Strategies to Increase Antenatal and Postnatal Care in Eastern Uganda

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ABSTRACT

Neonatal and maternal mortality remains high in Uganda due to birth asphyxia, prematurity, sepsis, and other complications that arise during pregnancy, childbirth, and postpartum. A lack of knowledge about and practice of crucial health interventions during the prenatal and postnatal period contributes to the very high neonatal and maternal mortality rates the country faces. In Uganda, 53% of women do not receive 4 or greater antenatal visits - much lower than the World Health Organization recommendation of 8 ANC visits and only 11% of women who give birth at home receive postnatal care within 2 days of delivery [1][2]. This is largely due to a clinical pathway gap where mothers lack the knowledge of important danger signs during pregnancy and childbirth and do not have access to health infrastructure that can provide that information. Thus, there is a need for a solution that can increase access to health information and increase the awareness surrounding the importance antenatal care (ANC) and postnatal care (PNC) in Uganda. By implementing this, we hope that maternal and neonatal health outcomes can improve.

INTRODUCTION

Neonatal mortality in Uganda remains unacceptably high and has stagnated over the last decade, at up to 27 out of 1,000 live births. [1]. Maternal mortality in Uganda also remains high, at 375 deaths out of 100,000 births [3]. Uganda is also at risk of missing The UN Sustainable Development Goal for reducing both neonatal and maternal mortality to t least 12 deaths per 1,000 live births and 70 deaths per 100,000 live births, respectively, by 2030 [2]. Major causes of neonatal death include birth asphyxia, prematurity, and sepsis [6] while major causes of maternal mortality include hemorrhage, infection/sepsis, eclampsia/high blood pressure, unsafe abortion, and obstructed and/or prolonged labor [8].

Addressing these causes can significantly decrease dangers to mothers and newborns in Uganda. It is often possible to predict and prevent neonatal and maternal death when key danger signs are addressed. The most important danger signs for the condition of the newborn include difficulty feeding, movement only when stimulated, low temperature (35.5℃ or below), high temperature (37.5℃ or above), respiratory rate over 60 breaths per minute, severe chest indrawing, and convulsions [7]. For the mothers, adequate care prior to labor, especially adequate antenatal care (ANC) coverage is crucial to maternal and fetal health. The World Health Organization recommends 8 ANC visits for all women, in order to detect problems during pregnancy. However, in Uganda 53% of women do not receive 4 or greater antenatal visits. That number is likely much higher in rural and poor communities [11]. Furthermore, many strategies can be implemented during pregnancy and the postpartum period, such as the identification of danger signs such as severe vaginal bleeding, swollen hands or face, and blurred vision during the pregnancy and severe vaginal bleeding, foul-smelling vaginal discharge, and high fever postpartum. Identification of these danger signs can save mothers' lives if they are addressed by knowledgeable medical professionals [9][10].

In Uganda, there is a significant association between low ANC attendance (4 or less visits) and increased likelihood of neonatal death [4]. Low ANC coverage results in problems that translate from a mother to her fetus. Infections in mothers can result in neonatal infections, anaemia can result in children that are small for their gestational age, pre-eclampsia or eclampsia can result in low birth weight, diabetes can result in preterm birth, problems in delivery can lead to congenital anomalies, excessing weight gain can lead to a large baby, and intimate partner violence can lead to fetal or neonatal mortality. Most problems can be prevented or anticipated with antenatal care [12] [13]. Prevention techniques include tetanus toxoid immunization, syphilis screening, pre-eclampsia and eclampsia prevention through vitamin supplementation, intermittent treatment for malaria, detection and treatment of infection, etc [14]. Thus, it is essential to identify methods to educate Ugandan mothers about the importance of ANC and PNC care in improving health outcomes.

OBJECTIVES

The goal of this study is to translate research findings into evidence based practices resulting in a clinical service delivery intervention which simultaneously increases patient engagement and reduces the likelihood of neonatal death.

- **Our first objective** is to design a novel phone based, SMS digital mhealth tool that functions to inform mothers of maternal and neonatal health care directives, thereby increasing mothers knowledge and participation of crucial prenatal and postnatal healthcare.
- **Our second objective** is to develop and validate a clinical decision support workflow to be deployed within in the SMS digital mhealth tool.

METHODS

A **literature search** was performed to identify and evaluate maternal and neonatal health interventions. The interventions were ranked based on the quality of their clinical outcomes. The engineering design features of these clinical interventions were used to **define the solution criteria** for mothers in Eastern Uganda. Research team **ideation** sessions were used to identify how we might use characteristics of the various design features for our own solution. Finally, we **prototyped** solution to be implemented during the antenatal and postnatal period.

Our prototype is a voice broadcasting system that conveys health information related to prenatal and antenatal care to mothers during their pregnancy through a handheld mobile phone. The voice broadcasting system delivers pre-recorded voice messages directly to the mother phone thereby ensuring the mother has the vital information needed to help handle complications during pregnancy or guide her to reach the nearest health facility. The system will send pre-recorded messages timed to a woman's stages of pregnancy and the postnatal period. The system will inform mothers about prenatal and postnatal care, birth preparedness, mother- to- child transmission of HIV, breast feeding, immunization, nutrition, family planning, common pregnancy complications and danger signs, common diseases of infants, and information about the nearest healthcare facilities. This information will empower Ugandan mothers, by serving to reduce maternal and neonatal deaths (Fig 1.). We propose this solution due to the high permeation of mobile technology in Uganda, with 25 million Ugandans owning a mobile phone. Rural areas are growing exceptionally fast in mobile phone usage.

