

MARCH 2024

# PROMPTS: AI-Enabled Messaging to Improve Delivery and Uptake of Immunisation Services in Kenya



# 1. Why

While there is a well-functioning immunisation programme in all 47 counties of Kenya, coverage challenges remain. WHO data published in June 2023 show that the immunisation rate for children 12 – 23 months is around 90%, with 97% coverage for BCG, Polio third dose rate of 87% and DTP third dose at 90%<sup>1</sup>. However, this means that many zero-dose and under-immunised children are missed by the formal health system. UNICEF estimates that there are 14,302 zero-dose children in Kenya and 114,000 children



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who have had some but not all of their recommended schedule of vaccinations (under-vaccinated)<sup>2</sup>. A study<sup>3</sup> into the reasons why children miss vaccinations in Western Kenya found that complacency (believing that immunisation wasn't needed anymore) was commonly reported, as well as the perception of bad health worker attitudes or practices. Health workers reported caregiver hesitancy, not knowing vaccination due dates and vaccine stock-outs as the most common reasons for caregivers to not have their child vaccinated.

Serious challenges persist for maternal and newborn health despite the number of women giving birth in health facilities steadily increasing around the world. In Kenya, over 6,000 women die annually during childbirth<sup>4</sup>. Only 8% of women living in poverty in Kenya can access quality maternal health services<sup>5</sup>, and many don't have the correct information to make informed choices about where and when to seek care.

The non-profit organisation Jacaranda Health deploys low-cost, evidence-based solutions within government health systems throughout Kenya to improve access to high-quality maternal and newborn care, including immunisation. Since 2017, Jacaranda has been using text messaging to improve uptake of health care services for mothers and children.

1 WHO immunization dashboard. Available [here](#)

2 Page 8 of the UNICEF Regional brief: Eastern and Southern Africa. The State of the World's Children 2023. Available [here](#)

3 Agócs M, Ismail A, Kamande K, Tabu C, Momanyi C, Sale G, Rhoda DA, Khamati S, Mutonga K, Mitto B, Hennessey K. Reasons why children miss vaccinations in Western Kenya; A step in a five-point plan to improve routine immunization. *Vaccine*. 2021 Aug 9;39(34):4895-4902. doi: 10.1016/j.vaccine.2021.02.071. Epub 2021 Mar 18. PMID: 33744047. Available [here](#)

4 Reducing Maternal Deaths in Kenya. Available [here](#)

5 Maternal Health Care in Kenya: Poor Quality for Poor Women. Available [here](#)

## 2. What

Jacaranda Health developed **P**romoting **M**others in **P**regnancy and Postpartum **T**hrough **S**MS, or **PROMPTS**, which is an AI-enabled SMS messaging service that empowers new and expecting mothers with information to safely navigate their pregnancies and seek care at the right time and place.

A woman enrolls in PROMPTS at public health facilities or via a Community Health Worker by submitting her phone number, the baby's due date and her preferred language (currently the system works in Swahili, English and Twi, with ongoing work to broaden its scope across many 'low-resourced languages'). To protect a woman's privacy, Jacaranda's procedures have evolved to comply with the strict data privacy laws in Kenya. Once enrolled, the mother starts to receive gestation stage-specific SMS messages, including clinical history surveys, appointment reminders for prenatal, postnatal and immunisation service visits, messages detailing possible danger signs before and after pregnancy, and advice about caring for herself and her baby. After delivery, the messages continue until the baby's first birthday, including encouragement to complete the full immunisation schedule. The service is free for the mother and accessible to everyone with a basic mobile phone as it doesn't require WhatsApp, the internet, or costly data charges.

