card. They then fill the register and instruct her to bring the card on the next camp day.

The ANM role requires a considerable amount of travel to and from the camps. Of the respondents, we saw that a considerable portion walk to the camp (50%), with the remainder taking a “scooty” (18%), a private vehicle (14%), a car or jeep (4%), bike (10%), and auto rickshaw (4%). The ANM also must travel to and from her home to the PHC in order to handle administrative matters. The majority of respondents required over 15 minutes to reach the nearest PHC from

their home, with approximately half requiring between 30 minutes and 2 hours.

Considering the ASHA and ANM both work in communities to ensure better health for patients, certain tasks require coordination between the two. When asked what these tasks are, the responses were Malaria, Family Planning, DOTS, High Risk Children, HIgh Risk Women, Hysterectomy, Vasectomy, Filling the ANC Register, Filling the Monthly Report, Home Visits, Surveys, Vaccination, male and female contraception, child malnutrition. Roughly half of the ANM respondents say they work with the ASHA “most times” in order to make explicit action plans for high risk patients at the end of each camp, with 36% “always” working with the ASHA and 10% only “sometimes.” When asked how the ANM usually collects data from the ASHA, face-to-face transfer was stated by 88% of respondents, a phone call was stated by 65%, referencing paper logs was stated by 58%, and SMS was used by 2% of respondents. In terms of the frequency of these data transmission interactions, 76% attest to weekly data collections from the ASHA, 14% engaged in daily data collection interactions, and 10% had monthly interactions.

The survey aimed to understand the entirety of ANM’s experience. When asked what the hardest part of the ANM job was, 57% of respondents replied with Mothers Don’t Care, 53% said that there’s too much travel, and 53% said the record keeping process was the hardest part of the job. Also noteworthy responses: the inability to save lives, unappreciative communities, and insufficient pay. When asked what the most rewarding part of the ANM job was, 90% responded with helping mothers, 84% said helping babies was the most rewarding aspect and 75% responded with “Saving lives.” The ability to hold a leadership role in the community as well as social status and respect were other popular responses.

In the status quo process, the median time for the data upload process from the ANM to the PHC, takes 120 minutes (IQR: 60-180 minutes) with a median of 20 RCH column calculations (IQR: 15-40) being made before submission. These columns include Total ANC, PENTA, TT, BCG, OPV, Measles, Hospital Delivery, PNC Visits, Child Death, IFA, Mother Death, Still Birth, Abortion, Adverse Events, and Disaggregation by Gender. 91% of ANMs responded that they had an accurate estimate of how many patients dropped out in their subcenter, with 95% of ANMs responding that they have an accurate estimate of how many patients are high risk in their subcenter.

Yet, roughly 95% of ANMs surveyed before launch of the KB platform attested to preferring a medical record application over their existing paper-based process. A few of the reasons given by ANM respondents justifying their preference for a medical record application involve avoiding the bulkiness of having to carry around the physical paper register, the quick syncing and accessibility of the data, and enhanced efficiency and accuracy in delivering health services due to the way records can be saved and accessed as well as the automatic reporting feature that saves a considerable amount of time for the ANM. About 88% of respondents said their biggest issue with the paper system is that it takes too much time.

Table 10. Quantitative Findings from ANM Baseline Survey

ANM Baseline Variable	Answers	Overall (n=163) Number (%)
Block of Operation for the ANM	*Sarada*	51 (31%)
	Salumbar	46 (28%)
	Jhadol	29 (18%)
	Gogunda	24 (15%)
	Lasadiya	13 (8%)
Education Status 1-12=1st through 12th grade; 13=graduate;14=post-graduate	*8*	5 (3%)
	9	4 (2%)
	10	37 (23%)
	11	5 (3%)
	12	59 (36%)
	Graduate	40 (25%)
	Post Graduate	13 (8%)
ANM Age	*Numerical (Years)*	Median: 37, IQR: 30-45
How many monthly camps regularly conducted	*4*	44 (27%)
	3	39 (24%)
	2	21 (13%)
	1	20 (12%)
	6	14 (9%)
	5	13 (8%)
	7	7 (4%)
	8	3 (2%)
	0	2 (1%)
Hours Worked Weekly at the Camp	*Numerical (Hours)*	Median: 6
		IQR: 5-6
Duties Outside of Camp	*Data Collection*	91 (56%)
	Coordination with the ASHA	117 (72%)
	Report Preparation	133 (82%)
	Facility-based care provision	145 (89%)
	Special Government Programs	94 (58%)
	Mission Indradhanush	25 (15%)
	PMSMY	21 (13%)
	Training/Meeting	86 (53%)
	Community Mobilization	60 (37%)
	Other	24 (15%)
Do you feel that you have enough time to spent at the health camp	*Yes*	149 (91%)
	No	12 (9%)
ANM Community Role	*Health Care Provider*	160 (98%)
	Coordination with ASHA and other Health Workers	58 (36%)
	Social Worker	135 (83%)
	Educator	60 (37%)
	Other	7 (4%)
Access:	*Mobile Phone*	Yes: 162 (99%)
	1. Yes	
	2. No	
	Smart Phone	Yes: 76 (47%)
	1. Yes	
	2. No	
	Regular Access to Cellular Network	
	1. Never	Never: 2 (12%)
	2. Most Times	Most Times: 68 (42%)
	3. Always	Always: 92 (56%)
How do you usually collect data from the ASHA?	*Referencing Paper Logs*	95 (58%)
	Phone Call	106 (65%)
	SMS	8 (5%)
	Face to Face	143 (88%)
	Other	4 (3%)
What kind of data do you usually collect with the help of the ASHA?	*Pregnant mother*	146 (90%)
	ANC	155 (95%)
	Birth	116 (71%)
	PNC	133 (82%)

ANM Baseline Variable	Answers	Overall (n=163) Number (%)
What kind of data do you usually collect with the help of the ASHA?	*Immunization*	150 (92%)
	Drop out, High risk	69 (42%)
	High Risk	80 (45%)
	Patient Death	67 (41%)
	Patient Migrated	17 (10%)
	Other	10 (6%)
How often do you connect with the ASHA for this data collection?	Daily	*22 (14%)*
	Weekly	*124 (76%)*
	Monthly	*17 (10%)*
How long on average does the data collection process from the ASHA tak?	Numerical (Minutes)	*Median: 60*
		IQR: 30-120
How often does the ANM work with ASHA to develop an explicit plan of action for high risk patients?	Never	*1 (1%)*
	Rarely	*3 (2%)*
	Sometimes	*17 (10%)*
	Most Times	*83 (51%)*
	Always	*59 (36%)*
What other tasks do you coordinate with the ASHA?	Data Entry	*45 (28%)*
	Patient Care	*133 (82%)*
	Mobilization	*99 (61%)*
	Health Advice	*140 (86%)*
	Transportation	*57 (35%)*
	Referrals	*65 (40%)*
	Other	*16 (10%)*
How to ensure all listed women and children come for services?	Communication via ASHA	*157 (96%)*
	Home Visit	*103 (63%)*
	Phone Call	*68 (42%)*
	Anganwadi Worker	*63 (39%)*
	Other Village Members	*52 (32%)*
	Other	*18 (11%)*
How to keep track of high risk and dropout patients?	Due List (Self Made)	*116 (71%)*
	RCH Register	*116 (71%)*
	Daily Diary	*99 (61%)*
	List (from gov't SMS)	*23 (14%)*
	Due List (from data entry operator/PHC)	*10 (1%)*
	ASHA List	*105 (64%)*
	Other	*3 (2%)*
What are those columns?	Total ANC	*157 (96%)*
	Total PENTA	*143 (88%)*
	Total TT	*141 (87%)*
	Total BCG	*131 (80%)*
	Total OPV	*128 (79%)*
	Total Measles	*123 (76%)*
	Total Hospital Delivery	*115 (71%)*
	Total PNC Visits	*112 (69%)*
	Total Stillbirth	*75 (46%)*
	Total Abortion	*66 (41%)*
	Total Death Child	*96 (59%)*
	Total Death Mother	*85 (52%)*
	Total Adverse Events	*49 (30%)*
	Total IFA	*96 (59%)*
	Disaggregation by Gender	*47 (29%)*
	Other	*22 (14%)*
How long does it take to find the Mother's info in the RCH register?	Numerical (Minutes)	*Median: 20*
		IQR: 15- 30
Do you have any issues with the paper system?	Too Much Time	*144 (88%)*
	Hand Calculation	*89 (55%)*
	Log Books Heavy	*78 (48%)*
	Keep Register	*133 (82%)*
	Make Register for Each Camp	*67 (41%)*
	Log Books Harder to Refer	*47 (29%)*
	To Separate Listing of the ANC and Immunization.	*79 (49%)*
	Other	*13 (1%)*

ANM Baseline Variable	Answers	Overall (n=163) Number (%)
Use of Apps? (Selected all that applied)	None	*108 (66%)*
	WhatsApp	*52 (32%)*
	Facebook	*11 (7%)*
	Video Call	*6 (4%)*
	SMS	*5 (3%)*
	Gmail	*3 (2%)*
	Paytm/Mobile Money	*2 (1%)*
	Other	*2 (1%)*
Do you prefer to keep records in an app?	Yes	*154 (95%)*
	No	*9 (5%)*
What is the hardest part of the job?	Record Keeping	86 (53%)
	Not Paid Enough	8 (5%)
	Too Much Travel	87 (53%)
	Mothers Do Not Care	93 (57%)
	Community is not appreciative	24 (15%)
	Not able to Save Lives	29 (18%)
	Not able to make the impact desired	37 (23%)
Most rewarding part of job?	Money	13 (8%)
	Pension	2 (1%)
	Insurance	1 (.5%)
	Helping Mothers	147 (90%)
	Helping Babies	137 (84%)
	Saving Lives (generally)	122 (75%)
	Social Status/Respect given	98 (60%)
	Leadership role in community	71 (44%)
	Other	9 (6%)

ASHAs

ASHAs work closely with the ANMs and serve as health liaisons for mothers and children in the community. In fact, when the ASHAs that were surveyed (N = 315) were asked to select from a list of all the roles in the community that applied to them, 79% percent of ASHAs indicated that they saw themselves as health workers, 76.5% percent described themselves as social workers, and 75.6% percent indicated they were informers. Some considered themselves to be "community connectors" (57.1%), while others also listed themselves as role models, friends and educators. A few (less than 8.0%) used the "other" option to describe various other roles, including data collection, taking care of children, persuading people [to engage in healthy behaviours] and record-keeping. Roughly 22% of ASHAs have completed up to the 12th standard, compared to 36% of ANMs surveyed. About 33.0% studied up to the 8th standard, while 5% reached the graduate level. Less than 1% of ASHAs studied at the post-graduate level. The vast majority of ASHAs are married (96.8%), and belong to either the scheduled tribe "ST" (49.2%), scheduled caste "SC" (13.02%), other backward caste "OBC" (14.6%), or general "GEN" (22.5%) caste categories. In order of socioeconomic status, ST = SC < OBC < GEN. On average, 41.6% of ASHAs surveyed have been serving as an ASHA for 5 to 10 years, and the average age of ASHAs is 31.1 years old. Most of the ASHAs surveyed (44.8%) indicated that they travel 0-15 minutes on average to the campsite from their house, while 37.5% of ASHAs travel 15-30 minutes to the campsite on average. For 14.3% of those surveyed, the average trip to the camp takes 30-60 minutes. For some (3.5%), this trip takes an average of 1 to 2 hours. On average, a given ASHA serves over 830 people in the community. Each ASHA visits approximately 10 households per day, makes 4 return visits to the same house for ANC reminders, 6 return visits for birth/PNC reminders, and 5 return visits for child vaccination reminders.

The clear majority of ASHAs (98.7%) indicated that they have mobile phone access. Only 8.0% reported never having network access, while 48.2% reported having network access most of the time and 43.7% reported always having network access. We then asked the ASHAs to list all the strategies they use to reach out to various community members. The most popular form of outreach used to remind mothers of upcoming camps was the home visit (96.8%), followed by phone call (51.4%), other village members (29.8%) or communication via the ANM (20.0%). Home visits were still the most popular form of contact for reaching new mothers, mothers who are hard to reach, or mothers who seem uninterested (89.2%), followed by communication via ANMs (48.2%), phone calls (43.2%), other village members (35.2%) or influencers from the community (29.5%). Resistant mothers were also most frequently contacted via home visit (94.6%), followed by communication via ANMs (49.8%), phone calls (38.4%) or other village members (36.5%). Interestingly, this may suggest that person-to-person interaction is a more valued method of contact or is more reliable than using a phone or other indirect communication methods to reach mothers. When asked what reasons resistant mothers most commonly give for not participating in ANC, most ASHAs indicated that the resistance stemmed from the household (49.8%), while many also indicated that the resistance stemmed from religious reasons (31.1%), lack of consequences for missing ANC (27.9%), adverse immunization events (27.0%), or the lengthy amount of time mothers have to spend at the camp (27.0%). Loss of daily wages was selected as a response by <23% of ASHAs. When asked what reasons mothers most commonly give for not giving birth at the hospital, again most ASHAs indicated that the resistance stemmed from the household (48.3%), while 127 of the 315 ASHAs gave an “other” reason for this (40.3%). Some of the most common other reasons included fears about the hospital, distance of the hospital, and lack of a timely vehicle to bring them to the hospital. Loss of daily wages and lengthy time spent at the camp site were selected as a response by 13.0% and 10.5% of ASHAs, respectively. The ASHAs reported that mothers most commonly resisted immunization for their children due to adverse immunization events, including fever or getting sick (47.6%) and resistance from the household (41.6%). Loss of daily wages and inconvenience were selected as a response by 17.5% and 12.4% of ASHAs, respectively. For all of the questions asked about reasons mothers give for being resistant to health services, <2% of ASHAs selected “poor interaction with the ANM” as a response. When asked what messages ASHAs typically use to reach uninterested mothers, many indicated that they would use messages emphasizing the health of the child (86.7%) or the health of the mother herself (76.2%). Others would use messages emphasizing monetary incentives (51.4%) or food incentives (51.1%). Roughly 45% of ASHAs emphasize the health of the community in such messages, while 8.6% would use other messages, including some that emphasize protection against disease or increase the mother’s awareness of various health schemes/programs that are in place for them and their children.

We then asked the ASHAs several questions pertaining to their own jobs and their interactions with the ANM. About compensation, 71.4% of ASHAs indicated that they receive monetary incentives and 48.9% indicated that they receive social incentives for their work; however, roughly half of those surveyed felt that these incentives are sufficient while the other half did not. About 44% of ASHAs said that the worst part of their job was the long travel required of them, followed by the fact that many mothers do not care (26.4%). In contrast, 40.0% of ASHAs indicated that the best part of their job was that they are able to save lives in a general sense, and that they are able to help mothers (28.3%) and babies (13.0%). Roughly half of ASHAs communicate with the

ANM verbally, while the other half communicates by phone. There seems to be a wide variety in the kinds of data that ASHAs collect with the help of ANMs, including immunization data (96.8%), information on pregnant mothers (95.2%), ANC data (94.9%), PNC data (90.2%), and birth data (80.9%). Roughly 45% indicated that they collect information on patient deaths and high-risk patients, while 37% collect information on patients at increased risk of drop-out. Roughly 17% collect information on patients who have relocated. The majority of ASHAs connect with the ANM for this data on a weekly basis (72.4%). The majority also indicated that the ANM records the information passed on from the ASHA by referencing paper logbooks (81.3%); on average, this process takes over an hour (mean = 66.2 minutes, median = 60 minutes). Other kinds of tasks that ASHAs coordinate with the ANM include facility-based care provision (80.3%), report preparation (79.0%), health advice (61.0%), home visits for PNC/ANC (60.3%), ensuring hospital delivery (60.0%) and special government programs (59.4%). When asked whether an explicit action plan is made with the ANM at the end of each camp for high-risk patients, 41.9% indicated that this happens “most of the time”, while 29.8% indicated that an action plan is “always” made and 21.3% said that a plan is “sometimes” made. About 3% indicated that such a plan is “rarely” made and 4.1% “never” make such a plan.

Figure 15. GPS Coordinates for ASHA Surveys:

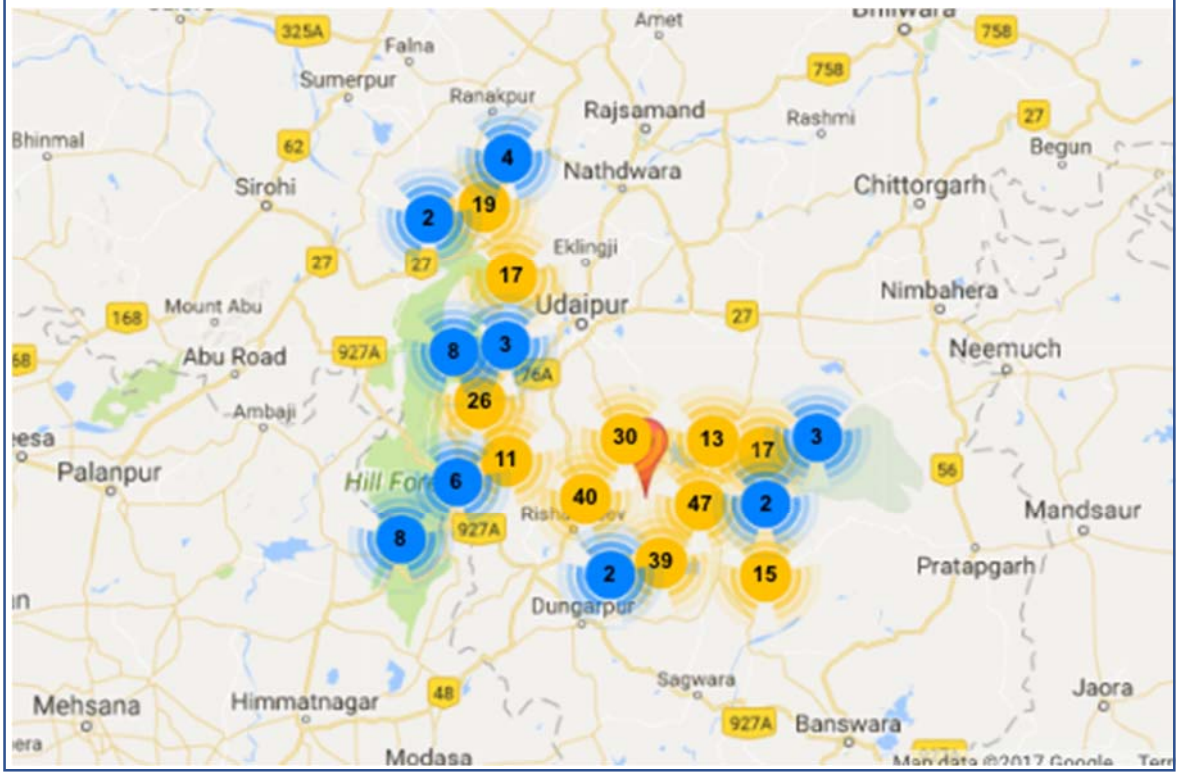


Table 11. ASHA Descriptive Statistics (n = 315 consenting participants)

