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Dear Khushi Baby Friends and Family,

This letter is admittedly long overdue. Although we have been deeply engrossed in the present, we continue to reflect and learn from our past.

This past year we have seen a period of growth, stability, and learning. 100+ Health workers used our system to track the health of an additional 15,000 pregnant women and infants across nearly 400 villages. Our field monitors ensured over 150+ children who were otherwise severely malnourished successfully received life-saving treatment.

We completed our two-year, 3200-mother randomized controlled trial. The results showed that the Khushi Baby system made a convincing impact, improving infant immunization rates by 12 total percentage points and decreasing infant malnutrition rates by 4 percentage points, all while improving data completeness and consistency by over 20% each. The proportion of scheduled health camps conducted increased from 40% to 80%. We welcomed new full-time innovators into our team: data scientists, designers, policy managers, developers, interns, and field monitors. We are now 25 young, and 25 strong.

We reinvisioned our entire system and began a process, not unlike the one we embarked on in 2016, to rebuild our system from the ground up, including over 200 screens in our android application.

Our work was recognized internationally when we won the Johnson and Johnson GenH Grand Prize -along with a $260,000 grant - and the Geneva Health Forum Innovation Prize. We were featured at the World Innovation Summit of Health in Qatar, the Global Citizen Movement Makers Summit, and at the Massachusetts General Hospital Global Pediatrics Summit.

“The change we wish to see comes from health workers like Bhavna Bhatt who tell us how the Khushi Baby system has enhanced her ability to plan for upcoming health camps and identify high risk patients. The impact we wish to bring comes from mothers like Priyanka, whose life would have been lost had she not been flagged as high risk and visited by our field monitor just as she was beginning to have eclamptic seizures.”
At the same time larger challenges remain works in progress:

- How long will health workers continue to use our system, when still expected to maintain their paper registers due to the government mandate?

- How will health workers willingness to use the system change in the face of decreased field supervision in the longer run?

- How can we design a system to minimize the level of data fraud and to maximize the data-driven actions for impact?

We do not have all the answers. Working in one community for an extended period of time however has allowed us to think deeply about these questions and to continue to refine our system, our approach, and our team. And as we look to scale to new geographies and health verticals, we will continue to balance of our hard-earned evidence and our genuine humility.

The change we wish to see comes from health workers like Bhavna Bhatt who tell us how the Khushi Baby system has enhanced her ability to plan for upcoming health camps and identify high risk patients. The impact we wish to bring comes from mothers like Priyanka, whose life would have been lost had she not been flagged as high risk and visited by our field monitor just as she was beginning to have eclamptic seizures. The vision we hope to share is affirmed by an amazing community of partners who have believed in our unique approach to health systems strengthening. This journey is long, but we have a feeling that we are headed somewhere important.

The year ahead has much to look forward to:

- Expansion of the Khushi Baby system to 1000 villages and 300+ health workers.
- Deployment of our new Khushi Baby 3.0 system.
- New modules to track family planning, maternal nutrition, and high risk cases during pregnancy and infancy at the referral health centers.
- Gamification of the health worker experience to incentivize data quality and impact
- A new interface for health officials to keep track of the most important indicators and take direct actions while on the go, with our mobile dashboard
- A new health vertical - tuberculosis, with a new prospective customer in a large hospital
- Integrating our maternal child health awareness calls with education delivery platforms and interactive storytelling
- Plans for a universal health card using our underlying NFC technology

So with full anticipation of the bumpy ride ahead, we invite you to cheer us forward
Stay khush.
Ruchit Nagar
LEADERSHIP
Ruchit Nagar
Founder, CEO
Mohammed Shahnawaz
COO

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Hamid Abdullah
Field Implementation Manager
Arjun Singh
Field & Logistics Assistant
Lovely Solanki
Field & Admin Assistant
Dhanwant Purawat
Lead Field Communication
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Sukhlal Dungari

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Summer Interns:
Shashank khandal, Vinay Kumar gupta, Samiksha Sharma, Saumya Srivastava, Tulika chakraborty, Jayvanthi, Nitesh Kumar, Tarun, Ali Asad, Altaf Ahmad, Md. Danish
When a woman becomes pregnant she attends the Maternal Child Health Nutrition (MCHN) camp where she is registered from eligible couple list and given a Khushi Baby Pendant. In future visits, the Auxiliary Nurse Midwife (ANM) uses the KB mobile app to scan the woman’s pendant (and authenticates with her biometric) to retrieve and update her health record. When the mother brings her newborn for the first vaccination, the ANM scans the mother’s pendant to digitally link the mother with her child. The ANM uses the app before the camp to review the duel list and during the camp for streamlined data-collection and decision-making support. ANM also tracks the family planning method being used by couples with this system. When the ANM returns to the town, data is uploaded to the Dashboard for health officials to review. Reports are shared weekly on WhatsApp Groups to make the data actionable. Automated voice calls are sent to the pregnant women and new mothers to guide their individual follow-up plan. Khushi Baby Field monitors are sent to households to follow-up with high-risk and drop-out mothers and children.

