M4D: Connecting and Engaging with End Users

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CSCI 497G/597G: Information and Communication Technologies for Development
Western Washington University
About Me

- 4th year UW grad student
- Spent 4 years teaching math and science in the Peace corps (South Africa & Liberia)
- Work on SMS projects in the Sub-Saharan Africa
Convergence of Two Global Themes
Global Focus On Maternal Health

Under 5 Child Mortality Rate

per 1000 Live Births


World

databank.worldbank.org
Kenya Neonatal Mortality Rate

Neonatal mortality rate has remained stagnant.

- Under Five: 99 in 1990, 71 in 2013
- One Month: 33 in 1990, 26 in 2013

Source: databank.worldbank.org
Known Interventions Have Great Impact

- Antenatal clinic visit
- Facility delivery
- Postnatal follow up
- Vaccination
- Contraception decision support

Engagement with health system is critical
Maternal Health in Kenya

- 61% delivery in a health facility
- 51% postnatal checkup within two days.
- 53% given information about breastfeeding.
Dramatic adoption of mobile phones

Mobile Subscriptions per 100 People

- **Kenya**

Year: 1990 - 2013

- Mobile subscriptions increased significantly from 0 in 1990 to 77 per 100 people in 2013.
Effects of a mobile phone short message service on antiretroviral treatment adherence in Kenya (WelTel Kenya): a randomised trial

Dr Richard T Lester MD a b c, Paul Ritvo PhD d, Edward J Mills PhD e, Antony Kariri BSc a, Sarah Karanja BSc a, Michael H Chung MD f, William Jack DPhil g, James Habyarimana PhD h, Mohsen Sadatsafavi MD i, Mehdi Najafzadeh MSc j, Carlo A Marra PharmD l, Benson Estambale MBChB l, Elizabeth Ngugi PhD a, T Blake Ball PhD b, Lehana Thabane PhD k, Lawrence J Gelmon MD a b, Joshua Kimani MBChB a b, Marta Ackers MD l, Prof Francis A Plummer MD b m

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Prior Work: Two Way Messaging

WelTel Kenya1: **Effects of a mobile phone short message service on antiretroviral treatment adherence in Kenya.** *Lester et al. The Lancet (2010)*

Simple Two-Way SMS Intervention

- Mambo (Hello)
- Sawa (fine)
- Shida (bad)
Research Questions

- Can two-way SMS be personalized?
- Can automated two-way SMS engage pregnant women with the health system?
  - Will they respond?
  - What type of replies are sent?
- Can an automated two-way SMS system adapt to individual events and context?
How To Design For Engagement

470 preprogramed messages
• 20 weeks prenatal, 10 weeks postpartum

Prenatal Week 27

[Name], this is [Nurse] from clinic. Iron helps carry nutrition to your baby. If it is low, you feel tired. Are you taking iron or do you need tablets?

Postpartum Week 8

[Name] this is [Nurse] from clinic. Are you having trouble breastfeeding? Giving the baby other fluids can cause illness and weakness. Please continue to only give breast milk to your baby for at least six months. How long do you plan to breastfeed?
470 preprogrammed messages
- 20 weeks prenatal, 10 weeks postpartum
- English and Swahili

**Week 25 ANC Message: English and Swahili**

<Name>, this is Kerubo from Mathare clinic. If you have bleeding during this time in pregnancy go to the clinic right away. Have you had any bleeding?

<Name>, mimi ni Kerubo kutoka kliniki ya Mathare. Kama wewe utatokwa na damu wakati huu wa mimba nenda kliniki haraka. Je umeshawahi kutokwa na damu?
Building a Hybrid SMS System

Individual Context
- Language
- Preferred send time
- Expected Due Date
- Next scheduled visit
[Name], this is [Nurse] from clinic. Iron helps carry nutrition to your baby. If it is low, you feel tired. Are you taking iron or do you need tablets?
TO: RAEI (#202)

Send message

0/144 characters, 0 messages

Message History

Study Nurse: March 9, 2014, 5:25 p.m.
Hi Rael, did she confirm from a doctor that the pain in the leg was due to the implant.