Question / Variable	Answer Options	Control	Treatment (Percent)	Overall / Average (Percent)
Treatment vs. Control Assignment		158 (50.2)	157 (49.8)	
Survey block that ASHA serves	Sarada			95 (30.2)
	Salumber			90 (28.6)
	Jhadol			58 (18.4)
	Gogunda			47 (14.9)
	Lasadiya			25 (7.9)
Education status (1-12 = 1st through 12th grade; 13 = graduate; 14 = post-graduate)	8	51 (32.3)	53 (33.8)	104 (33.0)
	10	51 (32.3)	41 (26.1)	92 (29.2)
	12	32 (20.3)	37 (23.6)	69 (21.9)
	9	12 (7.6)	18 (11.5)	30 (9.5)
	13 (grad)	8 (5.1)	7 (4.5)	15 (4.8)
	1	1 (0.6)	1 (0.6)	2 (0.6)
	14 (post-grad)	2 (1.3)	0 (0.0)	2 (0.6)
	11	1 (0.6)	0 (0.0)	1 (0.3)
ASHA age (mean (sd))	Numerical	30.98 (5.9)	31.31 (5.6)	31.14 (5.7)
Total years worked as an ASHA	5-10 years	64 (40.5)	67 (42.7)	131 (41.6)
	10-15 years	51 (32.3)	42 (26.8)	93 (29.5)
	4-5 years	24 (15.2)	23 (14.6)	47 (14.9)
	1-2 years	8 (5.1)	7 (4.5)	15 (4.8)
	3-4 years	5 (3.2)	9 (5.7)	14 (4.44)
	<1 year	4 (2.5)	5 (3.2)	9 (2.9)
	2-3 years	2 (1.3)	4 (2.5)	6 (1.90)
Which ASHA training modules did you complete? (ordered 1-7 from least to most advanced)	5, 6 & 7	126 (79.7)	121 (77.1)	247 (78.4)
	2, 3 & 4	14 (8.9)	24 (15.3)	38 (12.1)
	Other	14 (8.9)	10 (6.4)	24 (7.6)
	None	4 (2.5)	2 (1.3)	6 (1.9)
Mode of transport to house (select all that apply)	Walk			312 (99.1)
	Jeep/car			4 (1.3)
	Bicycle			1 (0.3)
	Cycle/Bike			1 (0.3)
	Scooty			1 (0.3)
	Private vehicle			1 (0.3)
Time of transport to camp site from house	0-15 minutes	72 (45.6)	69 (43.9)	141 (44.8)
	15-30 minutes	58 (36.7)	60 (38.2)	118 (37.5)
	30-60 minutes	21 (13.3)	24 (15.3)	45 (14.3)
	1-2 hours	7 (4.4)	4 (2.5)	11 (3.5)
How many people do you provide services to in your community?		899.89 (550.7)	763.38 (488.8)	Median = 780
				IQR = 530
Median number of houses visited daily				Median = 10 IQR = 10
Median number of return visits for ANC reminders				Median = 4 IQR = 4
Median number of return visits for birth/ PNC				Median = 6 IQR = 5
Median number of return visits for child vax reminders				Median = 5
				IQR = 5
Access to mobile phone?	Yes			311 (98.7)
	No			4 (1.3)
Access to network?	Most times			150 (48.2)
	Always			136 (43.7)
	Never			25 (8.0)
How often do you use a mobile phone to remind mothers?	Sometimes			149 (47.9)
	Most times			89 (28.6)
	Rarely			27 (8.7)
	Never			24 (7.7)
	Always			22 (7.0)

ASHA Baseline Survey	Answer Options	Control	Treatment (Percent)	Overall / Average (Percent)
Time of transport to camp site from house	0-15 minutes	72 (45.6)	69 (43.9)	141 (44.8)
	15-30 minutes	58 (36.7)	60 (38.2)	118 (37.5)
	30-60 minutes	21 (13.3)	24 (15.3)	45 (14.3)
	1-2 hours	7 (4.4)	4 (2.5)	11 (3.5)
How many people do you provide services to in your community?		899.89 (550.7)	763.38 (488.8)	Median = 780
				IQR = 530
Median number of houses visited daily				Median = 10 IQR = 10
Median number of return visits for ANC reminders				Median = 4 IQR = 4
Median number of return visits for birth/ PNC				Median = 6 IQR = 5
Median number of return visits for child vax reminders				Median = 5
				IQR = 5
Access to mobile phone?	Yes			311 (98.7)
	No			4 (1.3)
Access to network?	Most times			150 (48.2)
	Always			136 (43.7)
	Never			25 (8.0)
How often do you use a mobile phone to remind mothers?	Sometimes			149 (47.9)
	Most times			89 (28.6)
	Rarely			27 (8.7)
	Never			24 (7.7)
	Always			22 (7.0)
What strategies do you use to remind mothers? (select all that apply)	Home visit			305 (96.8)
	Phone call			162 (51.4)
	Other village members			94 (29.9)
	Communication via ANM			63 (20.0)
	Other			3 (1.0)
What message do you convey to hard to reach, uninterested mothers? (select all that apply) *Notable “other” options: the camp will protect mother and child from disease; there are schemes and programs in place for MCH	Health of child			273 (86.7)
	Health of mother			240 (76.2)
	Monetary incentives			162 (51.4)
	Food incentives			161 (51.1)
	Health of community			142 (45.1)
	Other*			27 (8.6)
What is the role of the ASHA in the community? (select all that apply); *Notable “other” options: data collection; assisting with hysterectomy/vasectomy and IUDs, getting medications to the sick, helping open bank accounts, meeting with adolescents, convincing people, improving IMR and MMR, attending meetings, reporting data, record keeping	Health worker			249 (79.1)
	Social worker			241 (76.5)
	Informer			238 (75.6)
	Community connector			180 (57.1)
	Role model			88 (27.9)
	Friend			78 (24.8)
	Educator			61 (19.4)
	Other*			24 (7.6)
	Village Leader			18 (5.7)
Do you receive incentives for any of these roles? (select all that apply)	Yes (monetary)			225 (71.4)
	Yes (social)			154 (48.9)
	No			29 (9.2)
Do you feel the incentives are sufficient?	Yes			157 (49.8)
	No			158 (50.2)

ASHA Baseline Survey	Answer Options	Control	Treatment (Percent)	Overall / Average (Percent)
What is the hardest part of your job? *Notable “other” options: difficulty in increasing awareness; performing vasectomy/hysterectomy; conducting surveys, convincing smokers to stop	Too much travel			140 (44.4)
	Mothers do not care			83 (26.4)
	Not paid enough			34 (10.3)
	Record keeping			27 (8.6)
	Other*			23 (7.3)
	Community is not appreciative			4 (1.3)
	Not able to save lives			4 (1.3)
What is the most rewarding part of your job? *Notable “other” options: visiting the field, sitting in the anganwaadi center, meeting people, learning new things on the job, achieving targets (e.g. immunization course)	Saving lives (generally)			126 (40.0)
	Helping mothers			89 (28.3)
	Helping babies			41 (13.0)
	Social status/respect given			22 (7.0)
	Other*			16 (5.1)
	Leadership role in the community			15 (4.8)
	Money			6 (1.9)
How do you usually communicate with the ANM? *Notable “other” options: both verbally and via phone; ANM does not show up	Verbally			155 (49.2)
	Phone call			150 (47.6)
	Other			10 (3.2)
What kind of data do you collect with the ANM’s help? (select all that apply)	Immunization			305 (96.8)
	Pregnant mother			300 (95.2)
	ANC			299 (94.9)
	PNC			284 (90.2)
	Birth			255 (81.0)
	Patient death			141 (44.8)
	High risk			137 (43.5)
	Drop out, high risk			116 (36.8)
	Patient migrated			54 (17.1)
	Other			15 (4.8)
How often do you connect with the ANM for this data collection?	Weekly			228 (72.3)
	Daily			50 (15.9)
	Monthly			37 (11.8)
How does the ANM record what you tell her?	Referencing paper logs			256 (81.3)
	Face to face			47 (14.9)
	Phone call			7 (2.2)
	Other			5 (1.6)
How long does this process take (in minutes)?				Median = 60
				IQR = 30

ASHA Baseline Survey	Answer Options	Control	Treatment (Percent)	Overall / Average (Percent)
What other tasks do you do with the ANM? (select all that apply) *Notable “other” options: family planning/vasectomy, salt test, compiling a list of adolescent girls in the community	Facility-based care provision			253 (80.3)
	Report preparation			249 (79.1)
	Health advice			192 (61.0)
	Home visits for PNC/ANC			190 (60.3)
	Ensure hospital delivery			189 (60.0)
	Special government programs			187 (59.4)
	General camp coordination with ASHA			152 (48.3)
	Data collection			129 (41.0)
	Referrals			118 (37.5)
	Transportation			107 (34.0)
	Community mobilization			64 (20.3)
	Other*			17 (5.4)
Do you work with the ANM to make an explicit action plan at the end of each camp for high-risk patients?	Most times			132 (41.9)
	Always			94 (29.8)
	Sometimes			67 (21.3)
	Never			13 (4.1)
	Rarely			9 (2.9)
Marital status	Married	153 (96.8)	152 (96.8)	305 (96.8)
	Widowed	2 (1.3)	4 (2.5)	6 (1.9)
	Separated	1 (0.6)	1 (0.6)	2 (0.6)
	Never Married	2 (1.3)	0 (0.0)	2 (0.6)

4.2. Comparison of survey sample with national population

Table 12. Comparison of Baseline Coverage Evaluation to NFHS-4

	Baseline Coverage Evaluation (n=1243)	NFHS-4 (Udaipur district- Rural) (n = 990)	NFHS-4 (Rajasthan state-Rural)	NFHS-4 (National-Rural)
Mothers who had 4+ Antenatal Care Checkups	16.5%	40.8%	34.1%	44.8%
Mothers who received TT in last pregnancy	88.2%	83.8%	88.6%	88.6%
Pregnancies for which the Mother received an MCP / MAMTA card	91.4%	90.5%	92.6%	90.0%
Percentage of institutional births	85.3%	70.6%	82.3%	75.1%
Percentage of mothers who brought their newborns to the hospital	12.9%* (within first month)	20.6%* (within 2 days)	22.0%	23.0%
Percentage of children age 12-23 months fully immunized (BCG, measles, and 3 doses each of polio and DPT)	24.1%	37.2%	53.1%	61.3%
Percentage of children under 3 years breastfed within 1 hour of birth	89.5%* (assessed for mothers with children 12-23 months)	22.1%	28.9%	41.1%
Percentage of children exclusively breastfed for 6 months	52.5%	49.3%	57.5%	56.0%

Differences for the proportion of mothers receiving four or more antenatal care checkups, percentage of institutional births, percentage of fully immunized children, percentage of children breastfed in the first hour differed between our Baseline Coverage Evaluation Exercise (2016-2017) and that of Indian institute for Population Sciences NFHS-4 Survey (2015-16) when comparing our five selected rural blocks with their estimates for “rural” Udaipur. Of note, we did

not have access to the confidence intervals of the NFHS-4 data. Several factors could be suggestive of this difference, should it be significant: namely the NFHS-4 data for Udaipur although lower in sample size may be more representative of the entire Udaipur Rural region. Furthermore, the difference in when the surveys were conducted could contribute. Additionally, the indicators themselves may be derived from unreliable data such as the mother's recall or MAMTA card. While 24.1% of mothers were deemed fully immunized by the criteria established in NFHS-4, true full-immunization coverage also considers the receipt of birth doses OPV0 and HepB0. When adding the consideration of OPV0 alone, our estimates for full immunization coverage drop below 3%, perhaps due to lack of availability of polio at institutions where deliveries took place or in part due to poor recall of all the vaccines the child had received in the past 12 months.

When comparing the health, indicators collected in the Enrollment Survey against the State and National NFHS-4 data, it is apparent that Udaipur lags well behind in antenatal care checkup completions and full immunization coverage. On the other hand, the data suggests the Udaipur District beats State and Central indicators for institutional delivery rate and proportion of children breastfed within the first hour.

Sociodemographic data comparisons are not being included here for analysis because the nature in which our Survey Questions were asked differ significantly from the NFHS-4 data that covers overlapping areas, and therefore comparisons cannot be made on the differing indicators.

4.3. Findings from qualitative sample

ANMs were asked to share their experiences in an open-ended format. Many commented on the distance from the subcenter as being a significant barrier to doing their job, while others commented on the difficulty of motivating mothers and conducting family planning services (1-4). Others shared difficulties with retaining patients and spending enough time with them (5, 6), while some expressed that they felt unappreciated and overworked (7). It is evident that there are at least some ANMs who feel proud of what they do and have experienced instances in which they felt they were educating the community or doing a service by making sure a child got fully vaccinated (8, 9). Finally, when asked how the KB system could be helpful to them, ANMs expressed that the new system would reduce their workload, allow them to generate automated reports, and remove the need to carry around bulky paper registers for long distances (10-12).

Table 13. ANM Qualitative Survey - Representative Quotes

1	"I live far from my Subcenter. Some people used to give me trouble when I would travel to the SC. Besides that, it's difficult to motivate people. I try my best, my 100%. If I have to convince someone to go Udaipur, it's very difficult. They are afraid that this will happen, that won't happen, and that I won't get my due money if I go."
2	"Sometimes it is difficult because we have to walk 2-3 kms. And the most difficult thing is for *nasbandi* [vasectomy] and family planning. We have a huge workload and all the work falls on us. We need people ready to help us. We hope you can help us."
3	"Once I was traveling in a car in Gogunda and it broke down. I had to walk 2 km."
4	"One time, when I was new to the job as an ANM, I visited a household to encourage vasectomy. The family had 7 children so I told the father that it would be good to go for vasectomy. I decided to tell the father with the mother He told me something very scary. He said 'Okay, I can take my wife to go for vasectomy, but if anything goes wrong, you will have to stay here with me'. I went home and cried to my husband that I don't want to do this job. He encouraged me to not worry and to do my job the right way."
5	"In this area, 7 months into pregnancy, the mother shifts to her in-laws house, She comes from who knows where and gets all of the vaccinations. The ANM is wanting to get her incentive. The mother wants her incentive. So then some ANMs get discouraged because they know that some mothers who they register will not stay in their catchment area."
6	"There is only one ANM. The ANM has to do registration, BP, Hb, Albumin/Sugar, Fill the Card, and make the mother aware. How can she do it all? I haven't seen it happen."
7	"We work the entire month. But sometimes we have problems at home. One time it was the last vaccine day, but my father had an accident. I was unable to go for that vaccine day, and the village raised an objection that 'the ANM Sister is not coming for vaccinations'. I will always remember that - that even working people for one day they couldn't tolerate. If I show up all other days it's not significant, but if I miss one day then - I'm not conducting camps. And that makes us feel bad because we are doing all this work and still they are saying that. We also have families."
8	"There was one child whose father left and whose mother then left. The baby stayed with the grandmother, and even though the baby was weak I made sure the baby got all required vaccines."
9	"Some mothers are worried that vaccines will cause fever, but I tell them that they won't cause any fever."
10	"This will reduce our work with RCH and linelist; we just keep it in our bag. I have four villages. Four villages means four registers. I won't have to bring four registers if I have this, just like I have a mobile. And any report can be found immediately."
11	"App will do automatic reporting. We won't have to repeatedly come to the PHC. We can sit at the block and show how much work is being done."
12	"Won't need to carry around the register for 4-5 km. You can open the KB app and see all the data for ANC, immunization, etc."

5. Validation of the evaluation design and its implications

5.1. Internal validity

Randomization

The study used a cluster randomized controlled trial design to account for treatment effects on multiple outcomes, while accounting for measured and unmeasured confounders, using a representative sample of the study sample frame: 162 SC's from 249 Subcenters across Jhadol, Gogunda, Lasadia, Salumbar, and Sarada Block. A clustered approach was employed to minimize contamination of intervention delivery within catchment areas. Cluster Randomization of Treatment Allocation will be relevant for all outcomes except the FICT outcome, in which Intervention exposure will not be randomized (the control group FICT outcomes will not be assessed due to measurement bias). This particular outcome will select for those mothers who at least attend the camp once, and therefore will not have validity that applies to camp defectors. This selection bias will be mitigated in part by considering relevant covariates for the FICT outcome and for Intervention uptake.

Blinding

The study is not being conducted by an independent agency, which poses question as to the bias the investigators bring to the table, given their stake in the success in the intervention. For logistical purposes, and given the nature of the intervention, it was not possible to conceal which SC's would be randomized to Treatment vs. Control. Such questions to validity must be mitigated by transparent data policies and proper reporting. Even then influences on study measurement may not be fully controlled.

Intention to Treat:

Analysis will take place on a per-protocol basis due to the requirement that the mother at least come to one camp for their data to be properly registered and verified for future outcomes tracking. Doing so will mitigate the study's ability to speak to effectiveness of the intervention for given real-world conditions.

Baseline comparison

Baseline characteristics of the Enrolled Sample are shown in Table 13 and in Table 9 for ANMs who were delivering the intervention. Many potential confounders were considered and measured unbalanced factors will be taken into account in the modelling analysis.

Contamination and Spill Over

No notable contamination of other mHealth interventions or differentially-applied MCH-targeted interventions at the VHND camp level. Spill-over of the intervention hasn't been observed, but can only be confirmed after the midline exercise. While Subcentres can be within 5km, there are also a buffer of non-treatment, non-control subcenters interspersed in the same 5 block area.

5.1.2 Balance table

For outcomes comparing data retention between MAMTA Card and KB Necklace, confounders related to mother demographics may be relevant. For this reason, survey results below are bifurcated for treatment and control group assigned mothers. The data suggests adjustment in the final analysis for the above outcome may be required for unbalanced factors including: *electricity at home, income bracket, land ownership, self-ownership of the mobile phone, roof type, latrine type, and ownership of various fixed assets.*

Table 14. Balance Table

	Control	Treatment	p-value
n	1639	1644	
Survey Block (%)			0.239
GOG	266 (16.2)	285 (17.3)	
JH	387 (23.6)	392 (23.8)	
LAS	125 (7.6)	147 (8.9)	
SAL	391 (23.9)	401 (24.4)	
SAR	470 (28.7)	419 (25.5)	
Health Status			
When is the baby due?			0.473
April	67 (4.9)	71 (5.4)	
August	1 (0.1)	0 (0.0)	
December	257 (18.7)	255 (19.4)	
February	132 (9.6)	152 (11.6)	
January	249 (18.1)	213 (16.2)	
July	0 (0.0)	1 (0.1)	
June	8 0.6)	6 (0.5)	
March	116 (8.4)	110 (8.4)	
May	44 (3.2)	39 (3.0)	
November	253 (18.4)	224 (17.0)	
October	187 (13.6)	200 (15.2)	
September	62 (4.5)	45 (3.4)	
Have at least one child under the age of 5?	1205 (73.5)	1206 (73.4)	0.994
SES			
Head of Household Age (mean(sd))	40.59 (14.75)	41.08 (14.83)	0.342
What is your relation to the head of the household?			0.309
Brother-in-law/Sister-in-law	1 (0.1)	4 (0.2)	
Brother/Sister	1 (0.1)	0 (0.0)	
Father-in-law/Mother-in-law	109 (6.7)	85 (5.2)	
Father/Mother	4 (0.2)	3 (0.2)	
Grandparent	1 (0.1)	1 (0.1)	
Great-grandchild	29 (1.8)	42 (2.6)	
Self	74 (4.5)	89 (5.4)	
Other (specify)	1 (0.1)	1 (0.1)	
Refuse to answer	0 (0.0)	1 (0.1)	
Son-in-law/daughter-in-law	465 (28.4)	489 (29.7)	
Son/Daughter	32 (2.0)	23 (1.4)	
Spouse/Partner	921 (56.2)	906 (55.1)	
Stepson/Stepdaughter	1 (0.1)	0 (0.0)	
Age (mean (sd))	25.08 (4.03)	25.17 (4.04)	0.536
Highest Grade Achieved of Mother (%)			0.656
Diploma	1 (0.1)	2 (0.1)	
Grades 1-5	301 (18.4)	316 (19.2)	
Grades 10-12	66 (4.0)	69 (4.2)	
Grades 6-8	202 (12.3)	218 (13.3)	
Grades 9-10	105 (6.4)	122 (7.4)	
Graduate	21 (1.3)	25 (1.5)	
Never go to school	938 (57.2)	884 (53.8)	
Other (Specify)	0 (0.0)	1 (0.1)	

	Control	Treatment	p-value
Post-Graduate	5 (0.3)	7 (0.4)	
Husband Age (mean (sd))	28.43 (4.85)	28.52 (4.86)	0.591
Highest Grade Achieved of Husband (%)			0.138
Diploma	8 (0.5)	10 (0.6)	
Don't Know	10 (0.6)	8 (0.5)	
Grades 1-5	420 (25.6)	402 (24.5)	
Grades 10-12	82 (5.0)	98 (6.0)	
Grades 6-8	436 (26.6)	407 (24.8)	
Grades 9-10	189 (11.5)	236 (14.4)	
Graduate	44 (2.7)	62 (3.8)	
Never go to school	433 (26.4)	403 (24.5)	
Post-Graduate	17 (1.0)	17 (1.0)	
Refuse to answer	0 (0.0)	1 (0.1)	
Home Condition			
What type of roof do you have?			
Concrete/Cement	333 (20.3)	348 (21.2)	0.577
Metal/Asbestos sheets	65 (4.0)	50 (3.0)	0.178
Straw/Thatch/Sod/bamboo/mud	628 (38.3)	575 (35.0)	0.051
Tile	1008 (61.5)	1013 (61.6)	0.974
Stone	286 (17.4)	339 (20.6)	0.023
What type of latrine do you use?			
Jungle/ Field	1473 (89.9)	1388 (84.4)	<0.001
Private latrine within the house with water	83 (5.1)	143 (8.7)	<0.001
Private latrine within the house without water	38 (2.3)	71 (4.3)	0.002
Private latrine outside the house with water	71 (4.3)	91 (5.5)	0.131
Time to Water			0.024
0 minutes (inside the house)	134 (8.2)	169 (10.3)	
1-10 minutes	677 (41.3)	682 (41.5)	
1-2 hours	10 (0.6)	9 (0.5)	
10-30 minutes	693 (42.3)	625 (38.0)	
30 minutes-1 hour	124 (7.6)	159 (9.7)	
Don't Know	1 (0.1)	0 (0.0)	
Electricity at home			0.001
Yes	1269 (77.4)	1354 (82.4)	
No	370 (22.6)	289 (17.6)	
Finances			
Primary means of income (%)			0.685
Agricultural labor	84 (5.1)	78 (4.7)	
Self-employed (agriculture)	529 (32.3)	514 (31.3)	
Self-employed (non-agriculture)	1026 (62.6)	1052 (64.0)	
Does your Income Vary			0.096
Static	269 (16.4)	304 (18.5)	
Varies	1346 (82.1)	1325 (80.6)	
Bank Account			0.114
No	108 (6.6)	125 (7.6)	
Yes	1527 (93.2)	1509 (91.8)	
Do you have Savings at the end of the month?			0.073
No	968 (59.1)	925 (56.3)	
Rarely	159 (9.7)	137 (8.3)	
Yes, frequently	212 (13.0)	263 (16.0)	
Yes, sometimes	279 (17.0)	290 (17.7)	
Savings (mean (sd))	1648.37 (2978.95)	1838.38 (3026.82)	0.308