Khushi Baby is neither a technology company nor an NGO. We are a social enterprise responsible for the end-to-end process of tracking and engaging maternal and child health from design to development to deployment to monitoring and evaluation. Having been borne out of a design class at Yale, building with our users and listening to their feedback has always been part of our DNA. Half of our team – the Khushi Baby Field Monitors – works directly from the field sites where the maternal and child health camps take place on a daily basis. We use a variety of design tools to continuously adapt our solution to meet their needs. We have used: card sorting to understand priorities, profile sketches, empathy maps, paper-prototypes of the application, camp observation, and co-creation sessions to ensure we are building something that solves real problems faced by our field champions at the last mile. Our process is made possible by an interdisciplinary team of doctors-in-training, public health practitioners, designers, data analysts, software developers, policy managers, research associates, and field operators. We are over 30 strong with 25, full-time staff based in Udaipur, India.
Early childhood

KHUSHI BABY SYSTEM MAP

FOR EFFECTIVE TRACKING AND CARE AT CAMP
- Patient due lists
- Follow-up reminders
- High risk alerts via SMS

FOR OPTIMISED COMMUNITY FOLLOW-UP
- Portable digital health record
- Offline biometric authentication
- Dialect specific voice call reminders for health camps

FOR INFORMED, TIMELY, PERSONALIZE HEALTH CARE

MOTHER CHILD FAMILY

ANM
FRONTLINE HEALTH WORKER

JOURNEY AT LAST MILE

MCHN CAMP
MATERNAL AND CHILD HEALTH & NUTRITION

4-6 CAMPS / ANM / MONTH

ASHA
COMMUNITY BASED HEALTH ACTIVIST

PRIMARY HEALTH CENTRE
MEDICAL OFFICER IN-CHARGE

DISTRICT HOSPITAL
CHIEF MEDICAL HEALTH OFFICER

KHUISHI BABY SYSTEM MAP

- Organizes data for district-level decision-making
- Tracks ANM’s monthly performance
- Monitors MCHN camp status in real-time
- Predicts supply-side gap with demand forecasting
- Strengthens link between high risk patients and care centres

- Biometric authentication
- Application runs offline
- Automated detection & prevention of data manipulation
- AI guided identification of high risk patients

Eligible couples
Antenatal care
Deliveries
Postnatal care
Child care
Death
Migration

Biometric authentication
Application runs offline
Automated detection & prevention of data manipulation
AI guided identification of high risk patients

Antenatal care
Infant vaccines
Maternal & child nutrition
Early child development
Referrals to PHCs
“Before the Khushi baby intervention, I previously went door to door to inform the beneficiaries about the MCHN Camp. Now, beneficiaries arrive at MCHN camps themselves because they receive Khushi baby voice calls and are aware about the immunization. Since Khushi Baby has provided the tablets to ANMs to digitize our work and reduce the hassle of paperwork, I have firsthand seen the advantages at MCHN camps. I remain hopeful that we ASHAs will also get such types of KB Tablets to ease our work burden and further our efforts in the field.”

-Meena Garg, ASHA, Deon Gaon Subcenter
OUR PROGRESS

GAVI Mid Term Review, December 2018, Dubai
Global Citizen Movement Makers Summit, UNGA September 2018, New York
Presentation at Yale School of Management, New Haven
Showcasing Khushi Baby Application to Rajasthan RCH Director, Dr Mittal
NCORE incubation kick start meeting, Bangalore
Yale SHI-CoWorks Foundry Incubation kickstart meet, Bangalore

Women’s Forum Daring Circles at VIVA Tech Conference, Paris
Submitting 3ie report to the Mission Director, Dr. Samit Sharma
OUR ENGAGEMENT

International Engagements

AVPN Conference, Singapore
Talk on Human Centered Design at Yale CEID, Khushi Baby’s birthplace
Gavi Midterm Review Summit
KB COO with Dr. Seth Berkley
Social Enterprise panel discussion at Yale SOM
Discussion at Yale University of Public Health

State-level engagement with IPE Global and JHPIEGO
Meeting with chief medical and health officers, Udaipur
Survey CTO training, Ahmedabad
CIFF Child Technology Makeplace, IIT Delhi
KB demo to state program manager, NHM, Rajasthan

National Engagements
“Khushi Baby has done a wonderful job. They have really worked hard and their team is dedicated. I personally have seen them working in the field, spending time training the ANMs to use the system. The ANMs are feeling more confident, using newer techniques and getting success in those techniques, performing better from the data analysis and feedback they receive from the system. I applaud Khushi Baby for all they have achieved in such a short period of time.”

