# Design and Usability Testing of a Mobile Phone-Based Patient Management System for Women in Rural Kenya

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## Overview

# Overview







# What we know...

Reducing maternal mortality is a major global health priority.

Most maternal deaths take place during a specific time period.

The burden of maternal mortality is greatest in poor and remote areas.

# What we know...

Most maternal deaths are avoidable.

Three delay model for maternal mortality:

1. Seeking care
2. Accessing care
3. Receiving care





# Mobile Phones and mHealth

- m-Pesa:
  - Mobile banking for everyone
- Magpi, OpenDataKit, Formhub:
  - Mobile data collection at the point of care
- Text message interventions
  - Patient education, health promotion
  - Provider training
- Interactive voice response (IVR)
  - Patient education
  - Emergency response

# Baby Monitor

- Targets pregnant women directly with IVR
- Women answer screening questions by pressing numbers on their keypads
- Pilot study in Nairobi showed that screenings were reliable compared to in-person assessments with nurses
- Second study conducted in parallel to this project: assess reliability and validity in a rural, remote population





# Research Objectives

- To understand the roles of CHVs, their responsibilities, needs, and environment
- To design a patient management system that addresses these characteristics
- To implement and evaluate the design solution based on feedback from the CHVs

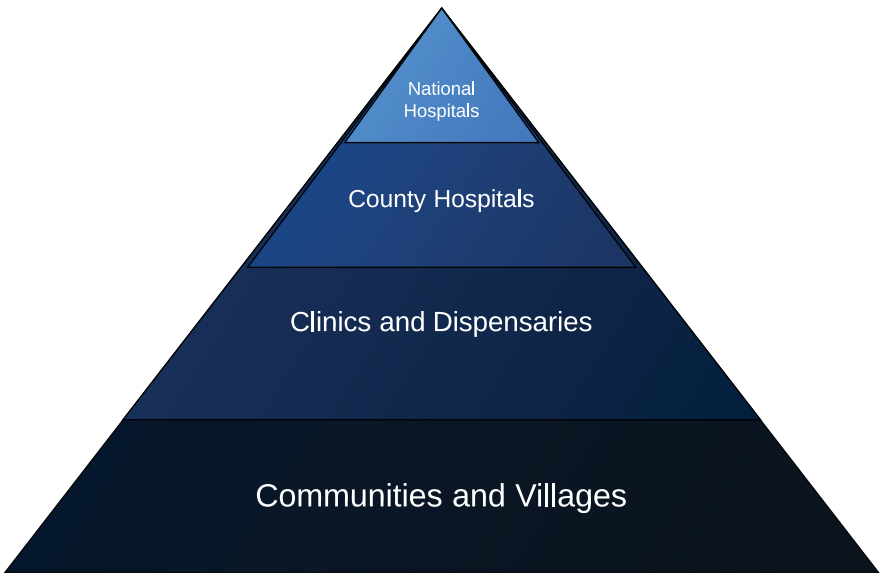
# Overview







# The Health System in Kenya



# Maternal Health Care in Kenya

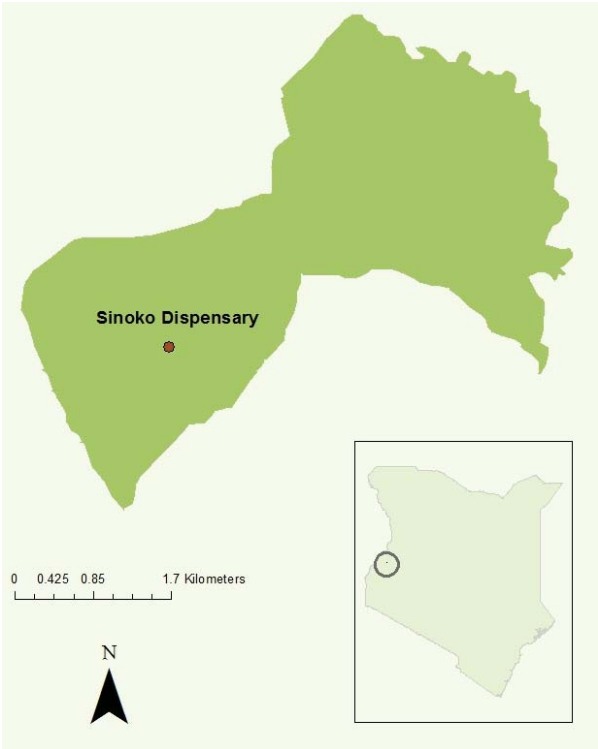
- Primary delivered at community level
- Free at all public health facilities as of June 1, 2013
- CHV responsibilities:
  - Pre- and post-natal home visits
  - Identify and monitor women throughout pregnancy
  - Family planning services
  - Maternal and child health services