	Control	Treatment	p-value
Do you own Land?			0.025
Don't Know	13 (0.8)	18 (1.1)	
No	78 (4.8)	112 (6.8)	
Refuse to answer	0 (0.0)	2 (0.1)	
Yes	1548 (94.4)	1512 (92.0)	
Number of Bighas (mean (sd))	3.03 (2.44)	3.11 (2.12)	0.628
Access to Mobile = Yes (%)	1367 (83.4)	1386 (84.3)	0.513
Who owns the Mobile			0.021
Brother-in-Law	24 (1.8)	18 (1.3)	
Don't Know	2 (0.1)	0 (0.0)	
Father-in-Law	68 (5.0)	79 (5.7)	
Husband	874 (63.9)	809 (58.4)	
Mother-in-Law	19 (1.4)	22 (1.6)	
Other (Specify)	5 (0.4)	1 (0.1)	
Self	370 (27.1)	454 (32.8)	
Sister-in-Law	3 (0.2)	2 (0.1)	
Son/Daughter	2 (0.1)	1 (0.1)	
Assets			
Is there chair/stool/sofa in the household? (Yes)	341 (20.8)	409 (24.9)	0.006
Is there refrigerator in the household? (Yes)	82 (5.0)	130 (7.9)	0.001
Is there TV in the household?			0.001
No	1343 (81.9)	1267 (77.1)	
Refuse to answer	2 (0.1)	0 (0.0)	
Yes	294 (17.9)	377 (22.9)	
Is there satellite tv dish/cable in the household?			0.004
No	1369 (83.5)	1299 (79.0)	
Refuse to answer	1 (0.1)	1 (0.1)	
Yes	269 (16.4)	344 (20.9)	
Is there Radio/Transistor/Stereo in the household?			0.202
No	1616 (98.6)	1611 (98.0)	
Refuse to answer	1 (0.1)	0 (0.0)	
Yes	22 (1.3)	33 (2.0)	
Is there two-wheeler in the household?			0.005
No	1113 (67.9)	1038 (63.1)	
Refuse to answer	2 (0.1)	0 (0.0)	
Yes	524 (32.0)	606 (36.9)	
Is there bicycle in the household?			0.133
No	1513 (92.3)	1530 (93.1)	
Refuse to answer	0 (0.0)	3 (0.2)	
Yes	126 (7.7)	111 (6.8)	
Is there bullock cart in the household?			0.071
No	1616 (98.6)	1606 (97.7)	
Refuse to answer	1 (0.1)	0 (0.0)	
Yes	22 (1.3)	38 (2.3)	
Are there draught animals in the household?			0.453
No	884 (53.9)	909 (55.3)	
Refuse to answer	1 (0.1)	0 (0.0)	
Yes	754 (46.0)	735 (44.7)	
Are there productive animals in the household?	1432 (87.4)	1410 (85.8)	0.195
Do you own a mobile phone?			
Yes	1386 (84.3)	1367 (83.4)	0.483

	Control	Treatment	p-value
If yes, who keeps this phone?			0.021
Brother-in-Law	24 (1.8)	18 (1.3)	
Don't Know	2 (0.1)	0 (0.0)	
Father-in-Law	68 (5.0)	79 (5.7)	
Husband	874 (63.9)	809 (58.4)	
Mother-in-Law	19 (1.4)	22 (1.6)	
Other (Specify)	5 (0.4)	1 (0.1)	
Self	370 (27.1)	454 (32.8)	
Sister-in-Law	3 (0.2)	2 (0.1)	
Son/Daughter	2 (0.1)	1 (0.1)	
Maternal Child Health Awareness			
Why is it important to attend ANC camps? (select all that apply)			
In order to ensure the child is healthy and protected from diseases	939 (57.1)	949 (57.7)	0.802
The government says they have to go	253 (15.4)	241 (14.7)	0.535
Other mothers are going with their children	98 (6)	86 (5.2)	0.352
To get materials for food	273 (16.6)	278 (16.9)	0.849
How many ANC camps should a mother visit during pregnancy?			0.073
1	68 (4.1)	74 (4.5)	
2	487 (29.7)	450 (27.4)	
3	540 (32.9)	523 (31.8)	
4	342 (20.9)	354 (21.5)	
5	86 (5.2)	93 (5.7)	
Don't Know	97 (5.9)	109 (6.6)	
Other (Specify)	19 (1.2)	37 (2.3)	
Refuse to answer	0 (0.0)	4 (0.2)	
Do you get informed about regular health camps?			0.58
Don't Know	9 (0.5)	15 (0.9)	
No	47 (2.9)	45 (2.7)	
Other (Specify)	1 (0.1)	2 (0.1)	
Refuse to answer	1 (0.1)	0 (0.0)	
Yes	1581 (96.5)	1582 (96.2)	
If yes, who informs you about these camps?			
ANM	209 (12.8)	182 (11.1)	0.136
ASHA	1408 (85.9)	1412 (85.9)	0.992
Other health worker	344 (21)	341 (20.7)	0.865
Someone else	111 (6.8)	124 (7.5)	0.39
Nobody	46 (2.8)	48 (2.9)	0.849
Did you ever share information about MCH Camps to others? If so, to whom?			
Yes, Relatives	422 (25.7)	424 (25.8)	0.976
Yes, Friends	173 (10.6)	158 (9.6)	0.368
Yes, Neighbors	725 (44.2)	750 (45.6)	0.424
No	615 (37.5)	619 (37.7)	0.936
Which disease(s) can be prevented by vaccines given during ANC?			0.216
Tetanus	1072 (65.4)	1060 (64.5)	
Don't know	553 (33.7)	564 (34.3)	
How many shots of Tetanus vaccine are required? mean(sd)	1.21 (0.89)	1.20 (1.02)	0.626
Do you think the child should go to the immunization camp?			
Yes	1607 (98)	1602 (97.4)	0.246
Why is it important to bring your child to camp during infancy? (select all that apply)			
In order to ensure the child is healthy and protected from diseases	1391 (84.9)	1399 (85.1)	0.857
The government says they have to go	268 (16.4)	231 (14.1)	0.065
Other mothers are going with their children	116 (7.1)	93 (5.7)	0.094
To get materials for food	372 (22.7)	374 (22.7)	0.968

	Control	Treatment	p-value
If yes, who informs you about these camps?			
ANM	214 (13.1)	180 (10.9)	0.0629
ASHA	1389 (84.7)	1388 (84.4)	0.803
Other health worker	325 (19.8)	318 (19.3)	0.726
Someone else	118 (7.2)	129 (7.8)	0.484
Nobody	64 (3.9)	65 (4)	0.944
Did you share information about the importance of immunizations to others?			
Yes, Relatives	384 (23.4)	382 (23.2)	0.897
Yes, Friends	177 (10.8)	146 (8.9)	0.064
Yes, Neighbors	723 (44.1)	751 (45.7)	0.368
No	642 (39.2)	684 (41.6)	0.155
Which diseases are preventable by vaccines? (select all that apply)			
Tuberculosis	156 (9.5)	162 (9.9)	0.741
Diphtheria	122 (7.4)	111 (6.8)	0.441
Pertussis (Whooping cough)	180 (11)	177 (10.8)	0.841
Polio	781 (47.7)	801 (48.7)	0.541
Tetanus	621 (37.9)	667 (40.6)	0.116
Measles	361 (22)	369 (22.4)	0.803
Jaundice	185 (11.3)	225 (13.7)	0.037
Have you received iron folic acid (IFA) tablets during your pregnancy?			0.433
Yes	1352 (82.5)	1373 (83.5)	
Did anyone in the family ever receive an SMS message regarding MCH camps?			0.184
No	1625 (98.8)	1622 (99)	

5.1.3 Other competing interventions

The status quo process of paper-based tracking directly competes with Khushi Baby's Intervention at the camp site. ANMs are still required to conduct paper-based monthly reports, and submit these reports to the DEO. This double work, is in part alleviated, by specially designed features in the Khushi Baby App aimed at making regular reporting streamlined by providing camp data in an organized manner. The double work however, does provide an extra burden to these ANMs, some of whom use the KB App with only occasional frequency.

Other mHealth Interventions are also being implemented in Udaipur. Of note, eVIN (electronic Vaccine Intelligence Network), UNDP's vaccine monitoring system, is used by LHVs to monitor stock during supervisory field visits. Boston Consulting Group is working with the State Ministry of Health and Family Welfare to implement practices to improve neonatal mortality (Chirayu Program) in the Block of Salumbar, one of the five geographical blocks where KB is also implemented. BCG has come to work closely with KB as one of their core focus areas is also improving accountability and data. Instead of competing, they have actually collaborated with KB to design additional modules required for alignment of the KB system with MOHFW requirements for scale-up.

5.1.4. Self-selection into the intervention

The incentives of receiving a KB Pendant (or for that matter Voice Call Reminders) are likely not strong enough to cause self-selection into Treatment groups given the existing barriers to

transportation and from deficits in health literacy. Migration during the last trimester of pregnancy is more likely to cause cross-over when mothers go to live with their in-laws before delivery. Such migration however would not be considered to be self-selecting.

5.1.5. Spillover

Mothers in the region do migrate from their village to the village of their in-laws in the third trimester of pregnancy, before delivering the child. As a result of this migration, cross-over or spill-over may take place.

Additionally, mothers living on the boundaries of two subcenter catchment areas may vary in their selection of the health camp they choose to attend. Catchment areas cater to roughly a 5km radius from the subcenter at the centroid.

Beyond spill-over of the Pendant from treatment areas into control areas, other components of the intervention may also have a role. ANMs, targets of the behavior change, do communicate amongst each other and therefore are not blinded from the intervention. Voice Calls too have a chance to cross boundaries of treatment and control subcenters if SIMs are exchanged, patients move, or false phone numbers are entered.

5.1.6. Behavioural responses to the evaluation

Hawthorne effects and resentment effects pose the greatest challenges to the evaluation. Hawthorne effects are relevant given the very close hand-holding provided by the KB Monitoring team to the Treatment ANMs. These KB Monitors in some cases are called upon to provide other kinds of support at the camp, and after the camp (for example to help the ANM sync the data at the network point). This close involvement between the KB Monitor and ANM could result in both dependence and in the ANM only working with the KB App in the presence of the KB Monitor. Behavior change of the ANM would therefore be due to the presence of the supervising monitor instead of the individual responsibility and tools to use the KB app in of themselves. Resentment effects also come into play when considering resistant ANMs, especially those in the Lasadia Block. Some ANMs resorted to various tactics to avoid using the KB App and ultimately on the recommendation of the BCMO we had to release these select few from their obligation in continuing. John Henry effects either on the part of the beneficiaries or on the part the ANMs were not observed.

5.1.7. Non-response

No mothers approached at the time of enrollment refused to take part in the study. Mothers who denied receipt of the KB Pendant will be ascertained in the midline survey exercise (ongoing). A known source of mothers who opted out from receiving Pendants has come from resistant ANMs in the Lasadia block deliberately informing mothers to not accept the Pendant.

5.2. Implications for ex-post power calculations

Two outcomes are relevant for ex-post power-calculations required for regression modeling: FICT and Patient Record Retention. Given measured baseline rates and average cluster size achieved, MDE for FICT and Patient Record Retention are 13.3% and 10% respectively, assuming 10% loss-to-follow-up. For FICT, given that Control is not considered, in order to establish an exposure criteria within treatment, whether a single KB Voice Call was received will act as the criteria. It is assumed that 50% of intra-intervention will receive the KB Voice Call, which can only be confirmed at midline.

Table 15. Ex-post Power Calculations[42]

Desired cluster size	Assumed Baseline rate	Estimated experimental rate	Minimum Detectable Difference	Clusters Required for ICC = 0.15	10% + requirement	Required Sample	Outcome
10	0.2	0.35	0.15	64	70.4	704	
10	0.3	0.45	0.15	76	83.6	836	
10	0.5	0.65	0.15	80	88	880	
10	0.2	0.3	0.1	138	151.8	1518	
10	0.24	0.34	0.1	152	167.2	1672	
10	0.3	0.4	0.1	168	184.8	1848	
10	0.5	0.6	0.1	182	200.2	2002	
10	0.2	0.25	0.05	514	565.4	5654	
10	0.3	0.35	0.05	646	710.6	7106	
10	0.5	0.55	0.05	736	809.6	8096	
20	0.2	0.35	0.15	56	61.6	1232	
20	0.24	0.373	0.133	74	81.4	1628	FICT
20	0.3	0.45	0.15	62	68.2	1364	
20	0.5	0.65	0.15	66	72.6	1452	
20	0.2	0.3	0.1	112	123.2	2464	
20	0.24	0.34	0.1	124	136.4	2728	
20	0.3	0.4	0.1	136	149.6	2992	
20	0.5	0.6	0.1	150	165	3300	Patient Record Retention
20	0.2	0.25	0.05	422	464.2	9284	
20	0.3	0.35	0.05	530	583	11660	
20	0.5	0.55	0.05	602	662.2	13244	
30	0.3	0.45	0.15	60	66	1980	
30	0.5	0.65	0.15	62	68.2	2046	
30	0.2	0.3	0.1	104	114.4	3432	

Actual Clusters = 81 (Treatment), 81 (Control) - Patient Retention Outcome

Actual Clusters = 81 (Treatment) - FICT Outcome

Measured Baseline FIC = 0.241

Baseline Patient Record Retention = 0.509

Actual Treatment: 1644 - FICT Outcome (Assumes half won't receive Exposure of Intervention)

Actual Control + Treatment: 3283 - Patient Retention Outcome

[42] Calculated using CRTSize Package on R

5.3. Implications for ex-post randomization

If randomization is done after baseline surveys, demonstrate that there is balanced randomization assignation.

Randomization was conducted on the basis of full immunization coverage strata derived from the PCTS Backend. Balance can be demonstrated below

Table 16. Randomization Balance on Previously Measured Strata of Immunization

Full Immunization Coverage Rate (PCTS)	Treatment	Control
Low (<60% FIC)	12	15
Mid (60-90% FIC)	33	30
High (>90% FIC)	36	36
Total	81	81

Randomization was conducted before baseline surveys were conducted on the Enrollment Sample.

5.4. Limitations and Implications from Baseline

The first and foremost limitation of the evaluation is in the form of data quality. Data quality in control (status quo) paper based tracking cannot be trusted on face value given our observations throughout the baseline process. As a result of this, our evaluation framework has had to adjust and can no longer directly compare the effectiveness of the intervention as a whole, using an intent-to-treat analysis, on health behavior outcomes (FICT1,2) against a pure control. The evaluation framework has therefore changed to accommodate for the data quality called into question. In doing so, the framework has in effect lost the original a priori conditions required in a pre-analysis plan.

The evaluation is tightly linked to the successful implementation of the intervention. The intervention itself has had challenges - technical and operational. These challenges have forced the intervention to mutate and self-correct over time. In doing so, the ability to isolate effects of the intervention components has been affected. In addition confounding due to time is now a factor that has manifested from the defacto stepped-wedge design. The self-correction of the platform also suggests the data quality outcomes are only static representations of the Treatment, requiring assessment both at Midline and Endline.

Finally, due to a delay in rolling out the intervention, the Enrollment Sample was unable to receive the Intervention during pregnancy. Our goal was to assess progress through pregnancy, into the immunizations required during infancy, accounting for the various baseline factors collected in the Enrollment Sample. While we do have non-cohort data for pregnancy related follow-up, the baseline factors for those mothers are missing. As a result our analysis is constrained to following-

up with the health outcomes of the child, without necessarily having reliable past medical history of the mother or knowing the adjusted effects of the intervention on the child outcomes when the mother is the one who starts receiving the KB Pendant and Voice Calls.

Given the adaptive nature of the intervention and multiple stakeholders involved, gaining deeper insights from qualitative analyses: free response messages and key informant interviews (semi-structured) with a variety of stakeholders, after some time has been allowed for the intervention reach a steady state will provide perhaps the most useful data for the level of policy recommendations at the District and State levels.

6. Major challenges and lessons learnt

The major challenge that we have faced has come in the form of receiving due funds on time from funding agencies. We have learnt to scale back budgets so that there is enough balance left in between tranches and given the unpredictability of tranche receipt, and to anticipate shortages by applying for supplementary grants to alleviate the intermittent financial burden.

Funding constraints have been exacerbated by the significant early challenges of rolling-out a technological intervention. Our application has required over 110K USD investment and over a year of development. Since launch, the app has undergone revisions to address bugs, new feature requirements, and user interface deficits noticed by monitors and ANMs. In this process, we also have had to combat the significant hurdle of dysfunctional tablets, provided to us by our partner organization OT-Morpho (formerly Safran-Morpho). After 5 months of intervention roll-out, we still have 50% of our ANMs using tablets that still have some issues: NFC tag scanning broken, processor issues, battery drain issues, and screen display issues. Our lesson learnt has been to engage directly with Morpho to find an alternate tablet and to replace all faulty tablets. In this process, we have also been able to identify a cost-effective tablet, the DataMini, that both meets cost, feature, and robustness requirements for a program at scale.

Additional challenges have included convincing district health officials, mandated by the state to implement existing paper-based tracking practices, to make room for the KB intervention (let alone in a randomized manner). ANMs still engage in paper-based data collection, even in the field, despite having access to the Khushi Baby App. We have learnt that involving the CMHO, being thorough in our approach, adhering to government requirements for data collection, and demonstrating persistence can allow us to gain the favor of key District Health Officials who can help us by mandating that ANMs work exclusively on the KB App during Camp Days and work on Paper formats during their month-end exercise to avoid double work. Additionally, KB has also added ‘Patient Search’ feature in the KB App so that filling of these Paper formats may be streamlined (without the need to refer poorly kept paper diaries) on off-camp days.

Overall, ANMs have displayed various levels of proficiency and enthusiasm towards the KB App. Some ANMs have been particularly resistant, and have encouraged mothers too to be resistant to receiving the KB Pendant. Other ANMs struggle with data entry with the Khushi Baby App despite extensive hand-holding and in-field support. Some ANMs inconsistently use the app - only using the app when a Monitor is present or sometimes forgetting to charge their tablet. In order to address these challenges, we have kept a kept a ratio of 1:5 Monitors to ANM to reinforce proper protocols among resistant or non-proficient ANMs. We have made additional visits to concerning ANMs with the support of BCMOs and the CMHO. In some cases, we have had to release ANMs from the KB App, on the advice of the BCMO due to the disturbances being caused to the rest of the cadre. Our Evaluation Strategy has also focused the Monitors efforts on closely following each and every process conducted by the ANM via vis the ANM Camp Observation Checklist.

Despite extensive training of LHVs, MOs, and BPMs on the Dashboard, the process to convert these stakeholders to daily active users of the Dashboard also has seen its set of challenges. Many MOs don’t use a computer at their desk. Certain technological issues causing backend data discrepancies have required that we pause efforts to encourage dashboard use until these issues

are first addressed. We have learnt that we cannot immediately jump to expecting these stakeholders will use the Dashboard in the current format. As a result, we are iterating upon the reports and actionable lists presented, and piloting these results through the channel of WhatsApp, in which all stakeholders from each block are connected. We have come to realize we still have more work to do to cultivate a culture of using data for action and ultimately for impact. We will be able to more proactively push for engagement after addressing some of the gaps in our reports that we aim to send in the WhatsApp groups.