- Dr. Sanjeev Tak, Deputy Director Medical and Health Services, Udaipur Zone, Rajasthan
In 2018, we went through a redesign of the flagship component of our system: our mobile application for the health workers - KB 3.0. The main goal was to turn the app into a tool for empowerment of the health worker rather than another tool to satisfy a data-reporting requirement. Our framework for empowering the ANMs included four key activities: motivating, monitoring, assisting, and rewarding. These activities were structured to form a habit loop to ensure that the app could organically integrate into the ANMs regular routine while allowing her to explore and build her knowledge, skills, and ability to make each interaction more impactful. To form a “habit loop” we incorporated cues within the app to prompt actions and rewards to encourage future actions.

For example, ANMs who select that they cannot conduct a camp are given a reminder of the number of mothers and children who will miss out on essential care. On the other hand, for every routine check-in, the ANM receives a message expressing gratitude for the potential impact she will deliver for that session. These nudges help bring empathy into our app and give it a value above a reporting tool. We also incorporated a simple view for the ANM to check her monthly progress and motivate her for the upcoming session. Using this module the ANM can become her own spokesperson at monthly meetings and get due credit for her work. At the same time she does not need to tabulate these key performance indicators by hand since they are automated through the app itself. We are going one step further to gamify the experience and bring joy into documenting patient encounters. Health workers will soon be able to see their strengths and weaknesses across different verticals (data quality, health behavior outcomes, health outcomes, attendance, knowledge/training). They will be able to earn points, level up, and receive social recognition from their peers on the basis of a top-performer list.

Overall, we worked alongside the ANMs to make the user experience minimal, joyful, and human. Continuous feedback from the ANMs and the development team allowed for purposeful iterations over this past year. The coming year will reveal the fruits of this labor, but the journey so far holds promise.
Beyond the mobile app for health workers we were in the lab for several new projects:

mDash: a mobile dashboard for health officials to see key performance indicators and make important calls to their teams while on the go. The motivation for this project came from a realization that health officials, despite having desktop computers, were not using these machines, and therefore also not using our web-based dashboard. At the same time, we saw success in engaging these health officials and health worker teams with our Khushi Baby WhatsApp groups. Health officials regularly used their smartphones and were comfortable calling-up their staff for follow-up. With the advent of our mDash, our goal was to drive these engagements with actionable data.

The health card: a new form factor to carry health data with new opportunities for physical, visual cues. From our inception, a hallmark of Khushi Baby has been the pendant - a culturally-symbolic wearable which housed our NFC chips. But with thoughts to engage with populations in peri-urban and urban settings and considerations of costs during scale-up planning, the card format reemerged as an alternative that could provide users with some choice. The card also allowed us to brand specific messages. We worked on an initial concept to depict a story of a child, Raksha (which means ‘protection’ in Hindi), on her journey towards receiving full immunization. With each immunization received, a corresponding bubble is filled, and Raksha is shown receiving a new golden piece of armor to defend herself from the evil illness monsters or raksashas. The family receives a corresponding voice call with the next episode of the story along with a thank you.

Universal Health Card: a portable, digital health record, for all patients. We worked on a concept to extend the use case for our technology platform beyond the maternal and child health field, so that it could be used by health providers in different care settings and bring new advantages to retrieving and updating medical history. Our goal is to redefine the interface between patient and provider in the first two minutes of the interaction. With our platform the provider can scan the health record, see the key history, see any pending action items, update the progress from today’s visit via speech-to-text, and save the encounter all within a minute. For high-volume patient settings which largely occur in an informal, paper-based health setting, such technology can make digital documentation feasible and more importantly, useful for both patients and providers.
Clear and concise use of color coding system.
- Clear referral points for high risk beneficiaries.
- Conversative user experience.
- Gamified modules.

Khushi Baby 3.0 application

- Personalised profile.
- Nutrition tracking.
- Educational flows.
- Assistive hints for frontline health workers.