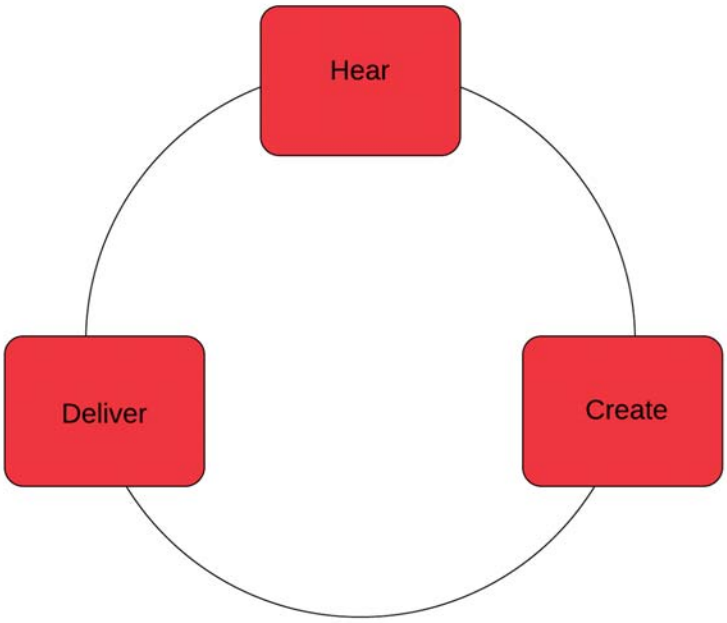


# Research Site

- Two community units
- Population: 10,744
- Clinic equipped for deliveries
- 55 CHVs
  - 195 individuals
  - 36 households



# Human-Centered Design








# Hear Phase

## Objective: to understand the users, their responsibilities, needs, and environment.

How does the current system of community-based maternal and child health care work?

- CHV focus group discussion
- CHV shadow days
- Clinic nurse focus group discussion

# Create Phase

## Objective: to develop a design solution based on what we've ''heard''.

How can voice and text interfaces be integrated to address the users' stated needs and specifications?

- Verboice
- VoIP, Asterisk, telecommunications company
- SMS gateway provider
- Analysis engine in R
- CHV mock testing





# Deliver Phase

## Objective: to implement and evaluate the design solution.

How well did the design solution address the users' stated needs and specifications?

- Usage: call data from July 2013 - March 2014
- Usability: evaluation survey administered through an automated Verboice call

# Overview







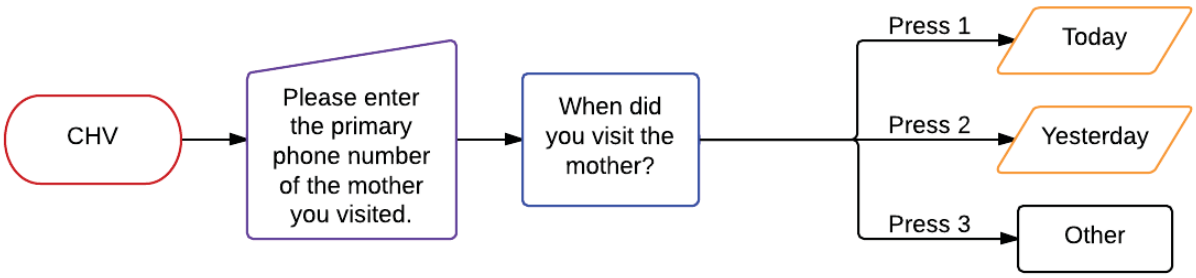
# Reporting Data

- CHVs submit reports every two weeks to the clinic
- Approximately 5-6 months to visit each household in each village
- Home visit information is hand-written, paper based
- Collecting data on number of deliveries in the community is a key component of reports
- Nurses rarely used CHV reports; presents challenges for preparing for prenatal, postnatal care at the clinic

# Reporting Data

## Design Principle: Reporting home visits through IVR

- CHV ''flashes'' the Baby Monitor number, receives free call back
- Identify themselves as CHVs with their national ID number