We have faced challenges in engaging with stakeholders at the Central MOHFW who are working with ANMOL. Despite a very successful meeting with the Deputy Representative of UNICEF India, and the promise to make an introduction, we have yet to connect with a MOHFW stakeholder with relevant political influence. We have had success on our own in getting the attention of the Ministry of IT, and being approached by them to replicate our project in Bihar. From these experiences, we have learned we cannot easily rely on external NGOs, who have to balance political interests, or for-profit companies, who have to advance their own agenda sometimes at the compromise of an effective pitch, to directly connect us with Central Ministry stakeholders. We will need to prove our own path.

7. Conclusion

The Khushi Baby team has conducted extensive field work in Udaipur to design, deploy, and monitor and evaluate this technological platform. In doing so, the team has come to understand the demographic profile of the mother's, ANMs, and ASHAs. The team too has come to learn and understand the journey of stakeholder engagement - it took over a year to convince the CMHO to write a letter and become an advocate for the platform, and still there are small factions of ANMs in Lasadia block who are resistant.

The team has come to appreciate the challenges and responsibilities borne by the ANMs. The combination of workload, poor facilities and supplies, the government mandate to fill paper records at the month end, the lack of accountability mechanisms, and lack of demonstrated value of data collection, and the need to meet health targets results in ultimate decline of ANM data quality and thereby care provision.

The team also sees opportunity in the prospect of engaging ANMs (who affirmed the need for a system that didn't require them to log a hefty register for multiple kilometers, and one that would save their time for monthly reports) and mothers alike (many of whom who have access to a cell phone but who have not yet been engaged on this medium for either ANC, PNC, or immunizations). High levels of being informed by the ASHA does not appear to translate in actionable knowledge of health for the mother or the child regarding number of visits to be conducted and why. This too suggests an opportunity for targeted and automated dialect specific voice call messaging (not SMS given literacy rates).

Behavior change on the part of the health management (the intended KB Dashboard users) will require a phase-wise approach of enticing officials with snippets of data in a digestible format, beginning with WhatsApp. The goal of these messages is to display the data in such a way that the health officer can pick up the phone and organize direct action. But this behavior change must be led initially by the KB team demonstrating how the data can be used to take action.

Critically, the ANM and the Health Official alike should not see the application as extra work. Although current government mandates for reporting and paper proofs do maintain a burden at the end of the month, the current application's Search Patient feature allows for speedier, unfalsified record entry from quick retrieval of patients from the tablet's database. Still some nurses, especially those elderly nurses, struggle with using the tablet. Others do not pick up the application until the Monitor arrives on the campsite.

On the other hand, mothers are seemingly coming to adopt the Pendant. In one scenario, a mother had approached a PHC and had informed the block medical officer that her pendant was her MAMTA card. The BCMO, having been out of the loop, and without a KB tablet on hand, called the electrician to determine what was inside the chip that made it an electronic MAMTA card.

Khushi Baby looks forward to moving into it's next phase of action - using data for decision making, and bringing more stakeholders of the health value chain into regular use. The next phase of evaluation will seek to directly compare the data quality of KB vs. PCTS and report back on user behaviors and satisfaction.

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Checklist of essential information to include in the baseline report

Chapters/ sections	Item No	Checklist items	Check	Reported on page No	If Not Reported, Reason Why
Title page	a	Study code (TW.1078)	✓	1	
	b	Study title	✓	1	
	c	Name of the person(s)	✓	1	
	d	Date of the report	✓	1	
List of acronyms			✓	7-8	
Summary			✓	6	
1. Introduction			✓	9-13	
2. Objectives of the evaluation	a	Description of intervention/programme	✓	14-30	
	b	Cost of the intervention	✓	30-31	
	c	Monitoring plan of the intervention	✓	31-32	
	d	Theory of Change (ToC)	✓	33-35	
	e	Evaluation questions	✓	36-37	
3. Methods	a	Evaluation design	✓	38-45	
	b	Evaluation timeline	✓		
	c	Sampling design for each quantitative survey	✓	46-49	
	d	Sampling design for each qualitative survey	✓	46-49	
	e	Description of survey instruments	✓	49	
	f	Description of survey implementation	✓	50-51	
	g	Techniques of qualitative data analysis	✓	51	
	h	Description of administrative data (if relevant)	✓	51	
	i	Description of secondary survey data (if relevant)	☐	Not Applicable	No secondary survey data used
4. Findings from the baseline surveys	a	Description of the quantitative sample	✓	53-57	
	b	Description of the qualitative sample	✓	66-84	
	c	Comparison of survey sample with national population	✓	86-86	
	d	Cross-tabulations, correlation and/or regression analysis using quantitative data	✓	Not Applicable	Will be calculated only after completion of midline data collection
	d	Findings from qualitative sample	✓	86-87	

5. Validation of the evaluation design and its implications	a	Balance table	✓	89-98	
	b	Description of other competing interventions (if relevant)	✓	98	
	c	Discussion of self-selection into the intervention	✓	98	
	d	Discussion of spillover and/or contamination	✓	99	
	e	Discussion of non-response bias	✓	99	
	f	Implications for ex-post power calculations	✓	99	
	g	Implications for ex-post randomization (if relevant)	✓	100	
	h	Implications for the design of the intervention and its evaluation	✓	100	
6. Major challenges and lessons learnt			✓	102-105	
7. Conclusion			✓	104-105	

Required tables and figures					
	a	List of indicators to monitor the implementation	✓	Table 4, page 32	
	b	Evaluation design figure (e.g. CONSORT-style randomisation flow diagram) – Annex B	✓	Figure 14. Page 47	
	c	Evaluation timeline (refer to Annex C)	✓	Supplemental Figure 3, Page 122	
	d	Location of treatment and control areas on a map, if available (refer to Annex D)	✓	Figures 3-4 , Pages 20-21	
	e	Descriptive statistics *of important socio-economic and demographic characteristics of the full sample population and important sub-groups* for quantitative sample	✓	Pages 53-84	
	f	Descriptive statistics of important socio-economic and demographic characteristics of the qualitative sample population and important sub-groups	✓	Table 12, Page 87	
	g	Comparison of the outcome variables and covariates that determine outcome of interest for the sample population with national population	✓	Page 85	
	h	Balance table with means and standard deviations of all primary and secondary outcomes and important covariates across study arms	✓	Table 13, Pages 89-98	
	i	Revised power calculations in a figure or a table	✓	Table 14, Page 101	

Appendices:

1. KB Comparison Matrix
2. IRB Approval Letter
3. Baseline Protocols
4. Khushi Baby Overview
5. Khushi Baby Dashboard
6. Evaluation Timeline
7. Full Immunization Coverage and Timeliness Outcome Framework
8. KB Monitor Workflow
9. Survey Instruments

KB Comparison Matrix

Product/ Platform/ Service	CommCare "ICT-CCS"	ANMOL	Khushi Baby 2.0
Competency	Design Development (App, Backend) Training guides for existing modules	UNICEF India - Chief Technical Consultant External Software House - development Government of India - training and deployment	Community-based design Tech Development (App, Backend, Hardware) Field-Level Training and Support Field-level Community Mobilization Field-Level Monitoring and Evaluation Field-Level Stakeholder Engagement Plans Data Analytics + Public Health Core
Purpose	Due-lists for ASHAs, Training Guides on Mobile for Awareness promotion at Household level, Supervisory monitoring interface of ASHAs by Female Lady Volunteers	Registration and Tracking of Service Delivery (antenatal, intra-natal, post-natal) Due Lists for ANMs Video Counseling Resources Dashboard for Monitoring	New digital health record for mothers, children Tracking of maternal, neonatal, child care Due Lists for ANMs Improved identification of supply-side gaps Automated Data Quality / Fraud Checks Dashboard designed for Decision Making Automated Voice Call Reminder platform for Community Engagement
Target Users:	ASHAs	ANMs, DEOs	Pendant: Mothers, Infants, App/Tablet: ANMs, LHVs Dashboard: LHVs, DEOs, BCMOs, BPMs, CMHO
Design Process	Research Pilot, unpublished design process	<1 year, unpublished design process	3 Years in rural Rajasthan, India with input from mothers, community members, ANMs, ASHAs, DEOs, LHVs, BPMs, BCMOs, CMHO
Designed according to NHM RCH Register Sections I-III	No	Yes	Section II, III currently, Section I currently being built
Evidence Base	1 RCT - 35 health workers, 120 Villages Assumes Data Quality	None	2 RCTs (1 ongoing), 81 ANMs, 280 villages Questions Data Quality
Currently Active Deployed	No	No	Yes
Key Differentiators	Modular build, compatible for wide range of devices including feature phones	Piloted with 11,000 ANMs	End-to-End Process Experience Patient-centric, decentralized, offline biometrically authenticated, health record built for last mile Emphasis on Data Quality Detection Emphasis on Data Actionability at District Level

IRB Approval Letter

CORT

Ethics Review Committee

Centre for Operations Research and Training (CORT)

402, Woodland Apartment, Race Course, Vadodara – 390007

Approval Document

Principal Investigators:

Ruchit Nagar, CO-PI
Mohammed Shahnawaz, CO-PI
Sanjana Malhotra, CO-PI

Project Title: cRCT with nested process evaluation of the effectiveness of the Khushi Baby system on improving timely antenatal care and infant routine immunization adherence in Udaipur, India

The CORT ERC reviewed to the above-mentioned project proposal on cRCT with nested process evaluation of the effectiveness of the Khushi Baby system on improving timely antenatal care and infant routine immunization adherence in Udaipur, India

The CORT ERC discussed: (1) The appropriateness of the methodology to be used to secure informed consent, (2) The rights and welfare of the individual(s) involved and (3) The potential benefits of the projects. There were clarifications sought for more understanding on the technology being used to store data and track children for timely and complete immunisation, regarding training of the health worker in using the technology, cost of the technology, cost efficiency calculations, analysis of time saved of the health staff by using this technology, appreciations for those who perform well and using the app more carefully to prevent any damage to the device.

The CORT ERC has concluded that the principal investigators have taken sufficient safeguards to carry out the research study. There is no known physical, emotional, psychological, or economical risk. Therefore, the CORT ERC approves this proposal.

Dr Rohit Bhatt
(Chairperson ERC)

July 15, 2016
Date

The Principal Investigator, in signing this report, agrees to comply to notify the CORT ERC office about any additions or changes in procedure subsequent to this review, report and instances of injuries to subjects and unanticipated problems involving risk to subject or others, to provide information on progress of the research on an annual basis. Any consent forms used in connection with this project must be retained by the Principal Investigator for three years after completion of the research.

Baseline Survey Exercise Protocols:

Note the following Measures were Executed during the Enrollment and Baseline Coverage Surveys which were taking place concurrently:

Listing Exercise: One Block Guide with an assistant in each block would travel to identified Health Sub Centres meeting ANMs and ASHAs to obtain data on eligible households in format provided to them. Each day the filled format would be sent to Project Associate at HQ for further process and to prepare lists for baseline surveyors.

- Block Guide will also act as back check monitors of survey exercise once listing exercise would be completed

Survey Exercise: A team would consists of six member of 5 surveyor + 1 revisit surveyor and each team would be led by one Supervisor.

- Surveyors will be administering three types of questionnaire based on the eligibility of the household (to be collected on hand-held tablets using “CTO Survey” software. One Surveyor from each team would also work as revisit surveyor to cover eligible household which are left uncovered during first visit of data collection due to various reason.
- Supervisors will be assigning households to surveyors on daily basis, ensure data quality , compiling tracking sheet, and prepare a list of revisit households and sharing same with his revisit surveyor and the project associate at KB HQ. Identification of the supervisor will occur as surveyor training proceeds and will be based on leadership skills, participation, and attentive discussion during the training procedure. The sample households drawn from the line list of eligible households will be communicated by the Project Associate to the baseline surveyors in the following way:
    - Tracking sheets with information on the households sampled from each village will be sent by the Project Associates to supervisor for baseline survey.
    - On the day of the survey, the supervisors will be given the tracking sheets to distribute among their team of baseline surveyors in the morning before going to the village.
    - These sheets will also be shared with monitors/back checker for regular monitoring of surveyed households.
- Possible scenarios could occur when a surveyor approaches a dwelling.
    - The dwelling is open: The surveyor would approach any adult member of the identified household and begin the baseline survey. At the end of the survey, the surveyor would write “D” (indicating “Done”) on the right side of the exterior wall of the dwelling, at a visible point; this would indicate that the the household has been surveyed.
    - If the household member refuses to answer, the surveyor would mark “NA” on the house to indicate exemption of the household from the study.
    - The dwelling is closed or empty: The surveyor would speak to an adult neighbor to reconfirm the eligibility of that household. The surveyor will have to make sure that the neighbor being asked these questions knows the household well i.e. they are aware of the number of members living in the household and are well

acquainted with the family. If not, the surveyor will look for a neighbor who is well acquainted with the neighbor.

- In this case, the entire survey would not be completed but only eligibility would be checked and name of household head and cellphone number of a household member would be noted.The following scenarios can take place:
  - The neighbor is asked about the approximate time the household member will return and if he is returning the very same day, the surveyor will stop the survey and return to the household later. The same is also included in the tracking sheet of the surveyors. The supervisor will be responsible for ensuring that all households are revisited again at the specified time.
  - In case the neighbor knows that the household head is returning the same day but is unsure of the time, the surveyor returns at the end of the day to check if he is back or not:
  - If the household head is back, the survey is conducted with the head

Before conducting survey, If the household is eligible then the surveyor would mark that household eligibility code (1=coverage, 2=Pregnant women, 3= Penta naive under 4 months of child) on their tracking sheet.

- In Case surveyor/supervisor find new eligible cases during village interview they will make a new ID for that particular respondent and conduct interview.
- If pregnant women from list delivered baby

- Tracking Sheet for surveyor:

  o Every surveyor will have a tracking sheet in which they will record the status of the household , who they have spoken to and whether the household is eligible or not.

  o Surveyors would keep a record of the households that they have completed in the tracking sheet, which will be submitted to the supervisor at the end of the day.

  o The supervisor would then compile the information from all the different tracking sheets:

    § number of eligible households in village under three different categories.

    § number of households where the surveyor spoke to household member

    § number of households where the surveyor spoke to neighbor

    § number of households where the surveyor spoke to no one

    § final survey status of the household

- Role of the supervisor

The supervisor would be primarily responsible for monitoring and supervision of her/his survey team. Additional mobile allowance of Rs 200 to be given to Supervisors to improve the coordination. They will also be responsible for the following:

- Assigning respondent IDs to the surveyors.
- Deployment of surveyors according to the number of respondent in each villages.
- Conducting accompaniment and shadow check

Digital Data Collection:

- The entire census exercise would be conducted digitally, using tablets
- Each surveyor would have an individual tablet on which they would collect data. Each supervisor will also be given a tablet to conduct the back checks
- Data from tablets would be uploaded every everyday at the KB HQ using wifi services available here. The supervisor will be responsible for sending the data on the server.

Revisits:

After completing the baseline survey exercise in a village, revisits would be conducted in this village depending on the source and content of information.

The numbers for revisits will be determined through the actual data collected and the will share the list daily with the PA/Program Manager. The calling will be done in the following manner:

- For HHs eligible according to the neighbor
    - Phone number of HH given: If the household is eligible, then the survey would be conducted with an adult of the household over the phone and added to the final data
    - Phone number of HH not given/not picked up but Neighbor number given: The neighbor would be called again and asked to take the phone to the actual household to complete the survey with the adult of the household.
    - Phone number of HH and Neighbor not given/not picked up/neighbor does not know/adult not available: A physical revisit will be made to collect the data
    - A member surveyor in each team would be responsible for calling/tracking the revisit HH

- Physical Revisits would happen in the following way:
    - A different team of 2-3 people would be responsible for conducting re-visits in tandem with the baseline surveys. The team would coordinate with field managers to collect maps to identify households which need to be re-visited. They would be given specific re-visit tracking sheet listing the Zone, HH number, Name of HH head, Status of HH
    - The re-visit team would also collect data digitally on tablets.
    - A household will be once called to check for data and if unsuccessful, will be revisited physically. If the information from the household is still unavailable, it will not be considered for sampling.

Physical Revisits would be made in the following cases as well:

1. When 10% of the HHs being called back (from non-eligibility) to confirm neighbors word proves to be inconsistent – then Village would need to be revisited

2. If we do not have enough HH members phone numbers and the neighbor claims in eligibility – we should still go revisit if majority is unconfirmed
3. When high number of BC data is inconsistent with original data

When neighbor is unable to get us to talk to the HH member (similar to 1.c and 3.c)

Table 9 (Full)

Question / Variable	Answers	Overall (n=3283) Number (% / Standard Deviation)
Average respondent age (mean (sd))	*Numerical*	25.13 (4.0)
Average age for head of household (mean (sd))	*Numerical*	28.47 (14.8)
Education level of husband (grade levels completed)	*Never attended*	836 (25.6)
	1-5	822 (25.2)
	6-8	843 (25.8)
	9-10	425 (13.0)
	10-12	180 (5.5)
	Graduate	106 (3.2)
	Post-graduate	34 (1.0)
	Diploma	18 (0.6)
Education level of mother (grade levels completed)	*Never attended*	1822 (55.5)
	1-5	617 (18.8)
	6-8	420 (12.8)
	9-10	227 (6.9)
	10-12	135 (4.1)
	Graduate	46 (1.4)
	Post-graduate	12 (0.4)
	Diploma	3 (0.1)
	Don't know	1 (0.0)
Do you own a house?	*Yes*	3274 (99.7)
	No	9 (0.3)
If yes, what material is your roof made from? (select all that apply)	*Concrete/cement*	681 (20.7)
	Metal/asbestos sheets	115 (3.5)
	Straw/thatch/sod/bamboo/mud	1203 (36.6)
	Tile	2021 (61.6)
	Stone	625 (19.0)
	Other	4 (0.1)
Describe the quality of material used to build your house wall	*Kuccha*	1732 (52.8)
	Pakka	1114 (33.9)

Question / Variable for Baseline Enrollment Sample	Answers	Number (% / Standard Deviation)
Describe the quality of material used to build your house wall	*Kuccha-Pakka*	436 (13.3)
	Other	1 (0)
Do you have access to sufficient water?	*Yes*	2926 (89.1)
	No	357 (10.9)
What kind of latrine do you use? (select all that apply)	*Jungle/field*	2861 (87.1)
	Private, indoor, with water	226 (6.9)
	Private, indoor, no water	109 (3.3)
	Private, outside, water	162 (4.9)
	Private, outside, no water	49 (1.5)
	Public	9 (0.3)
Do you have electricity at home?	*Yes*	2623 (79.9)
	No	659 (20.1)
If yes, what is your primary source of electricity?	*Kerosene*	630 (95.6)
	Other oil	4 (0.6)
	Candle	2 (0.3)
	Solar lantern	21 (3.2)
	No lighting	1 (0.2)
	Other	1 (0.2)
Do you have a mobile phone at home?	*Yes*	2753 (83.9)
	No	530 (16.1)
If yes, who owns the phone?	*Self*	824 (29.9)
	Husband	1683 (61.1)
	Father-in-law	147 (5.3)
	Mother-in-law	41 (1.5)
	Brother-in-law	42 (1.5)
	Sister-in-law	5 (0.2)
	Son/daughter	3 (0.1)
	Other	6 (0.2)
	Refuse to Answer	0 (0.0)
	Don't know	2 (0.1)

Question / Variable for Baseline Enrollment Sample	Answers	Number (% / Standard Deviation)
Occupation/income source (select all that apply)	*Self-employed (agriculture)*	2613 (79.6)
	Self-employed (non-agriculture)	407 (12.4)
	Agricultural labor	322 (9.8)
	Other labor	1945 (59.2)
	Pension	15 (0.5)
	Regular wage/salary earning	666 (20.3)
	Other	12 (0.4)
Which income source contributes the greatest to your financial standing?	*Self-employed (non-agriculture)*	2078 (63.3)
	Self-employed (agriculture)	1043 (31.8)
	Agricultural labor	162 (4.9)
Does your household income vary?	*Varies*	1671 (81.4)
	Static	573 (17.5)
	Don't know	28 (0.9)
	Other	9 (0.3)
	Refuse to answer	2 (0.1)
Does your family have money at the end of the month?	*Yes, frequently*	475 (14.5)
	Yes, sometimes	569 (17.3)
	Rarely	296 (9)
	No	1893 (57.7)
	Refuse to answer	2 (0.1)
	Don't know	45 (1.4)
	Other	3 (0.1)
Monthly savings	*Numerical*	Median: 1000 IQR = 500-2000
Do you own a bank account? Do you own a bank account?	*Yes*	3036 (92.5)
	No	233 (7.1)
	Don't know	12 (0.4)
Does your family own any land?	*Yes*	3060 (93.2)
	No	190 (5.8)
	Refuse to answer	2 (0.1)
	Don't know	31 (0.9)