Khushi Baby NFC health card
In-house design sprints for new features

Card sorting to understand user priorities

Iterative sessions after feedback from users

Testing and feedback sessions with user
Our core innovation has been to repurpose the Near Field Communication chip, which stores 868 bytes of data, into a full-purpose health record which can store 100 columns of maternal and child health data and the biometric template of the patient.

Health workers log in to our Android app with their biometric. Their GPS and time stamp is recorded to sign into a camp. In order to update a patient’s health record, they must a. scan the NFC chip and b. Scan the live thumbprint of the patient.
If the biometric template stored on the chip matches the live thumbprint’s digital template then the record is made accessible. This allows for the digital record to both be accessed by authorized users and authenticated by the patient without need to connect to a central database. Each encounter is saved onto the patient’s NFC chip which serves as a digital proof of the encounter which can be audited.

- The mobile application implements a series of validation to ensure structured data entry. Alerts are triggered to inform the ANM of high-risk patients and required actions.

- Behind the scenes, over 30 sophisticated data-quality checks are implemented to assess whether the data entered by the ANM is likely fraudulent.

- We automate data-collection for the ANM. Scanning the mother’s NFC chip auto-fills fields required for registration of a new child. Scanning the mother’s AADHAAR with our OCR technology also allows for several fields to be auto-filled.

- Our backend system automates report generation and delivery and schedules patient-specific voice call messages for follow-up.

**Key Metrics**

- Till date will have tested 170+ builds (Figure as on 24 June is 175)


- In the last 90 days 98% Crash Free Sessions

**Next On Deck**

- Automated generation of reports for the health officials.

- Automated generation of ANM performance ranking metrics.

- Fraud-resistant, image-based data collection for indicators like hemoglobin and weight, combined with AI-based image processing.

- Khushi Baby’s deep neural network will predict a) health behaviors, b) health outcomes, and c) optimized combinations of interventions to reduce adverse outcomes. Its defining feature will be the advanced data-quality layer used to differentially weigh the trustworthiness of any data point prior to incorporating it into the statistical model.

- Integration of AI-guided, high-risk score predictions into the ANM mobile app.

- Integration of AI-guided intervention strategies over automated voice messages and WhatsApp Groups.
KhushiBab

DEEP NEURAL NETWORK

Voice-to-Text Inputs
- KB App User Inputs
- Data Quality Layer
- KB High Risk Index Variables
- Outcomes Matrix

Smartphone Camera Inputs
- Fingernail image for Hb estimation
- ID card image data extraction

IOT/Device Inputs
- GPS
- Biometric
- Internal stopwatch
- Digital scales

24+ rule-based data quality checks
10+ Bayesian distributions of expected variable values

High Risk Tier
Last Checkup Score
Prior Medical History Score
Social Determinants Score

Behaviors:
Full Antenatal Care Coverage, Hospital Delivery, Post-delivery contraception, Full Infant Immunization by 12 months

Outcomes:
Delivery complication, Stillbirth, Maternal Death, Child Death, Neonatal Danger Signs, Severe Acute Malnutrition, Missed Developmental Milestones, Infant Hospitalization

Predicted Probabilities
- 0.60 = Probability of Delivery Complication
- 0.85 = Probability of any Infant Danger Signs
- 0.15 = Probability of Child Death
- 0.90 = Probability of Severe Acute Malnutrition

Actual Outcomes
- No Delivery Complication (I)
- Infant Danger Signs Present (I)
- No Child Death (I)
- Severe Acute Malnutrition of Child (I)

Error
- 0.60
- 0.15
- 0.15
- 0.10

Gradient descent function to minimize Error between Absolute Outcomes and Predicted Probabilities

Automated reports on ANM and Block Official WhatsApp Groups
Automated Voice Call Follow-up to family
Human Voice Call Follow-up to family
Mobilization of Field Monitors to the household

2 MILLION+ Data Points

150+ Variables from Family Planning, Antenatal Care, and Delivery of the mother + variables of the ANM and ASHA worker experience
Khushi Baby is not the first mHealth solution in the maternal and child health space. Medic Mobile, Dimagi, Antara Foundation, OPENSRP, and UNICEF India have developed applications for maternal child health tracking in offline settings. OpenMRS and DHIS2 have become prominent frameworks for digital health application interoperability. Armann, ZMQ technologies, and MOMA have focused on audiovisual communication and outreach. SMS and voice-based reminder strategies have been shown in RCTs to improve patient follow-up. Vaxtrac uses a biometric thumbprint reader, developed by to identify patients. Khushi Baby advances the mHealth paradigm forward by challenging two core assumptions, that are left unaddressed by the aforementioned solutions: first, that connectivity is available at the last mile and second, that data entered at the last mile are untampered. Our experiences from the field have shown us that mothers, health workers, and devices move between villages during the maternal child health journey.