Mothers can also ask PROMPTS a question at any time which links with an AI-enabled clinical helpdesk. The helpdesk currently processes up to 5,000+ questions daily, and uses Natural Language Processing (NLP) to read, respond to, and triage incoming messages according to clinical urgency. Given the sensitivity of the information the platform processes, the system is actively monitored by a human team of agents (including management staff, nurses and clinical officers, and general helpdesk agents), who review all NLP-suggested responses before they go out to mothers. When incoming messages include a danger sign (e.g. heavy bleeding during pregnancy), the NLP will prioritize this query to a human helpdesk agent for urgent follow-up (usually via a direct call to the mother), and referral to facility-based care or trained local counsellors (e.g. specialists in maternal bereavement).

# 3. How

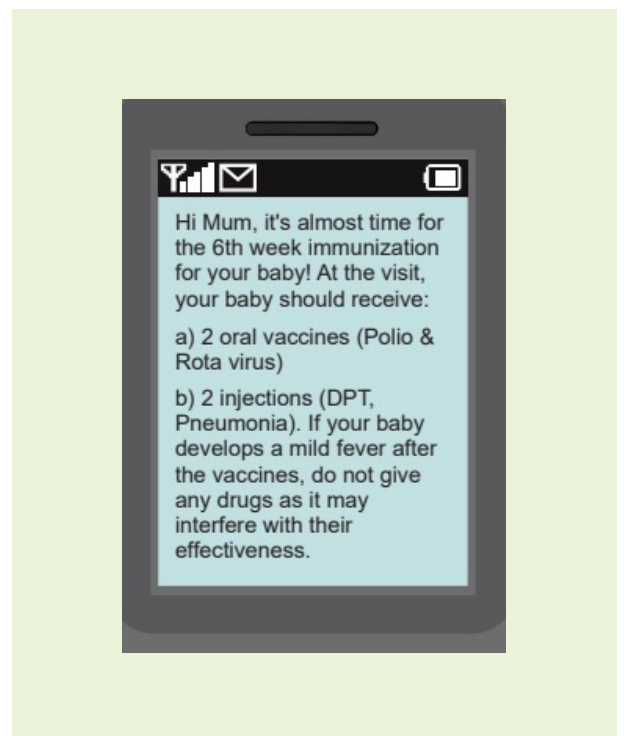
In 2017, Jacaranda started sending SMS messages to pregnant women coming to health facilities they were working in to encourage return for antenatal care. They leveraged existing sets of messages, such as the one developed by the Mobile Alliance for Maternal Action (see [here](#)), and carried out extensive human-centred message development testing with women and health workers to craft messages appropriate to the context.

When participants started sending questions to the service, a group of human agents started responding via a first-in-first-out approach. However, as message volumes increased over time, Jacaranda’s Technology team introduced AI to ensure high-priority cases received support first, and that no delays occur in supporting mothers in need. The system was trained on 190,000 annotated questions, processes over 200 different message categories, and responds to questions with an accuracy of 85%.

Incentivizing infant immunization uptake among Kenyan mothers: PROMPTS supports the uptake of infant vaccines by sending mothers reminders for immunisations by schedule and information about the type of vaccine (e.g. oral or injection) their baby should receive and when. As Sister Kimaru, a professional nurse, says, “Because they know the immunisation they are expecting, they ask for the right immunisation which makes it easier for us nurses. Mothers have more information. They are empowered.”

Empowering local governments to track and identify ‘red flags’ for infant immunization in the public health system: Beyond empowering mothers with information, PROMPTS also routinely nudges mothers to share feedback on immunization experiences and reasons for missed vaccinations. If a mother replies ‘no’ to the question, ‘Did you take your baby for the week 6 vaccination?’, the next question is ‘why?’.

The resulting data is aggregated into a series of real-time dashboards, PULSE, and shared routinely with Jacaranda’s network of 1,300+ facility and 22 government partners for better visibility into systemic barriers around immunization, such as hesitancy, stock-outs, or shortages of trained nurses to administer them. As Jacaranda’s Head of Quality Assurance Sarah Little says, “The benefit of PROMPTS is that it puts knowledge and





power into the mum’s hands in such a profound way, and then links their feedback with key decision-makers to help them address citizen-reported issues around infant immunization.”