Question / Variable for Baseline Enrollment Sample	Answers	Number (% / Standard Deviation)
If yes, how much land do you own (in bighas)?	*Numerical*	Median: 2 IQR: 1-3
Number of children under 5 in the household	*0*	1015 (30.9)
	1	1590 (48.4)
	2	627 (19.1)
	3	40 (1.2)
	4	8 (0.2)
	5	2 (0.1)
	6	0 (0.0)
	7	1 (0.0)
Did you ever receive a tetanus (TT) shot?	*Yes*	2999 (91.3)
	No	273 (8.3)
	Don't know	8 (0.2)
	Refuse to answer	3 (0.1)
Have you received iron folic acid (IFA) tablets during your pregnancy?	*Yes*	2725 (83.0)
	No	557 (17.0)
Do you get informed about regular health camps?	*Yes*	3163 (96.3)
	No	92 (2.8)
	Don't know	24 (0.7)
	Refuse to answer	1 (0.0)
	Other	3 (0.1)
If so, is there someone who primarily informs you of these camps? (select all that apply)	*ANM*	391 (11.9)
	ASHA	2819 (85.9)
	Other health worker	685 (20.9)
	Someone in community	235 (7.2)
	No	94 (2.9)
	Other	26 (0.8)
	Refuse to answer	3 (0.1)
Should mothers attend to ANC camps?	*Yes*	3218 (98.0)
	No	15 (0.5)
	Don't know	47 (1.4)

Question / Variable for Baseline Enrollment Sample	Answers	Number (% / Standard Deviation)
Should mothers attend to ANC camps?	*Refuse to answer*	3 (0.1)
How many ANC camps should a mother visit during pregnancy?	*1*	142 (4.3)
	2	937 (28.5)
	3	1063 (32.4)
	4	696 (21.2)
	5	179 (5.5)
	Don't know	206 (6.3)
	Other	56 (1.7)
	Refuse to answer	4 (0.1)
Why is it important to attend ANC camps? (select all that apply)	*In order to ensure good health*	2790 (86.9)
	The government requires it	473 (14.7)
	Because neighbors also go	209 (6.5)
	To get food/incentives	746 (23.2)
	Other	15 (0.5)
	Don't know	233 (7.3)
Why is it important to bring your child to camp during infancy? (select all that apply)	*In order to ensure good health*	2765 (85.9)
	The government requires it	494 (15.4)
	Because neighbors also go	190 (5.9)
	To get food/incentives	598 (18.6)
	Other	32 (1.0)
	Refuse to answer	1 (0.0)
	Don't know	265 (8.2)
What diseases do vaccinations help protect? (select all that apply)	*Tuberculosis*	318 (9.7)
	Diphtheria	99 (3.0)
	Pertussis (Whooping Cough)	357 (10.9)
	Polio	1582 (48.2)
	Tetanus	1288 (39.2)
	Measles	730 (22.2)
	Jaundice	391 (11.9)

Question / Variable for Baseline Enrollment Sample	Answers	Number (% / Standard Deviation)
What diseases do vaccinations help protect? (select all that apply)	*Other*	20 (0.6)
	Refuse to answer	11 (0.3)
	Don't know	1264 (38.5)
How many doses of the tetanus vaccine are needed during pregnancy?	*1*	2999 (91.3)
	2	273 (8.3)
	Refuse to answer	3 (0.1)
	Don't Know	8 (0.2)
Have you ever received an SMS for ANC, PNC or immunization-related services?	*Yes*	36 (1.1)
	No	3247 (98.9)

Table 10 (Full)

Question / Variable	Answers	Control (%)	Treatment (%)	Overall (n=163) Number (%)	Significance
Treatment vs. Control Assignment		77	86	163	
Survey block that ANM serves	Sarada			51 (31%)	
	Salumbar			46 (28%)	
	Jhadol			29 (18%)	
	Gogunda			24 (15%)	
	Lasadiya			13 (8%)	
Education Status (1-12 = 1st through 12th grade; 13 = graduate; 14 = post-graduate)	8	2 (2.6)	3 (3.5)	5 (3%)	
	9	0 (0.0)	4 (4.7)	4 (2%)	
	10	22 (28.6)	15 (17.6)	37 (23%)	
	11	1 (1.3)	4 (4.7)	5 (3%)	
	12	26 (33.8)	32 (37.6)	59 (36%)	
	Graduate	22 (28.6)	18 (21.2)	40 (25%)	
	Post Graduate	4 (5.2)	9 (10.6)	13 (8%)	
ANM Age	Numerical (Years)	38.03 (8.6%)	38 (9.9%)	Median: 37 IQR: 30-45	
How many monthly camps regularly conducted?	4			44 (27%)	
	3			39 (24%)	
	2			21 (13%)	
	1			20 (12%)	
	6			14 (9%)	
	5			13 (8%)	
	7			7 (4%)	
	8			3 (2%)	
	0			2 (1%)	

Mode of transport to Camps (select all that apply)	Walk			82 (50%)	
	Scooty			29 (18%)	
	Private Vehicle			23 (14%)	
	Motorcycle/ Bike			0 (0%)	
	Jeep/Car			7 (4%)	
	Auto Rickshaw			6 (4%)	
	Bicycle			16 (10%)	
Time of transport to PHC from house	15-30 minutes			64 (39%)	
	30-60 minutes			54 (33%)	
	1-2 hour			28 (17%)	
	0-15 minutes			15 (9%)	
	Over 2 Hours			2 (1%)	
Hours Worked Weekly at the Camp	Numerical (Hours)	6	5.62	Median: 6 IQR: 5-6	.023
Does the ANM feel enough time is spent at the Camp?	Yes			Yes: 148 (91%)	
	No				
Duties Outside of Camp	Data Collection			91 (56%)	
	Coordination with the ASHA			117 (72%)	
	Report Preparation			133 (82%)	
	Facility-based care provision			145 (89%)	
	Special Government Programs			94 (58%)	
	Mission Indradhanush			25 (15%)	
	PMSMY			21 (13%)	
	Training/Meeting			86 (53%)	

	Community Mobilization			60 (37%)	
	Other			24 (15%)	
ANM Community Role	Health Care Provider			160 (98%)	
	Coordination with ASHA and other Health Workers			58 (36%)	
	Social Worker			135 (83%)	
	Educator			60 (37%)	
	Other			7 (4%)	
Access:	Mobile Phone 1. Yes 2. No			Yes: 162 (99%)	
	Smart Phone 1. Yes 2. No			Yes: 76 (47%)	
	Regular Access to Cellular Network 1. Never 2. Most Times 3. Always			Never: 2 (12%) Most Times: 68 (42%) Always: 92 (56%)	
How do you usually collect data from the ASHA?	Referencing Paper Logs			95 (58%)	
	Phone Call			106 (65%)	
	SMS			8 (5%)	
	Face to Face			143 (88%)	
	Other			4 (3%)	
What kind of data do you usually collect with the help of the ASHA?	Pregnant mother			146 (90%)	
	ANC			155 (95%)	
	Birth			116 (71%)	
	PNC			133 (82%)	
	Immunization			150 (92%)	

	Drop out, High risk			69 (42%)	
	High Risk			80 (45%)	
	Patient Death			67 (41%)	
	Patient Migrated			17 (10%)	
	Other			10 (6%)	
How often do you connect with the ASHA for this data collection?	Daily			22 (14%)	
	Weekly			124 (76%)	
	Monthly			17 (10%)	
How long on average does the data collection process from the ASHA tak?	Numerical (Minutes)			Median: 60 IQR: 30-120	
How often does the ANM work with ASHA to develop an explicit plan of action for high risk patients?	Never			1 (1%)	
	Rarely			3 (2%)	
	Sometimes			17 (10%)	
	Most Times			83 (51%)	
	Always			59 (36%)	
What other tasks do you coordinate with the ASHA?	Data Entry			45 (28%)	
	Patient Care			133 (82%)	
	Mobilization			99 (61%)	
	Health Advice			140 (86%)	
	Transportation			57 (35%)	
	Referrals			65 (40%)	

	Other			16 (10%)	
How to ensure all listed women and children come for services?	Communication via ASHA			157 (96%)	
	Home Visit			103 (63%)	
	Phone Call			68 (42%)	
	Anganwadi Worker			63 (39%)	
	Other Village Members			52 (32%)	
	Other			18 (11%)	
How to keep track of high risk and dropout patients?	Due List (Self Made)			116 (71%)	
	RCH Register			116 (71%)	
	Daily Diary			99 (61%)	
	List (from gov't SMS)			23 (14%)	
	Due List (from data entry operator/PHC)			10 (1%)	
	ASHA List			105 (64%)	
	Other			3 (2%)	
How often is connection made with the PHC for data submission?	Weekly			94 (58%)	
	Monthly			66 (40%)	
	Daily			3 (2%)	
How long does the above process generally take?	Numerical (Minutes)			Median: 120 IQR: 60- 180	

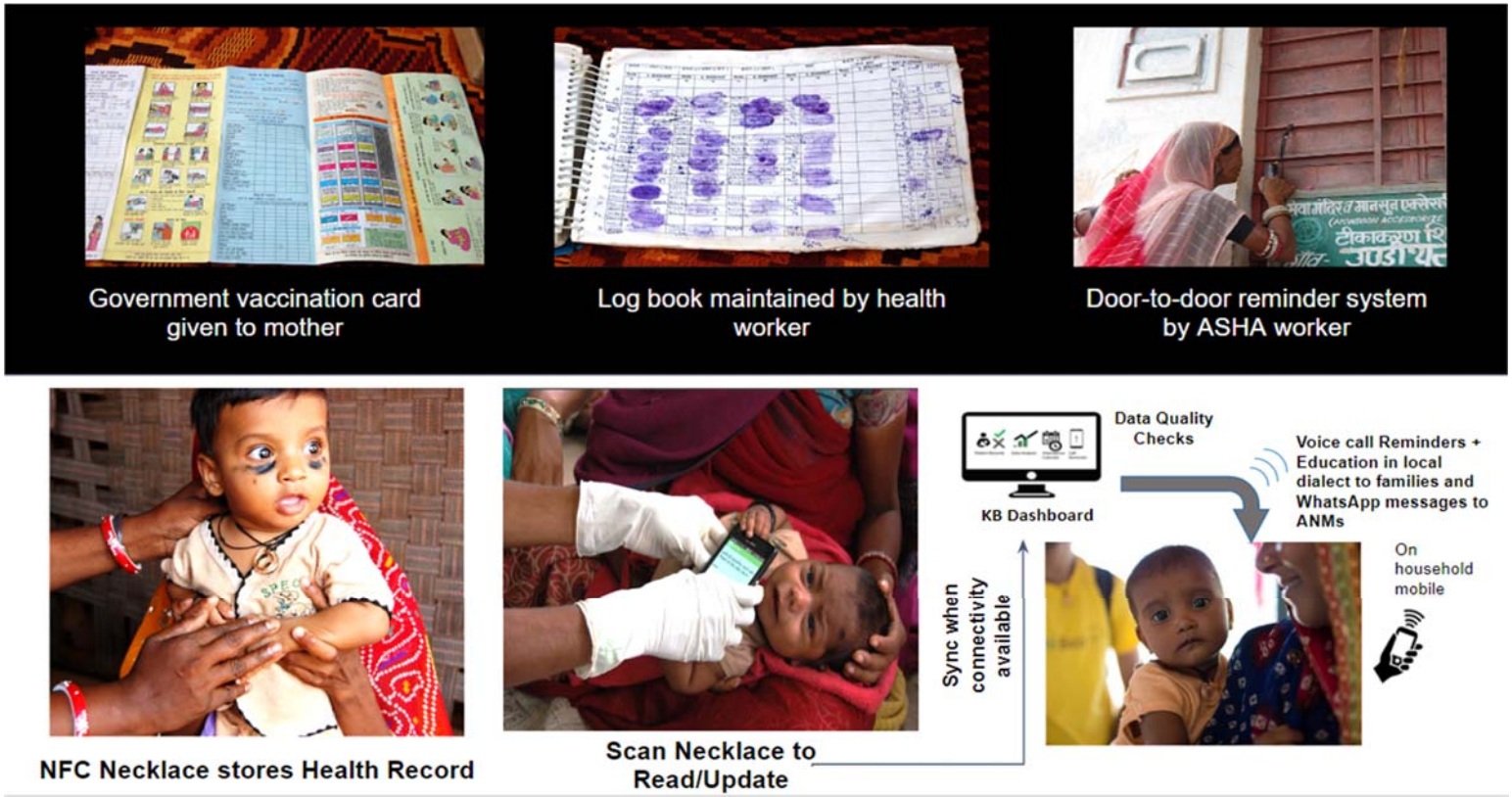
How many RCH columns must be calculated before submission?	Numerical (Columns)			Median: 20 IQR: 15- 40	
What are those columns?	Total ANC			157 (96%)	
	Total PENTA			143 (88%)	
	Total TT			141 (87%)	
	Total BCG			131 (80%)	
	Total OPV			128 (79%)	
	Total Measles			123 (76%)	
	Total Hospital Delivery			115 (71%)	
	Total PNC Visits			112 (69%)	
	Total Stillbirth			75 (46%)	
	Total Abortion			66 (41%)	
	Total Death Child			96 (59%)	
	Total Death Mother			85 (52%)	
	Total Adverse Events			49 (30%)	
	Total IFA			96 (59%)	
	Disaggregation by Gender			47 (29%)	
	Other			22 (14%)	
Do you have an accurate estimate of how many patients drop out of your subcenter?	Yes			149 (91%)	
	No			14 (9%)	

Do you have an accurate estimate of how many patients are high risk in your subcenter?	Yes			155 (95%)	
	No			8 (5%)	
How long does it take to find the Mother's info in the RCH register?	Numerical (Minutes)			Median: 20 IQR: 15- 30	
Do you have any issues with the paper system?	Too Much Time			144 (88%)	
	Hand Calculation			89 (55%)	
	Log Books Heavy			78 (48%)	
	Keep Register			133 (82%)	
	Make Register for Each Camp			67 (41%)	
	Log Books Harder to Refer			47 (29%)	
	To Separate Listing of the ANC and Immunization.			79 (49%)	
	Other			13 (1%)	
Use of Apps? (Selected all that applied)	None			108 (66%)	
	WhatsApp			52 (32%)	
	Facebook			11 (7%)	
	Video Call			6 (4%)	
	SMS			5 (3%)	
	Gmail			3 (2%)	
	Paytm/Mobile Money			2 (1%)	

	Other			2 (1%)	
Do you prefer to keep medical records on an app?	Yes			154 (95%)	
	No			9 (5%)	
What is the hardest part of the job?	Record Keeping			86 (53%)	
	Not Paid Enough			8 (5%)	
	Too Much Travel			87 (53%)	
	Mothers Do Not Care			93 (57%)	
	Community is not appreciative			24 (15%)	
	Not able to Save Lives			29 (18%)	
	Not able to make the impact desired			37 (23%)	
Most rewarding part of job?	Money			13 (8%)	
	Pension			2 (1%)	
	Insurance			1 (.5%)	
	Helping Mothers			147 (90%)	
	Helping Babies			137 (84%)	
	Saving Lives (generally)			122 (75%)	
	Social Status/Respect given			98 (60%)	
	Leadership role in community			71 (44%)	
	Other			9 (6%)	

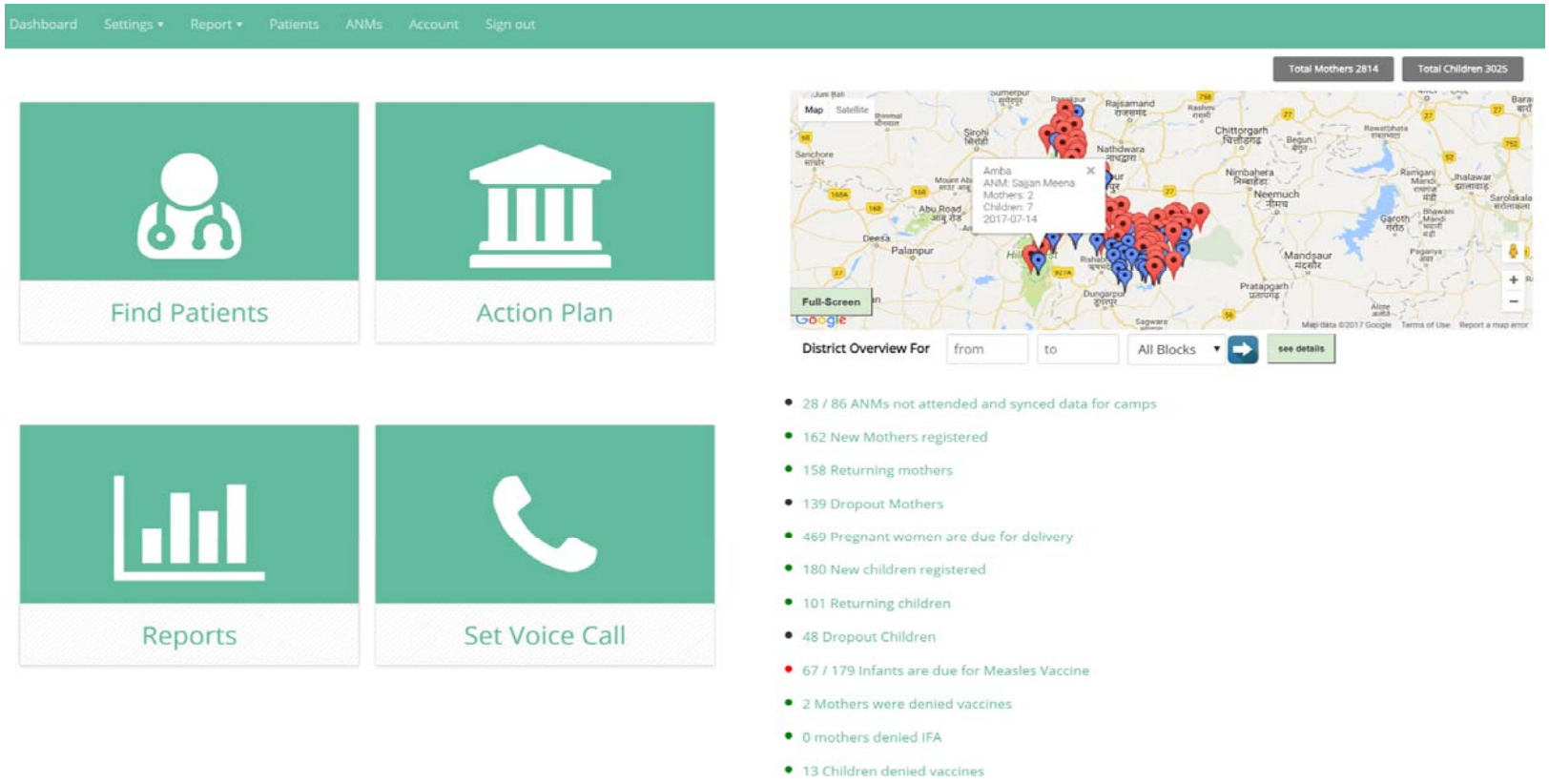
Caste	1. GEN			43 (26%)	
	2. OBC			36 (22%)	
	3. SC			18 (11%)	
	4. ST			61 (37%)	
	OTHER			5 (3%)	
Marital Status	1. Married			154 (95%)	
	2. Live-In, Divorced			2 (1%)	
	3. Separated			0 (0%)	
	4. Widowed			2 (1%)	
	5. Never Married			5 (3%)	