The assumption that health workers would be able to synchronize their patient due lists with the duelists of other health workers breaks down when connectivity is unreliable in last mile settings. Khushi Baby’s approach is to create a portable, decentralized record that travels with the patient, and allows their health to be reviewed and updated at the point of care without the need for prior synchronization of the health worker’s device.

We have observed frontline health workers entering data without performing tests, skipping important history questions, manually adjusting summary counts to meet health targets to suggest they had seen more patients or that fewer patients in their catchment area were high risk.

Khushi Baby’s approach has been to implement systems to both prevent and detect data manipulation and to encourage and incentivize data quality as a key indicator for health worker performance.
The Khushi Baby pendant and biometric requires the health worker to meet the patient and create a physical auditable proof of the encounter. GPS and time tracking and a series complex data quality rules detect ANMs who are likely manipulating data. The application experience in turn presents nudges and reminders to these ANMs. Most importantly, ANMs begin to see the data they enter used beyond reporting for real action, in the form of weekly follow-up on WhatsApp groups and automated voice reminders to their beneficiaries.

The Khushi Baby platform has been designed to make culturally-informed advances to this technological approach, through community-inspired design of the wearable digital health record, the mobile app for smartphone naïve health workers, and the patient-specific, dialect-specific voice reminders for populations that are largely illiterate.

Khushi Baby’s approach is to create a portable, decentralized record that travels with the patient, and allows their health to be reviewed and updated at the point of care without the need for prior synchronization of the health worker’s device. The platform has been designed to make culturally-informed advances to this technological approach.

“Khushi Baby has been working with Udaipur health department since 2015-16 in five administrative blocks. With unique digital health information platform they have been able to track over 27000 mothers and babies since then. The system focuses primary on accountability and quality of data that helps front line health worker and doctors in decision making. With upcoming new version 3.0 Application, with newly added modules of Eligible Couples List and Family Planning would be able to track more beneficiaries in coming time when we are universalising this to showcase Udaipur as a model district.”

- Dr Dinesh Kharadi, Chief Medical & Health Officer, Udaipur
Till date Khushi Baby system has been used to track the health of 25,000 mothers and infants. Since 2018, an additional 15,000 mothers and infants were registered into the Khushi Baby system by a team of 85 ANMs working in nearly 400 rural villages. Between 2016 and 2018, we completed a two-year randomized controlled trial with 3200+ mothers to rigorously evaluate the impact of our system on process, health behavior, and health outcomes. Despite significant financial, technical, and political struggles that we had to overcome, the results of the trial still showed:

12% Improvement in full immunization rates of infants

04% Decrease in infants who were moderately acutely malnourished

20% Improvement in data completeness and data consistency

40% Scheduled camps were held at the start of the Khushi Baby Intervention in February 2017.

80% Scheduled camps (2911/3678) were held from January 2018 onwards

x 100,000 Automated voice call reminders and educational messages were sent and received by families living in these remote villages.

Infants suffering from severe acute malnutrition were screened, followed-up via household visits, and successfully referred for higher level treatment.

“The best feature in the KB App is due list. It is helpful in decision making. Sometimes we forget the due vaccine of the child but in KB App we can see due vaccine on the due list.”

-Bhavna Bhatt, ANM, Deon Gaon Subcenter
We started the tracking of high risk children from January 2018. To date we have tracked 760 high risk children who were identified by ANMs, ASHAs, and algorithms applied on our data sets. We followed up these children with household visits and found that now some children are healthy and only 430 are high risk. We have successfully referred 157 children to malnutrition treatment centers with the help of ANMs, MOICs, and RBSK staff. To date 98 children completed their treatment courses. These children may have otherwise died from severe acute malnutrition.

Compared to a baseline rate of 40% of scheduled camps held in the first months of the Khushi Baby intervention roll-out in Q1 2017, the camp held rate has increased to nearly 80% with nearly 60% held according to plan. 2018 saw slight improvements in camps held on time with decreased in camps held off schedule and not held.

High risk children are tracked who all are identified by ANMs, ASHAs.
One Khushi Baby Field Monitor came across a child suffering from severe acute malnutrition during regular camp monitoring in the village of Hamited, in the sector of Parsad. The mother was encouraged to take this child, Radhika, to the malnutrition treatment center immediately. The mother deferred initially, prompting two Khushi Baby Field Monitors to follow-up at the household level the next day. They met both parents of Radhika. The father, a daily wage laborer, refused to take Radhika to the malnutrition treatment center, citing cost as a primary concern, and concern over who would look after the three other children at home during the 2-week hospitalization. The Khushi Baby monitors listened, observed, and carefully sought further understanding. They saw inside the kuccha (mud-based) house and noted unsanitary home environment. They heard from the father about how Radhika wasn’t feeding as well, and how her mother, who herself was appearing undernourished, was unable to express milk for breastfeeding. At the age of 11 months, the Radhika weighed 6kg. At 14 months she was down to 3kg.