Sometimes defaulting (when mothers don’t take their babies for vaccination) is linked to factors such as lack of transport. “We understand that mums have different barriers to vaccination and hope to bridge this gap,” explains Jacaranda’s Grace Kimenju. “Maybe they can’t reach or pay for transport to facilities, maybe they distrust the [healthcare] providers. PROMPTS tracks these responses and proactively shares information with county health managers”.

Jacaranda’s government partners are also able to use the dashboards and data from Jacaranda’s bi-annual surveys to identify ‘hotspots’ of under-immunized infants in each county, helping streamline limited resources and targeted health campaigns to areas or facilities where they are most needed.

**Top 10 Facilities by Average Immunization Score**

kepl\_vaccines

Facility	Rota2	Rota1	Penta3	Penta2	Penta1
	Average Score	Average Score	Average Score	Average Score	Average Score
Egerton Health Centre	100%			100%	
Ikona	100%			100%	
Isini/Kariakisi Dispensary	100%	100%	100%	100%	100%
Rambu Sub-County Hospital	100%		100%	100%	
Katagisi Dispensary	100%		100%	100%	
Kareta Dispensary	100%	100%	100%	100%	100%
Kavumbi Dispensary	100%	100%	100%	100%	100%
Kwara Dispensary					
KWU Health Centre	100%	100%	100%	100%	100%
Kithyula Health Centre	100%	100%	100%	100%	100%
Kisumu Health Centre		100%	100%		100%

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Egerton Health Centre					
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Rambu Sub-County Hospital	100%		100%	100%	
Katagisi Dispensary	100%		100%	100%	
Kareta Dispensary	100%	100%	100%	100%	100%
Kavumbi Dispensary	100%	100%	100%	100%	100%
Kwara Dispensary					
KWU Health Centre	100%	100%	100%	100%	100%
Kithyula Health Centre	100%	100%	100%	100%	100%
Kisumu Health Centre		100%	100%		100%



Figure: Examples of Jacaranda’s real-time dashboards cross-comparing client-reported immunization data by highest and lowest performing facilities, and overall scores by facilities.

# 4. Results

As of November 2023, there are over 1,300 Kenyan public health facilities in 22 Kenyan counties enrolling women in PROMPTS, and over 2.55 million mothers have used the service. The operating costs per mother are US\$0.74 for the whole time she is on the platform, and always free for the mother. Running costs for PROMPTS are covered through the county governments (an average of 15% cost share), or philanthropic contributions.

## 4a. IMPROVING HEALTHSEEKING FOR MOTHER AND BABY

PROMPTS has positively affected women's agency and increased health-seeking behaviour. According to a recent Randomized Control Trial:

- Women receiving messages from PROMPTS about danger signs are 3.51 times more likely to seek treatment if they experienced postpartum danger signs.
- Women receiving family planning messages are 1.85x more likely to take up family planning services vs. control and 2.1x more likely to choose a long-acting method.
- 90% of high-risk mothers flagged by PROMPTS get care at a hospital.;
- 20% more likely for PROMPTS users to attend 4+ prenatal care visits (vs. control)

Women who use PROMPTS trust the tool to provide information about how and when to seek health care. Women who were registered on PROMPTS completed the two postnatal care visits including immunisations more than women not on PROMPTS. Knowledge and behaviour changes show that PROMPTS develops improved agency to understand and demand quality care and also improves client-provider interactions. Women trust PROMPTS as a tool to provide information about how and when to seek care. This indicates that targeted messaging via a digital platform can lead to knowledge and behaviour change. Supported by these findings, Jacaranda is exploring the addition of new content to PROMPTS to address other clinical and contextual challenges faced by caregivers in these settings, using the same rigorous approach to user message testing.

## 4b. SUB-NATIONAL DATA USE: AMPLIFYING MOTHERS' VOICES TO INFORM MANAGEMENT

PROMPTS allows mothers to give feedback on the service they have received, giving voice to clients' experiences. Over 450,000 PROMPTS mothers have reported on their experience of care.