Supplemental Figure 1. Khushi Baby Intervention

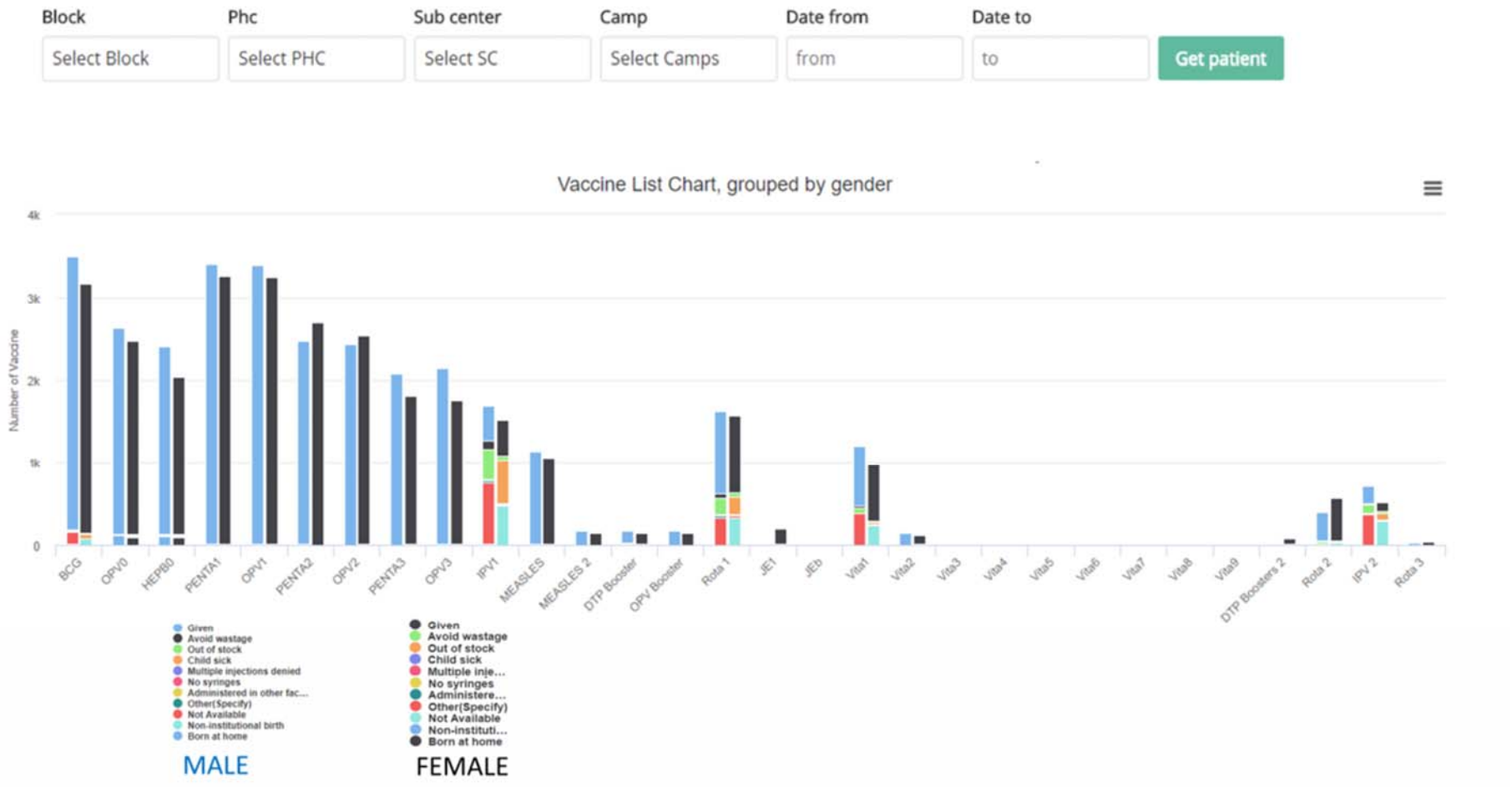


The Khushi Baby System provides a new health record for mothers and children in the form of an NFC-enabled necklace. This necklace is scanned by Nurses using an Android Tablet running the Khushi Baby App at the point of care to retrieve patient data and see information on due treatments and high risk alerts. Scanning the Necklace at the end of the patient visit allows the data to be saved onto the necklace. A backup of the data is created on the tablet as well. When the nurse returns from the field to the block office, she first comes to an identified network point where she syncs the health camp data to the KB Backend. Health Administrators and KB Team Members can make use of analytics provided on the KB Dashboard in the form of various reports. Programmable voice call reminders can also be scheduled on the KB Dashboard.

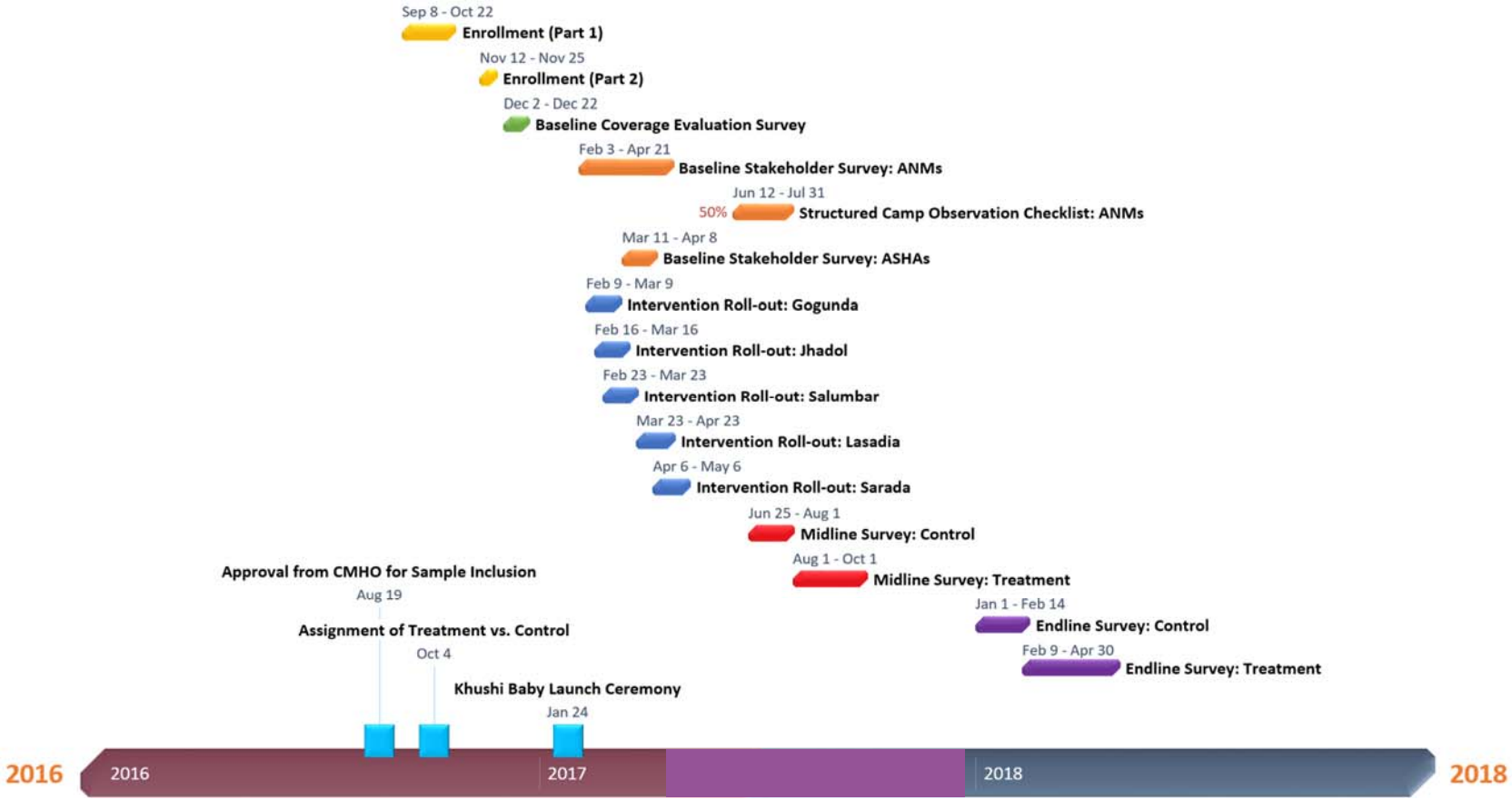
Supplemental Figure 2a. The Khushi Baby Dashboard



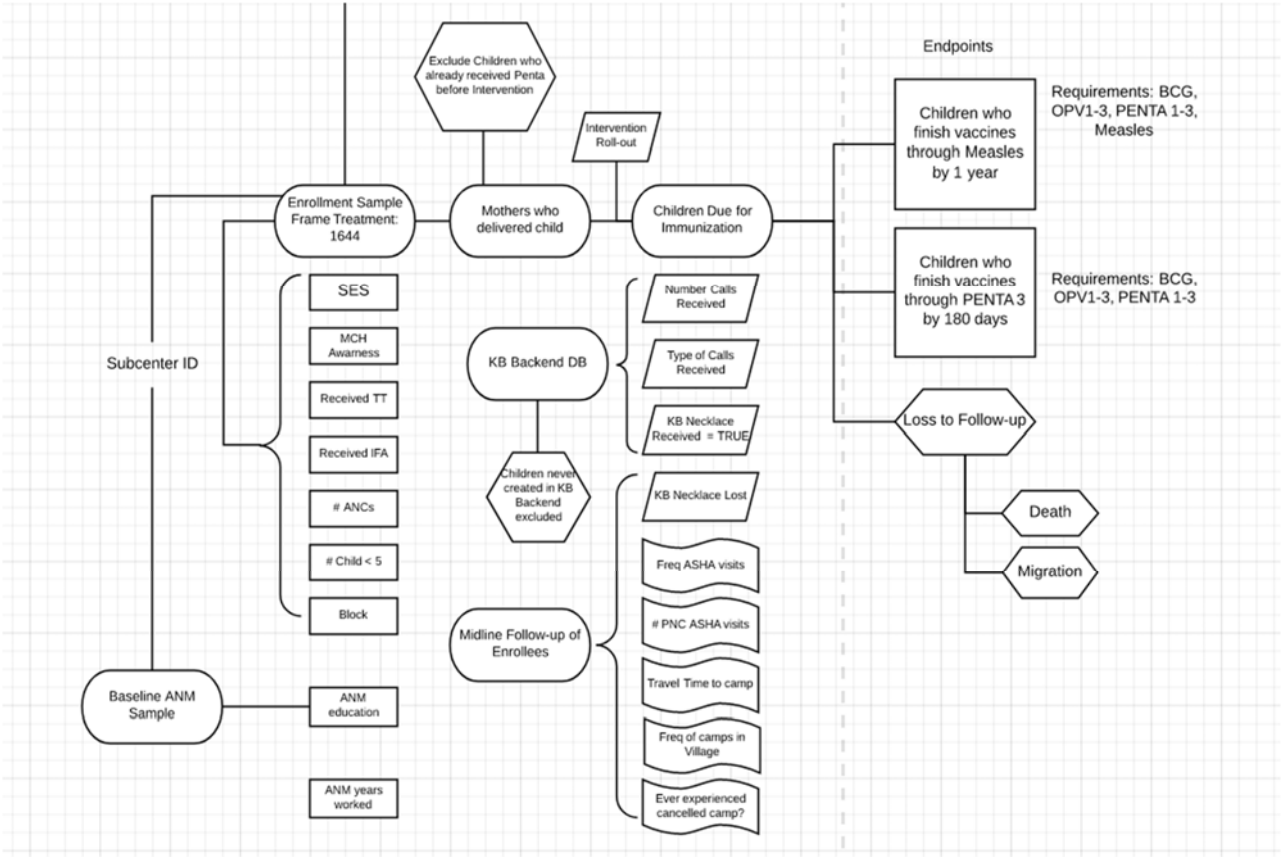
Supplemental Figure 2b. KB Immunizations Given and Denial Reason



Supplemental Figure 3. Evaluation Timeline

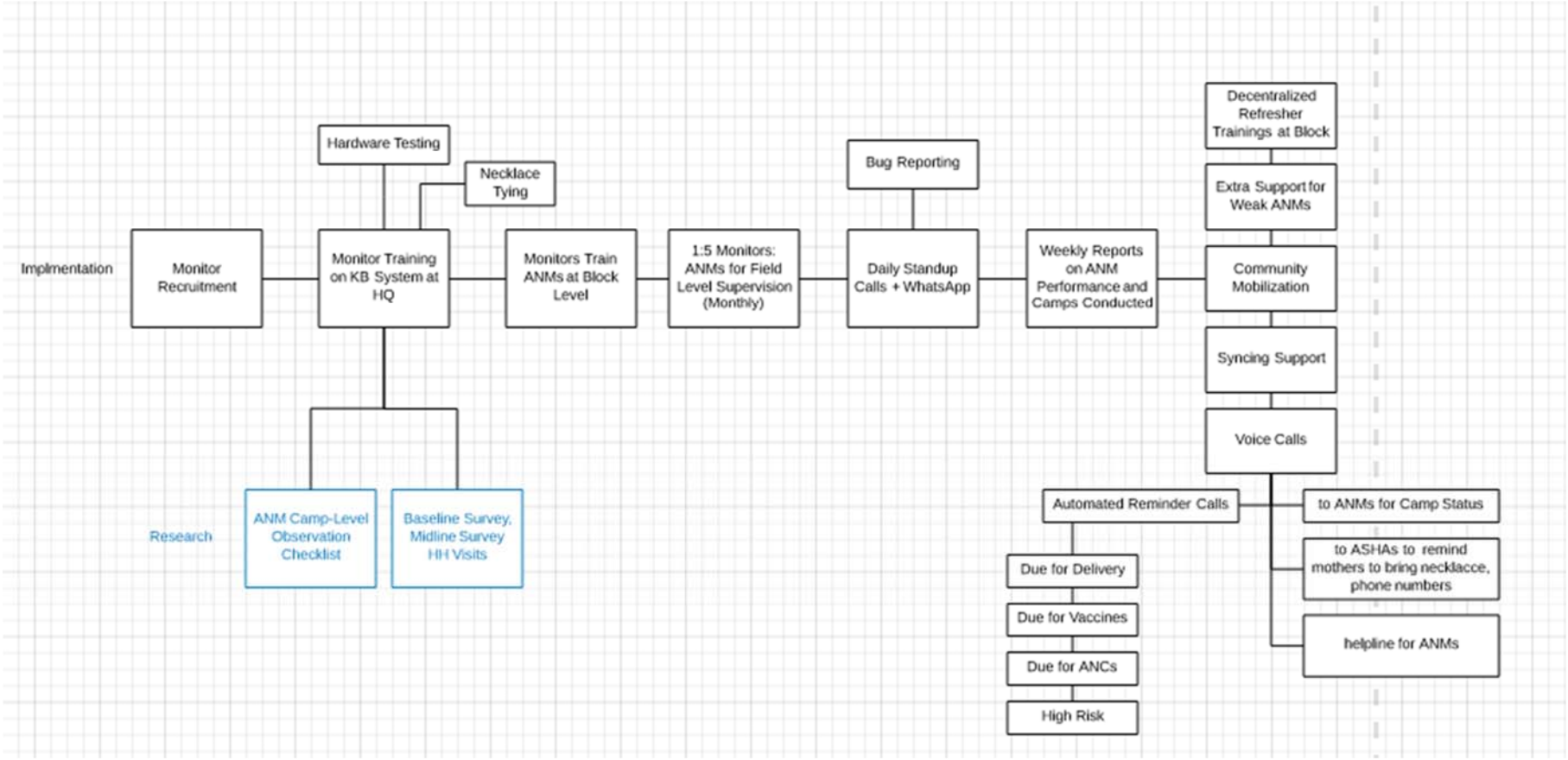


Supplemental Figure 4. Full Immunization Coverage and Timeliness Evaluation Framework



FICT outcomes may be dependent on many factors including baseline SES indicators, MCH awareness indicators, Geography, ANM education, frequency of ASHA visits, camp cancellations, travel time to the VHND camp, retention of the KB Necklace over time, and the Type and Number of KB Voice Calls delivered.

Supplemental Figure 5. Monitoring Plan



Supplemental Table 1. Survey Instruments - Enrollment Exercise

Enrollment Survey		
Question	Type	Answer Option
Please select right block name	Text	
Please select right PHC name	Text	
Please select right Sub-center	Text	
respondentI D	Numerical	
Please write down village Name !	Text	
Please write down surveyor ID !	Numerical	
Please write down Surveyor name	Text	
Section 1: Introduction - Namaste! I am from a research organization called Khushi Baby. We are working on a project for the health of pregnant women and infants.		
Q.1-What is your name ?	Text	

Q.2-What is your household head name ?	Text	
Q.3-What is age ?	Numerical	
Q.4-What is your relation with house head ?	Select One	Head Spouse,Partner,Son,Daughter,Son-in-law,daughter-in-law,Stepson,Stepdaughter,Grandchild,Brother,SisterBrother-in-law,Sister-in-law Father,Mother,Father-in-law,Mother-in-law,Grandparent,Great-grandchild,Other (specify),Refuse to answer
Q.5-Is there a pregnant woman in this household?	Select One	Yes, No
If you agree to participate in the study, please let us know by saying YES	Select One	Yes, No
Instructions for surveyor: These questions MUST be asked to the pregnant woman herself.		
A.1 What is your name?	Text	
A.2-How old are you?	Numerical	
A.3-What is the highest level of education completed by you?	Select One	Grades 1-5,Grades 6-8,Grades 9-10,Grades 10-12,Graduate,Post-Graduate,Diploma,Never go to school,Other (Specify),Refuse to answer,Don’t Know
A.4-What is your relationship to the head of the household?	Select One	Head Spouse,Partner,Son,Daughter,Son-in-law,daughter-in-law,Stepson,Stepdaughter,Grandchild,Brother,SisterBrother-in-law,Sister-in-law Father,Mother,Father-in-law,Mother-in-law,Grandparent,Great-grandchild,Other (specify),Refuse to answer
If other please specify -	Text	

A.5-What is your husband’s name?	Text	
A.6-How old is he?	Numerical	
A.7-What is the highest level of education completed by him?	Select One	Grades 1-5,Grades 6-8,Grades 9-10,Grades 10-12,Graduate,Post-Graduate,Diploma,Never go to school,Other (Specify),Refuse to answer,Don’t Know
If other please specify -	Text	
A.8-What month of pregnancy are you currently in?	Numerical	
A.9-How many ANCs have you completed?	Numerical	
A.10-Do you know about expected delivery date?	Select One	Yes, No
A.10- Do you know about expected delivery date?	Date	
A.11- If she doesn't know actual date than ask for month ?	Month	Jan,Feb,Mar,Apr,May,Jun,Jul,Aug,Sep,Oct,Nov,Dec
A.12- Are you having any child before this pregnancy ?	Select One	Yes, No
Section C: Household Characteristics		
C.1-Number of Children in the Household under 5	Numerical	

C.2-This is your home.	Select One	Yes, No
C.3-How should the walls of this house be classified as?	Select One	Kuccha,Pakka ,Kuccha-Pakka ,Other (Specify),Refuse to answer,Don't Know
If other please specify -	Text	
C.4-Which type of roofing material does your house have?	Select Multiple	Concrete,Cement Metal,Asbestos sheets Straw,Thatch,Sod,bamboo,mud Tile,Stone,Other (Specify),Refuse to answer,Don't Know
If other please specify -	Text	
C.5--How much time does it take you to reach the water source from your household? (One way)		0 minutes (inside the house),1-10 minutes,10-30 minutes,30min - 1hr ,1-2 hours ,Over 2 hours,Other (Specify),Refuse to answer,Don't Know
If other please specify -	Text	
C.6-Is water sufficient for all household activities?	Select One	Yes,No,Other (Specify),Refuse to answer,Don't Know
If other please specify -	Text	

C.7-Where do you, your family use the latrine?	Select Multiple	Jungle, Field Private latrine within the house with water Private latrine within the house without water Private latrine outside the house with water Private latrine outside the house without water ,Public latrine,Other (Specify),Refuse to answer,Don’t Know
If other please specify -	Text	
C.8-Which type of latrine is most frequently used?		Jungle, Field Private latrine within the house with water Private latrine within the house without water Private latrine outside the house with water Private latrine outside the house without water Public latrine
C.9-Do you have electricity at home?		Yes,No,Other (Specify),Refuse to answer,Don’t Know
If other please specify -	Text	
C.10-If there is no electricity, what is your primary source of energy for lighting?		Kerosene,Other oil,Gas,Candle,Solar lanterns,No lighting arrangement,Other (Specify),Refuse to answer
If other please specify -	Text	
Section D: Household Assets		

Please tell me whether the household has the following items:		
D.1-Chair, stool, sofa	Select one	Yes, No, Refuse to answer
How many?	Numerical	
D.2-Refrigerator (fridge)	Select one	Yes, No, Refuse to answer
How many?	Numerical	
D.3-TV (Black&white, Color)	Select one	Yes, No, Refuse to answer
How many?	Numerical	
D.4-Satellite TV dish, Cable	Select one	Yes, No, Refuse to answer
How many?	Numerical	
D.5-Radio, Transistor, Stereo	Select one	Yes, No, Refuse to answer
How many?	Numerical	
D.6-Any two-wheeler vehicle	Select one	Yes, No, Refuse to answer
How many?	Numerical	
D.7-Bicycle	Select one	Yes, No, Refuse to answer