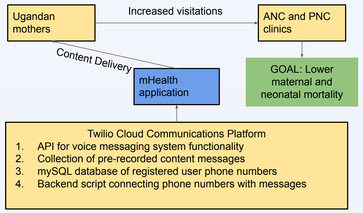

Fig 1. Workflow for mHealth solution

Our solution, with its informative and comprehensive messages timed to stages of pregnancy will help mitigate the problem of lacking maternal health education within rural communities, and prevent avoidable maternal and neonatal death by increasing awareness.

Furthermore, we have a detailed plan for implementing a testing design. The first phase involves message construction. A first round of messages will be curated based on literature search of maternal and public health information. Second, consultation with medical professionals will refine content to highlight important and actionable information. Lastly, we will run an observational pilot study to survey Ugandan women to see if they confirm that hearing the messages would cause a change in behavioral outcome, namely intent to seek ANC and PNC services.

RESULTS

Based on our literature search, we found our must-have criteria to include: high number of mothers reached, high direct health benefit of our solution, feasibility in the current landscape, sustainability, accessibility of the solution in rural areas, and safety. Nice to haves included cost-effectiveness, lower burden on physicians, less educational barriers to the solution, having a lower-tech solution, decreasing time and cost of implementation, decreasing the cost of the solution to the mother, convenience for use for the mother, lower labor to implement, and less materials required.

Additionally, we developed 4 solutions that would increase accessibility to ANC and PNC: (1) a boda boda system to transport mothers to health facilities for ANC and PNC (2) descriptive picture-based pamphlets distributed within communities to educate mothers on ANC and PNC (3) a mobile phone based voice broadcasting system informing mothers about the importance of ANC and PNC, and (4) Bringing prenatal vitamins provided during ANC to mothers such as iron and folic acid supplements that work to prevent life-threatening conditions. We evaluated the percentage of must-haves and nice-to-haves satisfied by each solution (Fig. 2).

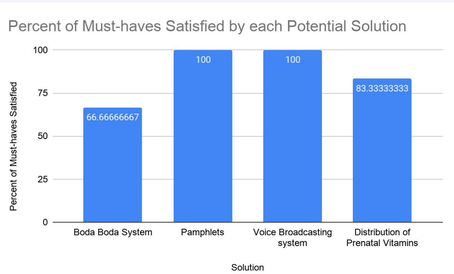

Figure 1. This figure reveals the percentage of Must-have criteria satisfied by our potential solutions

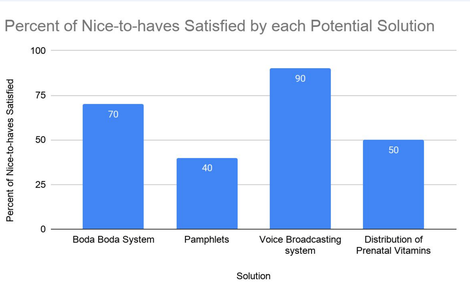

Figure 2. This figure reveals the percentage of Nice-to-have criteria satisfied by our potential solutions

DISCUSSION

We have developed a minimal viable product of a voice broadcasting and messaging system that conveys health information and spreads awareness of prenatal and antenatal care to mothers during their pregnancy through a handheld mobile phone. When mothers are registered, the system determines what health information she needs based on the stage of her pregnancy or her child's infancy. Then, the system uses voice broadcasting to deliver 60-second voice messages twice a week throughout her pregnancy and for 1 year following the birth of her child. Through this system, mothers are made aware of relevant resources and precautions. As more mothers are registered in this system, awareness is increased about maternal and neonatal health, decreasing mortality rates.

CONCLUSION

Through the evaluation of current solutions in place to tackle maternal and neonatal mortality in Uganda and around the world, major opportunities for intervention during the prenatal and postnatal period for mothers in rural Uganda were identified. After defining design criteria for solutions, it was concluded that pre-recorded voice messages containing maternal health information delivered to mothers via mobile phone would help deliveer crucial information to mothers about ANC and PNC without placing heavy burdens on health care providers. Messaging would fall under many important categories, such as maternal and neonatal danger signs, information on the nearest health facility, the importance of ANC and PNC, healthy practices prior to and after delivery, maternal mental health, etc. This solution would serve to improve health literacy and increase a mother's community of support during these crucial periods. As our next step, we plan to develop the content for our solution through clinical research, and design and implement a pilot study that delivers a minimum viable product for our solution to mothers in Uganda.

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ACKNOWLEDGEMENT & CONTACT

This study was supported by the Johns Hopkins University Office of Study Abroad. We kindly acknowledge the tireless efforts and intellectual support we received Lori Citti Ph.D. and Jenny Sax from JHU Office of Study Abroad. Communications should be directed to Samhita Vasu svasu2@jhu.edu