Introduction Methods Results Discussion

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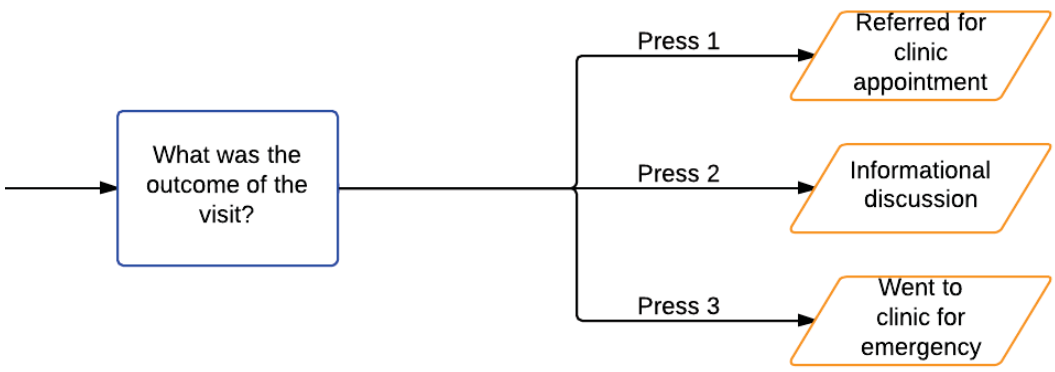


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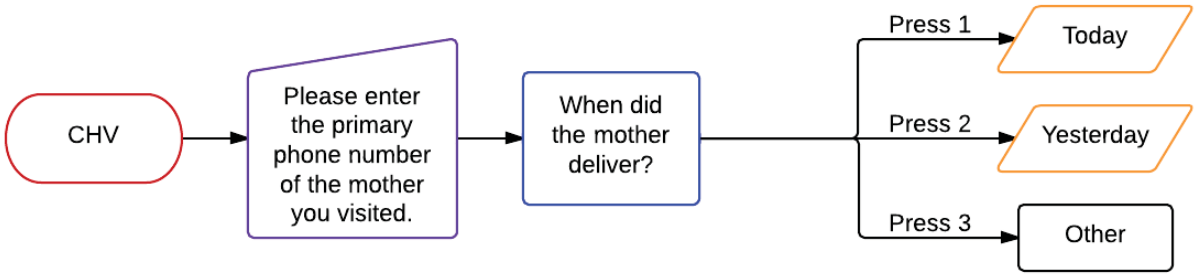




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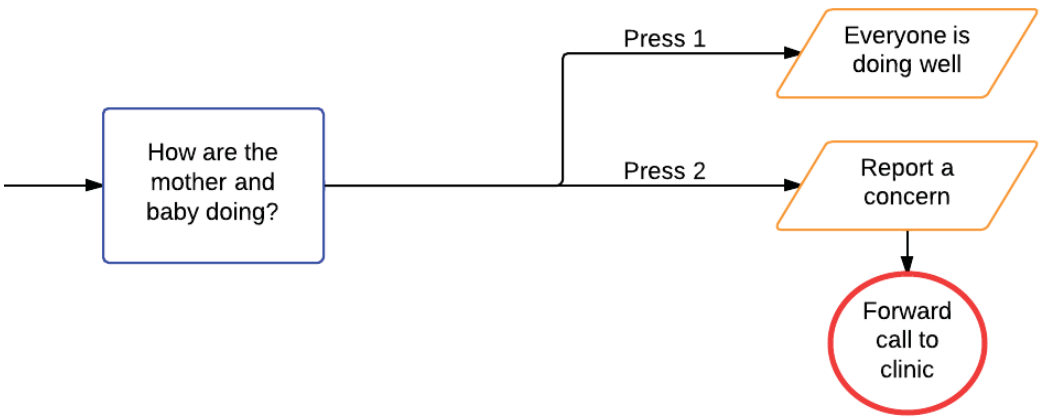


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# Patient Referral

- CHVs carry ''referral books'' with sheets given to patients to take to clinic
- Nurses estimated that 50 patients per week referred by CHVs
- CHVs have no way of knowing whether patients followed up on their referrals
- CHVs have no way of hearing about deliveries if not contacted directly





# Patient Referral

## Design Principle: Referral notifications through text message

- Visits from enrolled pregnant women logged by clinic nurses, data entered into Baby Monitor database
- R analysis script matched each woman who visited the clinic to the CHV assigned to her village of residence
- Automated text messages sent the following morning

*Hi. Betty Odong visited the clinic yesterday! This was her ANC 2 month visit. Please encourage her to continue attending appointments.*

# Patient Referral

## Design Principle: Delivery notifications through text message

- Family member ''flashes'' Baby Monitor number, receives free call back
- Identical to CHV reporting call flow
- R analysis script matches the woman reported to the CHV assigned to her village
- Automated text messages sent the following morning