This feedback includes information on:

- **Stockouts:** Mothers can share when they experience stockouts of vaccination which is a barrier to timely complete child immunisation.
- **Respectful care:** Mothers are often asked to share their experiences related to privacy, disrespect, discrimination or other problems.
- **Uptake of key services:** Mothers are asked if their baby received vaccination on schedule, or if they attended antenatal or postnatal care.
- **Clinical quality:** Mothers are asked to share if any clinical steps (e.g. measuring blood pressure) or information (e.g. discussing a birth plan) were missed out during their last clinical care visit.

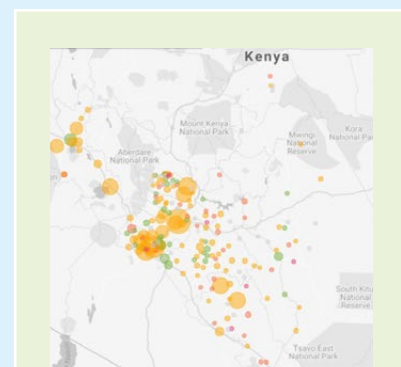
This information from mothers is provided to health system managers at the county, sub-county and facility levels. Through a process of human-centred design, real-time dashboards were developed which assist health managers in planning, service delivery, and monitoring.

One example is that reports of verbal abuse at a facility were resolved in a month by patient feedback being passed on to the facility manager in-charge. In another case, several mothers shared that they were feeling unsafe as the facility didn't have a fence. The facility's manager went to the sub-county office to get support from the county assembly and a fence was built.

Sister Loise Kimaru, the facility manager in-charge of Maragua District Hospital, Murang'a County, said that, "When they complain about a service, we try to resolve it; and when they send a compliment we are happy."

The information is collected in a dashboard, tracking county immunisation coverage, vaccines administered by type, and missed appointments by immunisation schedule (at birth, weeks 6, 10, 14, and months 6, 9, 12). This system allows health system administrators to collect feedback directly from their clients in a way that hasn't been possible before PROMPTS.

Jacaranda provides these dashboards to health facilities every month, and to sub-counties and counties quarterly. Many facilities now have regular meetings to review and discuss the updated dashboards and respond to the new information.



Jacaranda is able to track geographic hotspots of weak immunisation through the PROMPTS dashboards, showing where mothers report missing vaccinations. The circle sizes show the number of survey respondents and the colour indicates the number of basic vaccinations missed.

# 5. So what

The PROMPTS service now provides a valuable service that empowers pregnant women and mothers with information, responds to health-critical questions, and improves the linkage to care for maternal and child health, including immunisation.

Sister Caroline Macharia, the reproductive health coordinator of Murang'a County, believes that, "The PROMPTS programme is a game changer in improving maternal health. PROMPTS is the way to go, and it should be incorporated into any maternal health and immunisation support programme".

PROMPTS is currently active in approximately half the counties in Kenya. The service is primarily donor-funded with county government partners contributing about 15% of the costs. Jacaranda Health is ready to expand the implementation of PROMPTS to all 47 counties in Kenya, and it has started implementing PROMPTS in Eswatini and Ghana. The PROMPTS programme has been supported by USAID and the Clinton Health Access Initiative.

As well as the benefits for routine maternal and child care described here, PROMPTS also offers two major benefits for immunisation campaigns:

- Bi-directional communication with caregivers for babies to inform them of upcoming vaccinations, availability of vaccines, where to seek care, and how to respond to side-effects. Such messages have shown improvement in health-seeking behaviour.
- Data received from tens of thousands of mothers per district allows health managers to understand the caregiver's journey. This supports intelligent management to best use precious resources to conduct campaigns, field visits or re-training, and to improve the quality of service delivery to encourage greater immunisation coverage.



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## Acknowledgement

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