With respectful urgency, the Khushi Baby Field Monitors persuaded the family to take Radhika to the community malnutrition treatment center in Parsad. There the child was found to weigh 2.7kg with a mid-upper-arm-circumference of just 9cm, prompting immediate referral to the District Hospital. After 21 days in the ICU undergoing nutritional rehabilitation, Radhika gained over 1kg, and was discharged with dietary advice and multivitamins. Radhika remains on the path of recovery today, and her parents have a renewed trust in the health system which saved their daughter.

Khushi Baby Field Monitor came across a child suffering from severe acute malnutrition during regular camp monitoring in the village of Hamited. With respectful urgency, the Khushi Baby Field Monitors persuaded the family to take Radhika to the community malnutrition treatment center in Parsad. Radhika gained over 1kg, and was discharged with dietary advice.
Priyanka, a pregnant woman living in the Parsad Sector, had attended two antenatal care camps where the Khushi Baby platform was being used. On her first visit she her prior pregnancy history of obstructed labor was marked. In her second visit, she was found to have severe hypertension and edema, along with moderate anemia. Khushi Baby’s high-risk algorithm ranks mothers in terms of their likelihood of having an adverse pregnancy, delivery, or infancy-related health event. A list of highest ranked mothers is sent weekly over WhatsApp for ANMs to follow-up. Priyanka’s name was near the top of the list given her concerning presentation for preeclampsia, a leading cause of maternal mortality.

A Khushi Baby field monitor followed up at the household. When he reached, Priyanka was laying in her husband’s lap, having convulsions – a sign of preeclampsia with severe features. The Khushi Baby monitor called the ambulance and helped gather nearby villagers. Priyanka was carried on cot supported by the shoulders of 5 villagers to the highway, where she was then taken to the nearby community health center. The medical officer there recognized the signs of preeclampsia and immediately referred Priyanka to the District Hospital for definitive therapy.

Priyanka, who was 6.5 months pregnant at the time was given an injection of magnesium sulfate and induced for early delivery. The pre-term child did not survive, but the timely referral helped save Priyanka’s life. After four days in the hospital she returned home, where she remains on the path to recovery.
From September 2016 to July 2018 we conducted a landmark 3200-mother cluster Randomized Controlled Trial across 584 villages. The purpose of this experiment was to rigorously measure the value of the Khushi Baby system (“treatment”) in comparison to the existing government systems (“control”) for record-keeping and community engagement for maternal and child health. After conducting nearly 10,000 interviews, here are our key findings:

Key Evaluation Questions and Answers

- **Does the Khushi Baby System function robustly?**
  After initial struggles, yes

- **What is the frequency of hardware and software related issues in the field?**
  By endline 87 ANMs had 93.7% of sessions crash-free in the final 90 days

- **Does the KB System deliver data on time?**
  3.45 hours on average from field to backend (compared to 30 days on paper)

- **Do beneficiaries retain pendants more than MAMTA cards?**
  At 6 months yes, but at 15 months, no - retention is roughly equal.
Can the KB Platform improve the quality for maternal and child health data in rural Udaipur when compared to status quo processes?

Is the data complete for minimum, mandatory fields for infant health tracking?
98.7% for Khushi Baby vs. 77.1% for government paper health records

Is the data consistent between the beneficiary and the backend-source?
98.1% of records matched between Pendant and Backend for KB vs. 81.0% for paper health records government paper health records and the corresponding backend system

Is there an impact on the checkup-related processes followed and/or the proportion of false fields entered?
No significant differences (this is a key area that KB 3.0 will work to address)

If that the KB System works and generates higher quality data, does the KB system generate value or remain unused? Specifically how does the KB System generate differentiating data-driven engagement for better health care delivery and community engagement?
Every week 20+ WhatsApp messages were sent to health worker teams and over 1000 automated voice call reminders were sent to families. Health officials did not use the KB Dashboard, but did use WhatsApp Groups.

Does the collective KB System lead to high rates of full and timely infant immunization, and if so which factors were significant in predicting immunization outcomes?
Mothers in areas where KB was active were 1.66 times more likely to have their children fully vaccinated compared to mothers from control areas. This is after adjusting for potential confounding factors. This is consistent across multiple types of measurement - oral recall and review of the mother’s government health card.