How many?	Numerical	
D.8-Bullock cart	Select one	Yes, No, Refuse to answer
How many?	Numerical	
Information about livestock or other animals owned by the household		
D.9-Do you have 1 or more draught animals (strong working animal used to draw a load like cart plow etc) - e.g. mules, donkeys, camel, bullocks, horse?	Select one	Yes, No, Refuse to answer
How many?	Numerical	
D.10-Do you have 1 or more productive animals - e.g. cow, buffalo, sheep, goat, chicken, hen, rooster	Select one	Yes, No, Refuse to answer
How many?	Numerical	
Section E: HOUSEHOLD INCOME		
E.1-What are the sources of income for this household?	Select Multiple	Self-employed (agriculture) Self-employed (non-agriculture) Agricultural labor ,Other labor,Pension Regular Wage,Salary earning

		Other (Specify),Refuse to answer,Don’t Know
If other please specify -	Text	
E.2-What was the main source of income for this household last year?	Select one	Self-employed (agriculture) Self-employed (non-agriculture) Agricultural labor ,Other labor,Pension Regular Wage,Salary earning
If other please specify -	Numerical	
E.3-Does your income vary month to month or is it static?	Select one	Varies ,Static ,Other (Specify),Refuse to answer,Don’t Know
If other please specify -	Text	
E.4-Do you have at least 1 active bank account for the household?	Select one	Yes,No,Other (Specify),Refuse to answer,Don’t Know
If other please specify -	Text	
E.5-Do you or your family save any money at the end of each month?	Select one	Yes, frequently Yes, sometimes Rarely

If other please specify -	Text	
E.6-How much money do you save per month?	Numerical	
E.7-Do you or your family own any land?	Select one	Yes,No,Other (Specify),Refuse to answer,Don’t Know
If other please specify -	Text	
E.8-How much land do you, your family own?	Numerical	
Section F - Mobile Phone		
F.1-Does anyone in this household own a phone?	Select one	Yes, No
F.2-Who does this phone stay with?	Select one	Self,Husband ,Father-in-Law ,Mother-in-Law,Brother-in-Law Sister-in-Law Son, Daughter Other (Specify),Refuse to answer,Don’t Know
If other please specify -	Text	
F.3-Can you please share mobile number ?	Select one	Yes,No,Don't remember,Refuse to answer,Don’t Know
F.4-Please list the mobile number	Numerical	

F.5-Can we message, call you, this person to tell them about immunizations, ANC?	Select one	Yes,No,Refuse to answer
F.6-What would be the best time to call you?	Select one	Anytime ,Only in the morning,Only in the evening Other (Specify),Refuse to answer,Don’t Know
If other please specify -	Text	
Section H- Antenatal Care Awareness		
H.1-Do you think pregnant women should go to the immunization camp?	Select one	Yes,No,Other (Specify),Refuse to answer,Don’t Know
If other please specify -	Text	
H.2-Why should pregnant women go the immunization camp?	Select Multiple	In order to ensure good health throughout their pregnancy and good health for their child The government says they have to go,They see neighbors going ,To get materials for food Other (Specify),Refuse to answer,Don’t Know
If other please specify -	Text	
H.3-In your experience, how many antenatal care visits should you have when you are pregnant?	Numerical	
If other please specify -	Text	

H.4-Are you aware of session, immunization camps being held?	Select one	Yes,No,Other (Specify),Refuse to answer,Don’t Know
If other please specify -	Text	
H.5-Does someone usually inform you that session, immunization, ANC camps are happening on a particular day for pregnant women? If so, who?	Select Multiple	ANM,Ashaworker,other health worker,someone else No ,Other (Specify),Refuse to answer
If other please specify -	Text	
H.6-Have you ever informed anyone outside your family about the need for antenatal care, and if so, who?	Select Multiple	Yes, Relatives Yes, Friends Yes, Neighbors No ,Other (Specify),Refuse to answer
If other please specify -	Text	
H.7-What disease(s) can be prevented by vaccines you get during pregnancy?	Select one	Tetanus ,Other (Specify),Refuse to answer,Don’t Know
If other please specify -	Text	
H.8-For this ${vaccine} disease how many vaccinations do you need?	Numerical	

Section I - Child Immunization Awareness		
I.1-Do you think infants should go to the immunization camp?	Select one	Yes,No,Other (Specify),Refuse to answer,Don’t Know
If other please specify -	Text	
I.2-Why should children go the immunization camp?	Select Multiple	In order to ensure the child is healthy and protected from diseases ,The government says they have to go Other mothers are going with their children ,To get materials for food Other (Specify),Refuse to answer,Don’t Know
If other please specify -	Text	
I.3-Does someone usually inform you that session, immunization camps for children are happening on a particular day? If so, who?	Select Multiple	ANM,Ashaworker,other health worker,someone else No ,Other (Specify),Refuse to answer
If other please specify -	Text	
I.4-Have you ever informed anyone outside your family about the need for child immunization, and if so, who?	Select Multiple	Yes, Relatives Yes, Friends Yes, Neighbors No ,Other (Specify),Refuse to answer
If other please specify -	Text	

I.5-What diseases can be prevented by vaccine that infants get during the first year of their life?	Select Multiple	T.B.,Diphtheria ,Whooping Cough,Polio,Tetanus ,Measles,Jaundice,Other (Specify),Refuse to answer,Don't Know
If other please specify -	Text	
how many vaccinations do you need for each diseases?	Numerical	
Section G- Health Status- Pregnant Women		
G.1-During your pregnancy, did you receive iron tablets, syrip ?	Select One	Yes,No,Other (Specify),Refuse to answer,Don't Know
If other please specify -	Text	
G.2-Did you ever receive a TT vaccine?	Select One	Yes,No,Other (Specify),Refuse to answer,Don't Know
If other please specify -	Text	
SECTION J: INFORMATION ON GOVERNMENT SMS PROGRAMME)- Now we will ask questions on receiving any text messages		
J.1-Has anyone in your family received any SMS (text message) regarding Session Camps for immunization, ANC?	Select One	Yes, No

J.2-How many messages did you receive during your antenatal (ANC) period?	Numerical	
J.3-How many messages did you receive during your postnatal period?	Numerical	
If other please specify -	Text	
J.4-How many messages have you received to date?	Numerical	
J.5-Can you show me some sample messages on your mobile phone?	Select One	Yes Sure ,No, the messages got deleted ,No, I changed my phone No, that phone is not currently with me right now ,Refuse to answer
J.6-Take image of sms pic	Image	
Thank you !		
K.1-Is there any women who has delivered any child within last 45 days ?	Select One	Yes, No
K.2-Are they available for interview?	Select One	Yes, No

Supplemental Table 2. Survey Instruments - Baseline Coverage Evaluation

Khushi Baby- Baseline Coverage Estimate Survey (12-23 months of children)		
Question	Type	Answer Option
INTERVIEWER: COMPLETE BEFORE BEGINNING THE MODULE		
Please provide block name	Text	
Please provide PHC name	Text	
Please provide sub-center	Text	
Please provide Treatment Group	Text	
Please provide village name	Text	
Provide Respondent ID	Numerical	
Please provide surveyor ID	Numerical	
Please provide surveyor name	Text	
Section A: Introduction - Namaste! I am from a research organization named Khushi Baby. We are working on a project for the health of pregnant women and infants.		
Instructions for surveyor: Please provide information about the primary guardian of children between 1 and 2 years		

HH Status	Select One	House is open, adult is available, House is open, but no adult is available (how old are you?), House is open, but adult refuses to answer, House is closed, no one lives in house now. Migrated from village.
What is your name ?	Text	
How old are you?	Numerical	
Is there a child between 12 to 23 months of age in this household?	Select One	Yes, No
How many children between 12 to 23 months years are in your household?	Numerical	
Is this household's child is in our sample list ?	Select One	Yes, No
What is the name of your youngest child between 12 to 23 month in your home?	Text	
What is the sex of the child?	Select One	Female, Male, Transgender
How old is the child ?	Numerical	
Who is the primary caregiver of this child?	Select One	Mother-Father, Grandfather-Grandmother, Uncle-Aunty, Other Specify
If other, What is your relation to the child ?	Text	
Is the primary caregiver available ?	Select One	Yes, No
Consent		

Do you agree to participate in this study? Please give an oral response	Select One	Yes, No
Who is the primary caregiver of this child?	Select One	Mother-Father, Grandfather-Grandmother, Uncle-Aunty, Other Specify
What is the name of the primary caregiver ?	Text	
How old is she? How old are you?	Numerical	
What is her highest completed level of education? What is yours?	Select One	Grades 1-5, Grades 6-8, Grades 9-10, Grades 10-12, Graduate, Post-Graduate, Diploma, Never went to school, Refuse to answer, Don’t Know
The child's mother is present ?	Select One	Yes, No, not now, No, she died
What is the name of the child's Mother?	Text	
How old is she, are you ?	Numerical	
Please select your highest completed level of education	Select One	Grades 1-5, Grades 6-8, Grades 9-10, Grades 10-12, Graduate, Post-Graduate, Diploma, Never went to school, Refuse to answer, Don’t Know
What is the name of the child's father?	Text	
How old is he?	Numerical	

What is his highest completed level of education?	Select One	Grades 1-5, Grades 6-8, Grades 9-10, Grades 10-12, Graduate, Post-Graduate, Diploma, Never went to school, Refuse to answer, Don't Know
Instruction for Surveyor -- Section B and C Must be asked by child's Mother only		
The child's mother is present ?	Select One	Yes, No
We will ask you about details like your ANC check up, Session Camp and your experiences during pregnancy!		
What is your caste ?	Text	
What is your caste category ?	Select One	General, OBC, SC, ST, Others, Refuse to answer, Don't know
Do you have this child Immunization Card (MAMTA Card) If Yes, may I please see it?	Select One	Yes, No, Refuse to answer, Don't know
Did you ever had a Immunization Card (MAMTA Card)	Select One	Yes, No
Where is the mamta card currently?	Select One	Lost, With ANM, With AWW, With ASHA, Refuse to answer, Don't know
Please take a photograph of the MAMTA card Page 1.	Image	
Please take a photograph of the MAMTA card Page 2	Image	

Did you go for an ANC visit to any camp, hospital session while you were pregnant during this child ?	Select One	Yes, No
Where did you go mostly for ANC?	Multiple Choice	Immunization session camp, Sub center, Government District Hospital, CHC-PHC, Private Health clinic, Anganwadi center, School of my village, Anganwadi Center, School of other village
How many times have you gone for an ANC check up at a camp, hospital session ?	Numerical	
How many ANC visits have you completed?	Select One	0, 1, 2, 3, 4, 5, Refuse to answer, Don’t Know
Did you ever receive a TT vaccine?	Select One	Yes, No, Refuse to answer, Don’t know
How many tetanus vaccines have you received, if any?	Numerical	
Which pregnancy month ?	Multiple Choice	1st Month, 2nd Month, 3rd Month, 4th Month, 5th Month, 6th Month, 7th Month, 8th Month, 9th Month, Don’t Know
Did you receive iron tablets, syrup?	Select One	Yes, No

Why didn't you undergo your ANC visit ?	Multiple Choice	Don’t know about ANC, Don’t know about session camp, Session camp is so far from village, I am alone at home, No transport is available for going there, House member refuses to go, Immunization is harmful, Other (please specify), Refuse to answer, Don’t Know
Other (please specify)	Text	
Does anyone come to remind you for ANC visit ?	Select One	Yes, No
How often were you reminded?	Multiple Choice	Every time before camp, Sometimes, After missing of ANC visit, Don’t remember, Other (please specify), Refuse to answer
Other (please specify)	Text	
Who remind you for this ?	Multiple Choice	ANM, ASHA-ASHA sahyogini, Anganwadi worker, Other health person, Household member, Refuses to answer
From these individuals, who reminded you the most to attend your ANC visit?	Select One	ANM, ASHA-ASHA sahyogini, Anganwadi worker, Other health person, Household member, Refuses to answer
Did you get any reminders message on phone for ANC, delivery, or tika karan?	Select One	Yes, No, Refuse to answer, Don’t know

How many reminders ?	Numerical	
	Select One	Yes, No
How often did ASHA come to visit you during your pregnancy?	Numerical	
Did you face any troubles after your pregnancy that required you to go to the hospital ?	Select One	Yes, No
What happened?	Select One	Excessive swelling, Pain in Extrimities, Vomiting and dizziness, Anemia, Bleeding, Cramps, Other(Specify)
Other (please specify)	Text	
Please specify where you went for your medical treatment?	Multiple Choice	Government District Hospital, CHC, PHC, Sub center, Private Hospital, Private Clinic, Quacks, Other(Specify), Refuse to answer, Don't Know
Other (please specify)	Text	
Instruction for Surveyor -- Now we will ask you about Session camp, ANM, ASHA and ASHA sahyogini:		
How far is the immunization camp (where you usually get tika karan) from your house?	Select One	0-0.5 km, 0.5-1 km, 1-1.5 km, 1.5-2 km, More than 2 km less then 4, More than 4 km less then 6, Refuse to answer, Don't Know

How do you go from your home to each camp session?	Select One	Walk, Bicycle, Motor Cycle-Bike, Jeep-Car, Private Vehicle, Auto Rickshaw, Other(Specify), Refuses to Answer
Other (please specify)	Text	
How much time does it take for you to go to each camp session? (one-way, not round-trip)	Select One	10 min or less than 10 min, 10 min to 20 min, 20 min to 30 min, 30 min to 1 hour, More than 1 hour, NA, Refuses to Answer, Don't Know
How much time did you spend waiting at camp before being seen by ANM didi?	Select One	0-10 min, 10-20 min, 20-30 min, 30 min to 1 Hour, More than 1 hour, NA
How much time did ANM didi spend with you at the camp?	Select One	5-10 min, 10-15 min, 15-20 min, 20-25 min, 25-30 min, 30 min to 1 hour, More than 1 hour, NA, Refuses to answer, Don’t Know
Did you ever feel that you had questions after camp that ANM didi did not answer ?	Select One	Yes, every time, Yes, sometimes, Never, Don’t Remember, NA, Refuses to answer, Don’t Know
Did anyone in your family or outside your family ever prevent you from going to camp during ANC? Were you prevented from going to the hospital for birth and hospital for PNC?	Select One	Yes every time, Yes sometimes, Never, Don’t Remember, NA, Refuses to answer, Don’t Know
Have your ANC check up details been recorded in your mamta card ?	Select One	Yes, No, Sometimes, Refuses to answer, Don’t Know

Where was your child born ?	Select One	Government Hospital, CHC, PHC, Sub center, Private Clinic, Home, In transit(to hospital), Other (specify)
Other (please specify)	Text	
Did anyone assist you during delivery?	Multiple Choice	ANM, ASHA, ASHA sahyogini, Anganwadi worker, Other health person, TBA(Traditional Birth Attendant), Household member, No one, Other (specify)
Other (please specify)	Text	
Was Asha didi present for childbirth?	Select One	Yes, No
How often did Asha didi come to visit you in first month following birth ?	Numerical	
Did your child face any trouble in first month that required going to hospital ?	Select One	Yes, No
Why ?	Multiple Choice	Pneumonia, jaundice, Low birth weight, Diarrhea , diarrhea, Premature birth, Sepsis, Congenital anomalies, Other(Specify)
Other (please specify)	Text	

Where did you go ?	Multiple Choice	Government District Hospital, CHC, PHC, Sub center, Private Hospital, Private Clinic, Quacks, Other(Specify), Refuse to answer, Don’t Know
Other (please specify)	Text	
Did you receive any incentive from govt for this delivery ?	Multiple Choice	Yes, Money under JSY, Yes, Supplementary food, Yes , Medicines, don’t know about any incentive, Nothing, Refuse to answer
Did you ever face hunger during your pregnancy ?	Select One	Yes, No
When ?	Select One	Many times in month, Many times in week, Daily, Other (specify), Refuse to answer
Other (please specify)	Text	
How often ?	Numerical	
Did you give colostrum (first mother milk) to the child ?	Select One	Yes, No
Until when did you give Exclusive Breastfeeding to your Child?	Select One	Till first month, Till second month, Till third month, Till fourth month, Till fifth month, Sixth month or more, Other(Specify), Refuses to answer, Don’t Know

Other (please specify)	Text	
When did you give supplementary feeding for first time ?	Select One	First month, Second month, Third month, Fourth month, Fifth month, Sixth month, After Sixth month, Other(Specify), Refuses to answer, Don't Know
Other (please specify)	Text	
We will now ask some questions about your child's medical history!		
D.1- Did your child ever receive any vaccinations to prevent him, her from getting diseases?	Select One	Yes, No
Did your child receive POLIO vaccine?	Select One	Yes, No, Refuse to answer, Don't know
How many times was the POLIO vaccine given?	Numerical	
Did your child receive BCG vaccine?	Select One	Yes, No, Refuse to answer, Don't know
How many times was the BCG vaccine given?	Numerical	
Which month(s)?	Select One	1, 2, 3, 4, Don't Know
Did your child receive PENTA vaccine?	Select One	Yes, No, Refuse to answer, Don't know

How many times was a PENTA vaccination given?	Numerical	
Which month(s)?	Multiple Choice	1, 2, 3, 4, 5, 6, Other(Specify)
Did your child receive MEASLES vaccine?	Select One	Yes, No, Refuse to answer, Don’t know
How many times was the MEASLES vaccine given?	Numerical	
Which month(s)?	Select One	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, Refuse to answer, Don’t Know
Does anyone come to remind you for immunization ?	Select One	Yes, No, Refuse to answer, Don’t know
How often were you reminded?	Multiple Choice	Every time before immunization camp, Sometimes, After missing immunization, Don’t Remember, Refuses to answer
How were you reminded ?	Multiple Choice	SMS of phone, ANM or by ASHA, ASHA came to home, Any other health worker, Family member, Other(Specify), Refuse to answer, Don’t Know
Other (please specify)	Text	

Why has your child not been immunized?	Multiple Choice	Don’t know about immunization, Don’t know about session camp, Session camp is far from village, I was alone at home, No availability of vehicle, House member refuses to go, Immunization is harmful, Other(Specify), Refuse to answer, Don’t Know
Other (please specify)	Text	
Does anyone come to remind you for immunization ?	Select One	Yes, No
How often were you reminded?	Multiple Choice	Every time before immunization camp, Sometimes, After missing immunization, Don’t Remember, Refuses to answer
Other (please specify)	Text	
How were you reminded ?	Multiple Choice	SMS of phone, ANM or by ASHA, ASHA came to home, Any other health worker, Family member, Other(Specify), Refuse to answer, Don’t Know
Other (please specify)	Text	
special_notes	Text	THANK YOU

Supplemental Table 3. ANM Survey

ANM Pre_Intervention		
Question	Type	Answer Option
INTERVIEWER: COMPLETE BEFORE BEGINNING THE MODULE		
Please select right block name	Text	
Please select right PHC name	Text	
Please select right Sub-center	Text	
Treatment Group	Text	
Write Respondent ID	Numerical	
Please write down surveyor ID !	Numerical	
Please writen down Surveyor name	Text	
Introduction - Namaste! I am from a research organization called Khushi Baby. We are working on a project for the health of pregnant women and infants. Now we will ask some questions related your work.		
If you agree to participate in the study, please let us know by saying YES		
What is your name ?	Text	

Age ?	Numerical	
What is your address ?	Text	
Phone Number ?	Numerical	
Education Status ?	Select one	8 Class, 9 Class, 10 Class, 11 Class, 12 Class, Graduate, Post_Graduate, None
What is your SC name ?	Text	
What is your PHC name ?	Text	
How Many Camps do you do conduct ?	Numerical	
Which camps are those?	Text	
How Many Camps do you do regular conduct monthly?	Numerical	
Which camps are those?	Text	
Mode of transport (to the ANC, immunization camp) ?	Select one	Walk, Bicycle, Motor Cycle, Bike, Scooty Jeep, Car, Private Vehicle, Auto Rickshaw, Other(Specify)
Other	Text	
Time of transport to furthest camp site from your house ?	Numerical	0-15, 15-30, 30-60, 1-2 hour, Over 2 hour
Time of transport to the PHC your house ?	Numerical	0-15, 15-30, 30-60, 1-2 hour, Over 2 hour