Rael Nyansiyioka: March 6, 2014, 5:47 p.m.
I've heard about it. My best friend was using one for 5 yrs. It was effective, but the problem started on her 3rd yr one leg was hurting she couldn't walk until she was forced to remove it & she recovered within a short time

System: March 6, 2014, 1 p.m.
Have you heard about the Implant? Do you know anyone who has used it?

System: March 6, 2014, 1 p.m.
Rael this is Karuru from Mathare.
Deployment

- 100 women registered at ANC visit.
- Eligibility Criteria:
  - Daily access to mobile phone.
  - Read/Write English or Swahili
- Only visited study nurse for non-medical study follow up.
Location and Context: Mathare North Health Center
Target Demographic: Young, poor and uneducated

Average Age: 24 years

First Time Mothers: 54%

Average Household Income: $69/mo (USD)

Education Level:
- Completed Primary: 68%
- Completed Secondary: 12%

Technology Use:
- Use SMS Regularly: 35%
- Used Internet: 7%
- Basic phone: 45%
How was the system used?

Between Aug 2013 and Aug 2014

- 3661 System Messages
- 944 Participant Messages
- 423 Nurse Messages (only one nurse)

On average each participant sent 2 messages per month.
82 participants sent at least one message.
When do women respond?
When do women respond?

Number of Weeks From Delivery

Total Messages Received

40%
When do women respond?

Women use the system at the most critical time of their pregnancy.
How fast do women respond?

- 75% respond within 0 days.
- 11% respond within 1 day.
- Few respond within 2 to 7 days.
- Some respond after 7 days.

Number of Messages vs. Days Between Prompt and Response
How fast do women respond?

- 75% respond within the first hour.
- 11% respond within the first day.

Days Between Prompt and Response:

0 | 1 | 2 | 3 | 4 | 5 | 6 | >7

Number of Messages:

- First Hour
- 11%
- 75%
How fast do women respond?

50% of all responses received within 1 hour of sent message. High level of engagement!
What do women say?
Nyambu this is Kerubo from Mathare clinic. Regular, strong stomach pains are a sign of labor. If you feel strong tightening of your belly, leaking of fluid or any bleeding go to the clinic. Have you had any labor pains? How often do you feel them? Are you worried?
Nyambu this is Kerubo from Mathare clinic. Regular, strong stomach pains are a sign of labor. If you feel strong tightening of your belly, leaking of fluid or any bleeding go to the clinic. *Have you had any labor pains? How often do you feel them? Are you worried?*

**Response: Nov. 21 1:44pm**

Hi, am not as such worried, but i have a little fear. I have never had any labor pains.
Hi, madam [nurse], kindly will u state for me items that are needed when i will attend clinic during labor pains e.g clothing for the baby, basin, .and what els......

Response from Nyambu: Nov. 21 1:44pm

Hi, am not as such worried, but i have a little fear. I have never had any labor pains.

Nov. 21 1:54pm

Hi, madam [nurse], Have you had any labor pains? How often do you feel them? Are you worried?
Hi, am not as such worried, but i have a little fear. i have never had any labor pains.

Nov. 21 1:54pm

Hi, madam [Nurse], kindly will u state for me items that are needed when i will attend clinic during labor pains e.g clothing for the baby, basin, and what els......

Response from Study Nurse: Nov. 22 4:26pm

Hi [Name], you need baby clothes, shawl, leso, basin, spirit, cotton wool. that is mainly it. the rest you can inquire from the nurses when you reach the hospital.
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You need baby clothes, shawl, leso, basin, spirit, cotton wool. That is mainly it. The rest you can inquire from the nurses when you reach the hospital.

Response from Study Nurse: Nov. 22 4:26pm

Hi [Name],

You need baby clothes, shawl, leso, basin, spirit, cotton wool. That is mainly it. The rest you can inquire from the nurses when you reach the hospital.