Are there any spillover effects of the Khushi Baby system on:
Rate of severe acute malnutrition and moderate acute malnutrition?
Yes, infants in areas where KB was active were 26.4% less likely to have moderate acute malnutrition. This is after adjusting for potential confounding factors.

Infant hospitalization rate and Infant mortality rate when comparing Treatment vs. Control? No significant differences between KB and Control
• **Comparing Treatment to Control, how have the attitudes, behaviors, and awareness for mothers and fathers with respect to the health care of their child changed?**

More mothers in Treatment said that they felt empowered to make decisions on their health. More mothers in Treatment said they felt comfort towards exclusive breastfeeding practices. More mothers attributed their increase in awareness and their husband’s increase in awareness to mobile messages they received from the KB system.

• **Comparing Treatment to Control, how have the attitudes, behaviors and practices changed for ANMs and ASHAs from Baseline to Endline?**

ANMs cited benefits including ease of identifying high risk patients, automatic generation of due lists, time saved at the camp, and noticeable improvement in camp turn-up from voice calls. ASHAs were indirect beneficiaries of the system. Although they did not use the app, they strongly reported that due to Khushi Baby voice calls that they had seen improvement in uptake of antenatal care, hospital delivery, and uptake of child immunization. Before Khushi Baby they would have to go repeatedly to certain households to remind them for upcoming camps. Now instead mothers and pregnant women are receiving the Khushi Baby call, calling the ASHA to confirm the camp the next day, and coming themselves, in some cases, before the camp even starts.

• **What is the end user feedback on components of the system from mothers, ANMs, ASHAs, and block managers who have experienced the pendant, KB App, KB Automated Voice Calls, and KB WhatsApp groups respectively?**

W62/67 ANMs who used the app reported they would prefer to continue using the same system moving forward. 68/77 ANMs in the control areas also preferred to switch to the app despite not using it during the trial. The average rating for the app was 4 out of 5 stars. Health officials and supervisors strongly appreciated the system, particularly the WhatsApp groups through which they reported that they saw an improvement in how the ANM was addressing high risk and drop out beneficiaries.
Khushi Baby

STATEMENT OF FINANCIAL POSITION
As of December 31, 2018

<table>
<thead>
<tr>
<th>ASSETS</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current Assets</td>
<td>$227,212.04</td>
</tr>
<tr>
<td>Fixed Assets</td>
<td></td>
</tr>
<tr>
<td>Accumulated Depreciation</td>
<td>-1,095.00</td>
</tr>
<tr>
<td>Equipment</td>
<td>9,978.57</td>
</tr>
<tr>
<td>Total Fixed Assets</td>
<td>$8,883.57</td>
</tr>
<tr>
<td>TOTAL ASSETS</td>
<td>$236,095.61</td>
</tr>
</tbody>
</table>

| LIABILITIES AND EQUITY                     |            |
| Liabilities                                |            |
|   Current Liabilities                      | $35,813.65 |
| Total Liabilities                          | $35,813.65 |
| Equity                                     |            |
|   Opening Balance Equity                   | 12,523.88  |
|   Retained Earnings                        | -61,772.81 |
|   Net Revenue                              | 249,530.89 |
| Total Equity                               | $200,281.96|
| TOTAL LIABILITIES AND EQUITY               | $236,095.61|
# Statement of Activity

**Khushi Baby**  
**Statement of Activity**  
_January - December 2018_

<table>
<thead>
<tr>
<th>Revenue</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Donation Income</td>
<td>254,562.24</td>
</tr>
<tr>
<td>Grant Received</td>
<td>260,000.00</td>
</tr>
<tr>
<td><strong>Total Revenue</strong></td>
<td><strong>$514,562.24</strong></td>
</tr>
</tbody>
</table>