*Hi. Betty Odong delivered her baby on 08-04-2014!*





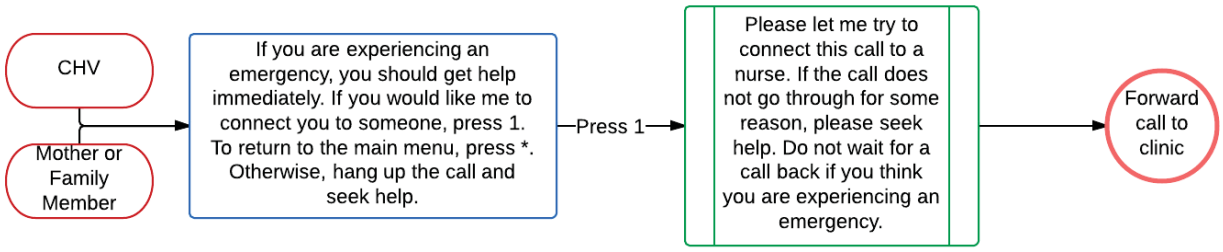
# Emergency Response

- CHVs are usually called during an emergency
- Recommend that the patient go to the clinic for immediate care
- Often, the clinic was unprepared to handle an emergency case
- Little to no direct communication between CHVs and clinic nurses about incoming emergencies

# Emergency Response

## Design Principle: Reporting emergencies through IVR

- CHV, mother, or family member ''flashes'' the Baby Monitor number, receives free call back
- Indicate that they would like to report an emergency



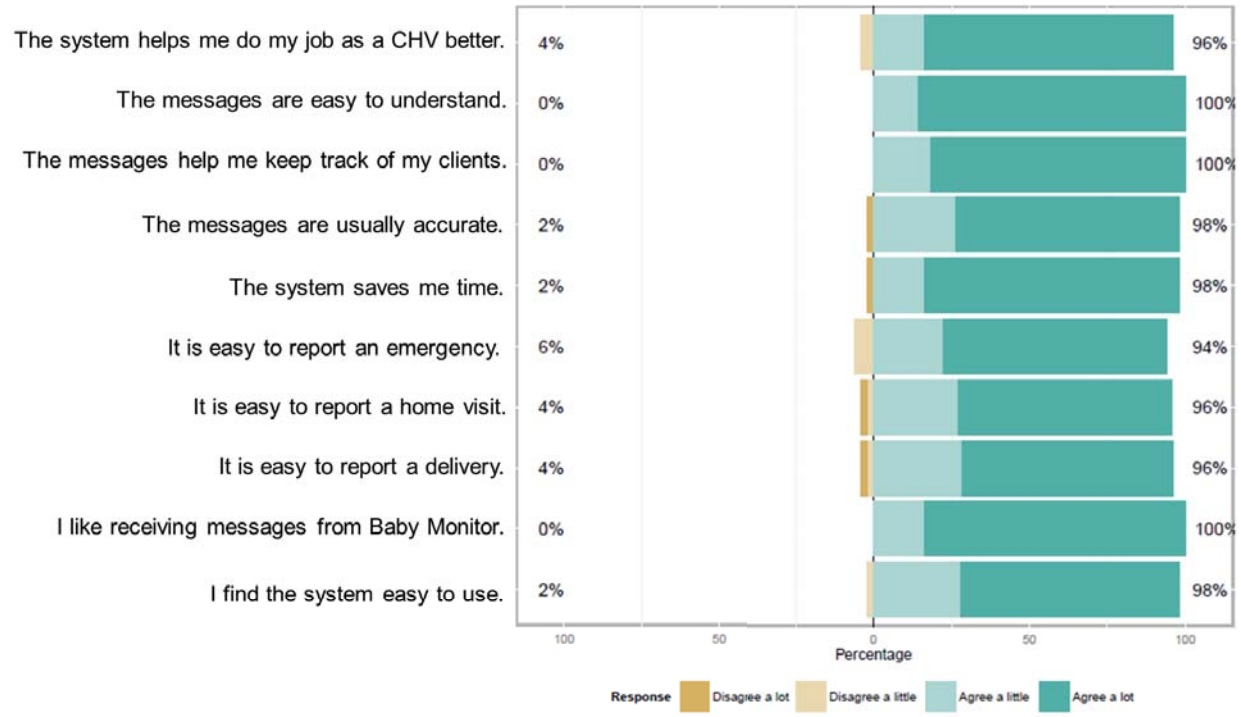





# Call Volume

- 1,312 total calls registered from CHVs
- 401 valid calls registered from CHVs
- Call volume fluctuated over the eight month period
- CHVs reported 95 home visits and 71 deliveries during this period

# Usability Results








# Overview

# Lessons Learned

- Oral translation of messages
- Quality of voice messages
- Mobile network variability





# Limitations

- Pilot study: small convenience sample
- Time constraints: one single iteration of HCD cycle

# Future Research

- Impact on process outcomes: home visits, clinic visits for prenatal and postnatal care, deliveries
- Integration of screening service: decision-making support for CHVs
- Additional features suggested by focus group participants: reminders for upcoming events
- Considerations for scaling up:
  - Long-term cost of IVR
  - Patient enrollment strategies
  - CHV engagement strategies