How many hours do you work weekly at the Camp Site ?	Numerical	
Do you feel that you can spend enough time with the patient, and also collect data at the same time?	Select one	Yes, No
If Not, Why ?	Audio Record	
What duties do you have outside of the ANC, Immunization Camp ?	Select Multiple	Data Collection Coordination with the ASHA, Report preparation, Home Visits for PNC Facility-based care provision Special Govt Programs, Mission Indradhanush, PMSMY training, meeting, community mobilization, Other(Specify)
Other	Text	
What is the role of the ANM in the community?	Select Multiple	Health care provider, Coordination with ASHA and other, health workers, Social Worker, Educator, Other(Specify)
Other	Text	
Do you have access to a mobile phone?	Select one	Yes, No
Do you have access to a smart phone?	Select one	Yes, No

Do you have regular, consistent access to cellular network ?	Select one	Never, Most Times, Always
How do you usually collect data from the ASHA?	Select Multiple	Referencing paper logs, Phone Call, SMS, Face to Face, Other(Specify)
Other	Text	
Which kind of data do you collect with the ASHA's help?	Select Multiple	Pregnant mother, ANC, Birth, PNC Immunization, Drop out, high risk, High Risk, Patient Death, Patient Migrated, Other(Specify)
Other	Text	
How often do you talk or meet to hope for this type of data collection?	Select one	Daily, Weekly, Monthly
How long, on average, does this process take to collect data from ASHA?	Numerical	
How do you ensure that all listed women, children come for services?	Select Multiple	Home visit, Phone call, Other village members, Communication via ASHA worker, Aganwadi worker, Other(Specify)
Other	Text	

Do you work with the ASHA to make an explicit action plan at the end of each camp for high risk patients?	Select one	Never, Rarely, Sometimes, Most times, Always
What other tasks do you coordinate with the ASHA?	Select Multiple	Data entry, Patient care, Mobilization, Health advice Transportation, Referrals, Other(Specify)
Other	Text	
How do you keep track of high risk and drop out patients?	Select Multiple	Due List (self made), Due List (from govt SMS) Due List from Data Entry Operator, PHC ASHA list, RCH register, Daily Dairy, Other(Specify)
Other	Text	
How often do you connect with PHC for data submission?	Select one	Daily, Weekly, Monthly
How long, on average, does this process take in the PHC?	Numerical	
How many RCH columns do you need to calculate before submission?	Numerical	

What are those RCH columns?	Select Multiple	Total ANC, Total TT, Total Hospital Delivery Total PNC visits, Total PENTA Total OPV, Total BCG, Total Measles Total Adverse Events, Disaggregation by Gender Total Death Child, Total Death Mother Total IFA, Total Still Birth Total Abortion, Other(Specify)
Other	Text	
Do you have an accurate estimate of how many patients are dropped out in your subcenter?	Select one	Yes, No
Do you have an accurate estimate of how many patients are high risk in your subcenter?	Select one	Yes, No
How long on average would it take to make a list of high risk mothers, drop out mothers, high risk children, and drop out children?	Numerical	
What do you do when the mother doesn't come with the MAMTA card?	Audio Record	

If the MAMTA card has no info, date, legibility, how do you find out which vaccines have been given and when?	Audio Record	
How do you identify which child is which if the babies have the same name or unnamed?	Audio Record	
How do you identify which child is which if babies are twins, triplets?	Audio Record	
How long does it take you to find out the Mother's info in the RCH register?	Numerical	
Which forms do you fill out to give from the Subcenter	Select Multiple	Form 6, Form 7, Form 8, Form 9 HMIS, PCTS, JSY, RSBY, Bhamasha NFSA, ASHA Incentive, Other(Specify)
Other	Text	
How long does it take to prepare packet for LHV each month?	Numerical	
How many times do you give report packets to LHV each month?	Numerical	

Please rate your ability to communicate health behavior messages to mothers at the end of the visit for follow-up steps ?	Select one	Poor, Average, Good, Very Good, Best
Please rate your ability to record data in all required RCH fields ?	Select one	Poor, Average, Good, Very Good, Best
Please rate your confidence in decision making regarding field protocols for medications ?	Select one	Poor, Average, Good, Very Good, Best
Please rate your confidence in decision making regarding field protocols for vaccines	Select one	Poor, Average, Good, Very Good, Best
Please rate your confidence in decision making regarding field protocols for tests	Select one	Poor, Average, Good, Very Good, Best
Do you have any issues with paper system?	Select Multiple	Too much time, Hand calculation, Log books heavy, Keep register, Make register for each camp, Everyday somebody Reports, To separate listing of the ANC and, immunization Log books harder to refer, Other(Specify)
Other	Text	

Do you use any of the following mobile apps?	Select Multiple	Facebook, whatsapp, gmail, Video Call SMS, Paytm, mobile money None, Other(Specify)
Other	Text	
Would you prefer to keep medical records on an app <Describe KB>?	Select one	Yes, No
Why or why not ?	Audio Record	
What is hardest part of your job?	Select Multiple	Record Keeping, Not paid enough, Too much travel, Mothers do not care, Community is not appreciative Not able to save lives, Not able to make the impact desired, Other(Specify)
Other	Text	
What is most rewarding part of your job?	Select Multiple	Money, Pension, Insurance Helping Mothers, Helping Babies Saving Lives (generally), Social Status, Respect given, Social Awareness, Leadership Role in, Community, Other(Specify)
Other	Text	
ANM Caste ?	Select one	GEN, OBC, SC, ST, Other(Specify)

Other	Text	
ANM Marital status ?	Select one	Married, Live-In, Divorced, Separated, Widowed, Never Married
Tell us a Story about mother and child health with KB	Audio Record	
Thank you !		

Supplemental Table 4. ASHA Survey

Khushi Baby- Questionnaire for Asha Sehyogni		
Question	Type	Answer Option
INTERVIEWER: COMPLETE BEFORE BEGINNING THE MODULE		
Please select right block name	Text	
Please select right PHC name	Text	
Please select right Sub-center	Text	
Treatment Group	Text	

Write Respondent ID	Numrical	
Please write down surveyor ID	Numrical	
Please write down Surveyor name	Text	
Introduction - Namaste! I am from a research organization called Khushi Baby. We are working on a project for the health of pregnant women and infants. Now we will ask some questions related your work.		
If you agree to participate in the study, please let us know by saying YES		
What is your name?	Text	
What is your age?	Numrical	
What is your village name ?	Text	
Phone Number	Numrical	
Education Status	Select One	8th Class, 9th Class, 10th Class, 11th Class, 12th Class, Graduate, Post_Graduate, None, Less than 8th Class
Village camp	Text	
Sub Center Name	Text	

How many years have you been working as an ASHA	Select One	Less than 1, 1 to 2, 2 to 3, 3 to 4, 4 to 5, 5 to 10, 10 to 15, More than 15
Which modules of ASHA training did you complete?	Select One	None, 2-3 & 4, 5-6 & 7, Other(Specify)
Other	Text	
How many people do you provide services to in your community?	Numrical	
Mode of transport for house reminders for camps, vaccinations	Select Multiple	Walk, Bicycle, Motorcycle, Bike, Scooty, Jeep, Car, Private Vehicle, Auto Rickshaw, Other(Specify)
Other	Text	
TIme of transport to camp site from your house	Select One	0-15, 15-30, 30-60, 1-2 hours, Over 2 hours
Time of transport to the furthest house from your house for reminders	Select One	0-15, 15-30, 30-60, 1-2 hours, Over 2 hours

Average number of houesholds you are visiting daily	Numrical	
Average number of visits to the same house for reminders for ANC	Numrical	
Average number of visits to the same house for reminders for birth, PNC	Numrical	
Average number of visits to the same house for reminders for child immunization	Numrical	
Do you have access to mobile phone?	Select One	Yes, No
Do you have regular, consistent access to cellular network	Select One	Never, Most Times, Always

Do you regularly use this mobile phone to remind mothers?	Select One	Never, Rarely, Sometimes, Most times, Always
What strategies do you use to remind mothers?	Select Multiple	Home visit, Phone call, Other village members, Communication via ANM, Other(Specify)
Other	Text	
What strategies do you use to recruit new mothers, mothers who are hard to reach, mothers who are not interested?	Select Multiple	Home visit, Phone call Poster, Other village members, Communication via ANM, Panchayat meeting, Influencers from the community, Other(Specify)
Other	Text	
What strategies do you use to recruit mothers who are resistant?	Select Multiple	
Other	Text	Home visit, Phone call Poster, Other village members, Communication via ANM, Panchayat meeting, Influencers from the community, Other(Specify)

What reason do resistant mothers give for not doing ANC?	Select Multiple	Resistant from Household Resistance from Religious Leader, Adverse Immunization Event Poor Interaction with ANM, Inconvenience Takes too Long at Camp, Loss of Daily Wages No Consequences for Missing Checkup, Other(Specify)
Other	Text	
What reason do resistant mothers give for not doing hospital birth?	Select Multiple	
Other	Text	Resistant from Household Resistance from Religious Leader, Adverse Immunization Event Poor Interaction with ANM, Inconvenience Takes too Long at Camp, Loss of Daily Wages No Consequences for Missing Checkup, Other(Specify)
What reason do resistant mothers give for not doing child immunization?	Select Multiple	Resistant from Household Resistance from Religious Leader, Adverse Immunization Event Poor Interaction with ANM, Inconvenience Takes too Long at Camp, Loss of Daily Wages No Consequences for Missing Checkup, Other(Specify)
Other	Text	

What message do you convey to hard to reach, uninterested mothers	Select Multiple	Health of you, health of child, health of community, incentives for food, monetary incentives, Other(Specify)
Other	Text	
What is the role of the ASHA in the community?	Select Multiple	Informer, Social Worker, Health Worker, Community Connector, Friend Educator, Role Model, Village Leader, Other(Specify)
Other	Text	
Do you receive incentives for any of these roles?	Select Multiple	Yes - monetary, Yes- social, No
If yes, do you feel the incentives are sufficient?	Select One	Yes, No
What is hardest part of your job?	Select One	Record Keeping, Not paid enough, Too much travel, Mothers do not care, Community is not appreciative, Not able to save lives, Not able to make the impact desired, Other(Specify)
Other	Text	

What is most rewarding part of your job?	Select One	Money, Pension, Insurance Helping Mothers, Helping Babies Saving Lives (generally) Social Status, Respect given Leadership Role in Community Other(Specify)
Other	Text	
How do you usually communicate with the ANM?	Select One	Phone call, SMS, Verbally Other(Specify)
Other	Text	
Which kind of data do you collect with the 's ANMs help?	Select Multiple	Pregnant mother, ANC, Birth, PNC Immunization Drop out, High Risk, Patient Death Patient Migrated, Other(Specify)
Other	Text	
How often do you connect with the ANM for this data collection?	Select One	Daily, Weekly, Monthly

How does the ANM record what you tell her?	Select One	Referencing paper logs, Phone Call SMS, Face to Face, Other(Specify)
Other	Text	
How long, on average, does this process take?	Numrical	
What other tasks do you coordinate with the ANM	Select Multiple	Data Collection, Coordination with the ASHA Report preparation, Home Visits for PNC, ANC, Facility-based care provision, Special Govt Programs, Ensure Hospital Delivery, Referrals, Health advice, Transportation, Community, mobilization, Other(Specify)
Other	Text	
Do you work with the ANM to make an explicit action plan at the end of each camp for high risk patients	Select One	Never, Rarely, Sometimes, Most times, Always
Other	Text	
What is your Caste Category ?	Select One	GEN, OBC, SC, ST, Other(Specify)
Marital status (married, single, divorced, widow)	Select One	Married, Live-In, Divorced, Separated, Widowed, Never Married

Thank you !

Supplemental Table 5. ANM Camp Observation Checklist

ANM Checklist and Monitoring		
Question	Type	Answer Option
INTERVIEWER: COMPLETE BEFORE BEGINNING THE MODULE		
Please provide the correct name	Text	
Please provide block name	Text	
Please provide PHC name	Text	
Please provide sub-center	Text	
Please provide Treatment Group	Text	
Please provide ANM name	Text	
Last camp visited by ANM	Multiple choice	Today, Yesterday, 2-3 days ago, Last week, Last fifteen days, Last, Month, Last two month
Have you visited the camp today ?	Select one	Yes, No
Logistic_Check_List		
Please record the camp start time (hh:mm AM/PM)	Only for Monitor	

Please note camp name	Text	
Was a an IFA Tablet available at this session?	Select one	Yes, No
Was Vitamin A available at this session?	Select one	Yes, No
Was an Albendazole Tablet available at the session?	Select one	Yes, No
Was Oral Rehydration Salt (ORS) available at this session?	Select one	Yes, No
Was a Zinc Tablet available at this session?	Select one	Yes, No
Were drugs for minor illnesses available?	Select one	Yes, No
Was a B.P apparatus available?	Select one	Yes, No
Was a Stethoscope available?	Select one	Yes, No
Was a weight scale available (adult).	Select one	Yes, No
Was an infant/baby weight machine available?	Select one	Yes, No
Was a thermometer available at this session site?	Select one	Yes, No

Was privacy (i.e. bed, screen) available for conducting the ANC check up?	Select one	Yes, No
Was an RCH Register available?	Select one	Yes, No
Was clean drinking water available at this session site?	Select one	Yes, No
How many mothers and children visited camp prior to your visit (i.e in front of you)?	Numerical	
ANC Check List		
Did an ANM perform the antenatal check up?	Select one	Yes, No
Was a TT available for the ANC services?	Select one	Yes, No
Were IFA tablets provided to the pregnant women?	Select one	Yes, No
Was the ANM maintaining B.P records? Including the weight of the pregnant women?	Select one	Yes, No
If not, which information was missing ?	Multiple choice	Weight, B.P. test, H.B. test, Blood sugar test, Urine test, Height

Why was the following information not being recorded?	Multiple choice	Manipulate data, written data without test, Manipulating data from last entry, Other
Did an ANM enter the ANC and immunization records on MAMTA card ?	Select one	Yes, No, Sometimes
Was counselling conducted on the pregnant women for antenatal care?	Select one	Yes, No
ANM’s KB Performance Monitoring Checklist		
Did an ANM carry all KB system components to the camp? Including: KB Morpho Tab, KB necklace/pendant	Select one	Yes, No
If No, please give reason	Multiple choice	Tablet is not charged, Tablet is not working, App is not working, ANM feeling incompetent to use the app, ANM is not interested, ANM is not having tablet
Did ANM check in with KB app and select the correct camp?	Select one	Yes, No

If No, please give reason	Multiple choice	Tablet is not charged, Tablet is not working, App is not working, ANM feeling incompetent to use the app, ANM is not interested, ANM is not having tablet
Did ANM use a checklist for the following items: vaccine box, scale etc.	Select one	Yes, No
Did ANM use KB system with all beneficiaries?	Select one	Yes, No
If No, please select why	Multiple choice	Tablet discharged, Short out of pendant, App crash, Tablet hanged, pendant is not scaning
Did ANM face any app crashes or technical difficulties?	Select one	Yes, No, Sometimes
PLease select the corresponding type of technical difficulties	Multiple choice	Tablet stalled (slow), App crashed, pendant is not scaning, Biometric registration
Did ANM correctly register the following modules: {Mother registration, Child Registration, Returning Mother & Child Modules} (full process)	Select one	Yes, No

Did the ANM correctly utilize Lost Tag process for Missing and, or Non-functional Tags	Select one	Yes, No, Sometimes
Did ANM enter all available information under 'General Information' category? (i.e. Aadhar, bank details etc.)	Select one	Yes, No, Sometimes
Did ANM utilize the Edit Profile tab for prior missing information, if any?	Select one	Yes, No, Sometimes
Did ANM enter the past illness (illness history) in the KB application, if any?	Select one	Yes, No, Sometimes
Was ANM checking: HB, BP, Sugar, Urine Test and weight of beneficary?	Select one	Yes, No, Sometimes
Was ANM entering correct details of HB, BP, Sugar, Urine Test and weight of beneficary?	Select one	Yes, No
Was ANM entering inacurrate (false) data?	Multiple choice	Manipulating data for this checkup, recorded data without performing test, Manipulating data from last entry
Did ANM administer double the dose of IFA Tablet for anemia?	Select one	Yes, No, Sometimes

Did the ANM make any referrals using the KB app?	Select one	Yes, No, Sometimes
How many new pregnant women were entered in KB system?	Numerical	
How many new children were entered in KB system?	Numerical	
How many returning pregnant women and children were entered in KB system?	Numerical	
Was a pendant given to every first registered mother?	Select one	Yes, No
If No, please select why.	Multiple choice	It takes time to register new mothers, Takes time to update data, Mother refuses to take pendant, Sometimes forget to update, High turnup of mother at camp, Tablet or pendants are not in stock, Tablet or pendants are not working, Don't remember if Pendant was already given, Mother did not bring her pendant back, The Mother is not a resident of this camp (here temporarily with inlaws), The mother is not a resident of this camp

Have you ever not given the KB pendant to newly registred mother?	Select one	Yes, No
If Yes, please select the corresponding reason why	Multiple choice	It takes time to register new mothers, Takes time to update data, Mother refuses to take pendant, Sometimes forget to update, High turnup of mother at camp, Tablet or pendants are not in stock, Tablet or pendants are not working, Don't remember if Pendant was already given, Mother did not bring her pendant back, The Mother is not a resident of this camp (here temporarily with inlaws), The mother is not a resident of this camp
Have you ever given services to registered mother without updating data on KB pendant ?	Select one	Yes, No

If Yes, please select the corresponding reason why	Multiple choice	It takes time to register new mothers, Takes time to update data, Mother refuses to take pendant, Sometimes forget to update, High turnup of mother at camp, Tablet or pendants are not in stock, Tablet or pendants are not working, Don't remember if Pendant was already given, Mother did not bring her pendant back, The Mother is not a resident of this camp (here temporarily with inlaws), The mother is not a resident of this camp
Did any mother refuse necklaces? If so, how many?	Select one	Yes, No
If so, why ?	Select one	Caste and class, Mother does not like pendant, Objection from family member, Objection from religious leader
Was an ASHA available ?	Select one	Yes, No
Was there internet access at the SC catchment area?	Select one	Yes, No, Sometimes

If internet was unavailable, did ANM ensure sync (updating) of recently recorded data?	Select one	Yes, No
Did you observe ANM conduct any inappropriate behavior with necklaces? (i.e. hoarding necklaces, giving out necklaces incorrectly, filling out necklaces at another time, scanning but not checking that scan was successful)	Select one	Yes, No, Sometimes
Please select the corresponding type of behavior observed	Multiple choice	Hoarding necklaces, Giving out necklaces incorrectly, Given empty pendant, Filling out necklaces at another time, Scanning but not checking that scan was successful
Have you monitored the full camp?	Select one	Yes, No
In front of you, how many mothers and children visited camp?	Numerical	
Feedback by Monitors and Self ANM on KB Application		
Is ANM is comfortable in login in application?	Rating	Very good, Good, Average, Poor, Very Poor
Was ANM comfortable with logging out of the KB application ?	Rating	Very good, Good, Average, Poor, Very Poor

Was ANM comfortable in syncing data?	Rating	Very good, Good, Average, Poor, Very Poor
Was ANM comfortable in registering biometric of patients?	Rating	Very good, Good, Average, Poor, Very Poor
Was ANM comfortable with filling all the details of last ANC visit?	Rating	Very good, Good, Average, Poor, Very Poor
Was ANM comfortable in filling all the information previous and today immunization?	Rating	Very good, Good, Average, Poor, Very Poor
Was ANM comfortable with typing on app keyboard.	Rating	Very good, Good, Average, Poor, Very Poor
Was ANM comfortable with navigation from screen to screen on the Tablet?	Rating	Very good, Good, Average, Poor, Very Poor
Was ANM comfortable with scanning the necklace?	Rating	Very good, Good, Average, Poor, Very Poor
Was ANM comfortable with scanning the KB necklace and returning it to the mother and child?	Rating	Very good, Good, Average, Poor, Very Poor
Was ANM comfortable with searching data of mother and child on the KB application?	Rating	Very good, Good, Average, Poor, Very Poor
Was ANM comfortable with recognizing color codes of due list?	Rating	Very good, Good, Average, Poor, Very Poor

What is anyone hardest part of the process	Text	Yes, No
What is the hardest part of the process	Text	
Please rate on how your ability to recognize high risk patients has changed with the high risk cases?	Rating	Very good, Good, Average, Poor, Very Poor
Do you think that after implementation of KB system your knowledge about immunization of mother and children has increased?	Rating	Very good, Good, Average, Poor, Very Poor
Please note if you want to given some extra Information about ANM	Rating	Text
Thank You for your completion of this questionnaire. Your input is greatly appreciated in helping us improve our KB system.		