| GROSS PROFIT                | $514,562.24 |

<table>
<thead>
<tr>
<th>Expenditures</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Advertising</td>
<td>924.26</td>
</tr>
<tr>
<td>Bank Charges</td>
<td>2,344.82</td>
</tr>
<tr>
<td>Delaware Tax</td>
<td>147.20</td>
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<tr>
<td>Development Services</td>
<td>52,234.47</td>
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<tr>
<td>Dues &amp; Subscriptions</td>
<td>701.28</td>
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<tr>
<td>Event Fees</td>
<td>1,893.73</td>
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<tr>
<td>Internet Expenses</td>
<td>35.06</td>
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<tr>
<td>Internship Expense</td>
<td>860.00</td>
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<tr>
<td>Legal &amp; Professional Fees</td>
<td>4,550.00</td>
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<tr>
<td>Lodging Expenses</td>
<td>1,199.78</td>
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<tr>
<td>Meals and Entertainment</td>
<td>152.99</td>
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<tr>
<td>NFC Tags</td>
<td>3,487.00</td>
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<td>Office Expenses</td>
<td>482.92</td>
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<tr>
<td>Office Supplies</td>
<td>3,099.20</td>
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<tr>
<td>Operating Expense (India Office)</td>
<td>35,673.83</td>
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<tr>
<td>Reimbursement</td>
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<tr>
<td>Salary and Wages</td>
<td>94,561.73</td>
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<tr>
<td>Shipping and delivery expense</td>
<td>36.80</td>
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<tr>
<td>Software Expenses</td>
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<tr>
<td>Stationery &amp; Printing</td>
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<tr>
<td>Subcontractors</td>
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<tr>
<td>Telephone Expenses</td>
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<td>Travel</td>
<td>21,205.18</td>
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<tr>
<td>Web Service Expenses</td>
<td>369.56</td>
</tr>
<tr>
<td>Webhosting Expenses</td>
<td>60.32</td>
</tr>
<tr>
<td><strong>Total Expenditures</strong></td>
<td><strong>$265,031.35</strong></td>
</tr>
</tbody>
</table>

**NET OPERATING REVENUE**  
$249,530.89

**NET REVENUE**  
$249,530.89
Maternal and Child Health Programs:

Rajasthan

- 3 Districts over 3 years as proof of scale-readiness: $2M (700,000 beneficiaries)
- Full State Roll-out over 3 years: $16M (4,500,000 beneficiaries)

As a GAVI INFUSE PACESETTER:

- Gates Foundation will 100% match any investment of at least $1.5M

Specific Projects (over next 24 months):

- Udaipur District Expansion: $700K
- Primary Health Center integration: $100K
- AI/Machine Learning: $100K
- Universal Health Card: $250K
- Tuberculosis integration with Nikshay: $200K

Annual Budget: $300K
Runway through: July 2020
With proof of impact from a 2-year randomized controlled trial, the Udaipur District government has given the go-ahead to expand Khushi Baby district-wide. Khushi Baby also now sits on the Rajasthan State’s working group for Integration of Health Management Systems. There are six interrelated programs for Khushi Baby’s growth:

- **Expansion to the Full District:** expanding the revised “KB 3.0” platform to cover the Udaipur District universally will provide a blueprint for other districts to replicate while serving as a litmus test for the Rajasthan State MOHFW to evaluate for further scale-up

- **Building a module for Primary Health Centers (PHCs) and district hospitals** who will see high risk mothers and children referred from village-level camps to ensure continuity of informed medical care. This will also include a collaboration with Janitri, an IOT device that records key data at the time of delivery with a dual purpose: a) to better inform the delivery workflows in the Janitri application based on antenatal care data collected by KB and b) to better inform postnatal care recommendations in KB based on Janitri-collected data during delivery

- **Machine learning for precision public health:** using data models from nearly 2 million data points to better predict which mothers and children are at highest risk of short- and long-term outcomes, which health workers are committing data fraud, and which voice calls to send to optimize follow-up rates

- **Universal Health Card:** applying the NFC core technology for health records beyond maternal and child use cases. Everyone deserves to have their health history in their pocket. We are making a provider-facing app with voice-to-text technology for easy documentation with an integrated system for automated patient follow-up.

- **mDash:** We are working on providing an actionable dashboard for health officials which can allow them to take data driven engagements while on the go

- **Khushi TB:** We are working with Yale GHLI and Cowrks Foundry to commercialize and scale our solutions within the Indian market. We are starting with a project to integrate our core technology with the Government of India’s digital platform for TB-tracking: Nikshay

We look forward to welcoming new socially-motivated innovators and partners to our Khushi Baby family. Turning five is certainly a key milestone for our organization. We are excited for the next five years ahead!

“It has been a pleasure mentoring the Khushi Baby team over the past 6 months. This team of designers, developers, and public health researchers has been able to track the health of over 25,000 patients in 400+ rural villages. They have completed a 2-year 3,200 mother randomized controlled trial to prove the efficacy of their solution. I look forward to evolving this innovative technology platform into a great program and a global standard that will scale at many levels, and encourage impact investors to consider not only their potential, but also their determination and track record. Together, we can to ensure that every baby is Khushi - happy and healthy.”

-Sanjay Purohit, Strategic Advisor, Khushi Baby