Nov. 22 4:42pm

Hi [nurse],

Thanks for your information. Your messages are really encouraging.
my headache is very pain and kizuguzugu
the 1st thing i would like 2 say hi 2 u hpng dat ur fine. my qstn is dat when ivisted clnc last mnth itryd 2 expose my complication 2 the dctor dat the lab told 2 hav some medicine coz of infctn bt they gav out 2 me some amoxil capsols 4 me 2 use 2 x 3 pa day bt whn i used them 4 the 1st 4 day i was flng stomach strng pain den i just chsn my self 2 surrender tkng thm did i wrng or icld cntnu usng them bcz its how they use 2 cure
the 1st thing i would like 2 say hi 2 u hpng dat ur fine. **my qstn is dat when ivisted clnc** last mnth itryd 2 expose my complication 2 the dctr dat the lab told 2 hav some medicine coz of infctn bt they gav out 2 me some amoxil capsols 4 me 2 use 2x3 pa day bt whn i used them 4 the 1st 4 da y i was flng stomach strng pain den i just chsn my self 2 surrender tkng thm did i wrng or i cld cntnu usng them bcz its how they use 2 cure you should have used them for 5 days. **amoxil are antibiotics which help when you have infection.** you should have another urine test and if the infection is still there you will have to take the whole dose for 5 days.
the 1st thing i would like 2 say hi 2 u hpng dat ur fine. my qstn is dat when ivisted clnc last mnth itryd 2 expose my complication 2 the dctr dat the lab told 2 hav some medicine coz of infctn bt they gav out 2 me some amoxil capsols 4 me 2 use 2 x 3 pa day bt whn i used them 4 the 1st 4 da y i was flng stomach strng pain den i just chsn my self 2 surender tkng thm did i wrng or i cld cntnu usng them bcz its how they use 2 cure. you should have used them for 5 days. amoxil are antibiotics which help when you have infection. you should have another urine test and if the infection is still there you will have to take the whole dose for 5 days.

Important to keep a human in the loop
Participant Questions

I haven't started any family planning I want to try coil. I was advised by a friend to try herbal tablet one per month not yet used kindly advice me this am confused pls.
Participant Questions

I haven't started any family planning. I want to try coil. I was advised by a friend to try herbal tablet one per month, not yet used. Kindly advice me this. I'm confused, please.

Hi [Name], I don't have a lot of information about the herbal family planning method, but like any other family planning, it is not 100% effective. I can teach you about the coil. An IUD is a small, T-shaped plastic device that is wrapped in copper or contains hormones. The IUD is inserted into your uterus by your doctor.
Lessons Learned

The difficulty of keeping the systems state up to date.
Nurse Response Time

Number of Messages

Days Between Prompt and Response

0 days: 48%
1 day: 21%
2 days: 14%
3 days: 5%
4 days: 3%
5 days: 2%
6 days: 1%
>7 days: 1%
You have 2 new messages

You have 2 new visits to view

You have 4 new calls to make

You have 2 translations to do
Privacy in mHealth

Connecting pregnant women to medical professionals through SMS.

Mother's responded with sensitive medical information

- Domestic violence and abuse
- Personal medical issues
- HIV and other STD's
Connecting pregnant women to medical professionals through SMS.

How can we provide privacy for mHealth programs?

- Domestic violence and abuse
- Personal medical issues
- HIV and other STD's
USSD is used by large companies

- Mobile Operators
  - Manage Pre-paid accounts
  - Share airtime and data
- Banks
  - By airtime
  - Transfer money
  - Pay bills
- Other services
  - Google
  - Facebook
Why small projects use SMS and IVR

USSD has required working directly with mobile operators. This means it is only feasible at scale and for large commercial projects.

“It took me nine months to negotiate with Safaricom for a USSD code”

- Samuel Gikandi
  CEO Africa's Talking
Third party gateways are doing the work to partner with operators and providing more open APIs.
Video Example running on Africa's Talking

Convert KSH to USD
Code can be dialed directly without accessing menus.
Simple USSD Test
1. Guess A Number
2. Convert KSH
3. Random Swahili Words
4. My Phone
USSD is a relative unexplored universal application expanding the design space across multiple domains.

Multiple third party service providers are offering USSD accesses making it reasonable for small projects to explore.

We have built a USSD library making it easy to do rapid development basic applications and are looking for opportunities for future deployments.
Questions and Comments

- Mathare North Health Center
- University of Washington
  - Richard Anderson
  - Brian DeRenzi
  - Jennifer Unger
  - Grace-John Stewart
- University of Nairobi/Kenyatta National Hospital
  - Dyphna Magaka
  - John Kinuthia
  - Daniel Matemo