International Journal of Gynecology and Obstetrics 113 (2011) 148–151

Contents lists available at ScienceDirect

International Journal of Gynecology and Obstetrics

journal homepage: www.elsevier.com/locate/ijgo

CLINICAL ARTICLE

Using cell phones to collect postpartum hemorrhage outcome data in rural Ghana

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ARTICLE INFO

Article history:
Received 28 June 2010
Received in revised form 22 November 2010
Accepted 27 January 2011

Keywords:
Cell phones
Field research
Health services networks
Information and communication technologies
M-health
Rural health

ABSTRACT

Objective: To evaluate the use of cell phones by professional and traditional birth attendants in rural Africa for reporting postpartum hemorrhage (PPH) data. *Methods:* Ten birth attendants from the remote Sene District of Ghana participated in the study. Subjects were trained to send Short Message Service text messages from cell phones using a simple numeric protocol to report data regarding PPH: maternal age; PPH; use of bimanual uterine compression; maternal and neonatal mortality; and prenatal care. Participants sent texts to a pre-programmed number to report data for all births they attended over a 90-day period. *Results:* In total, 425 births and 13 (3.1%) cases of PPH were reported during the 90-day period after training. All attendants followed the reporting protocol correctly, although with uncertain data integrity. *Conclusion:* The results indicate that it is possible to train professional and traditional birth attendants to use cell phones to report health-related outcome data via a specified protocol. Reporting from rural-based providers may present a more accurate picture of what occurs in remote communities because it happens in real time. These findings could be exportable to other program evaluation or population-monitoring applications (healthcare and other) where rural outcome tracking is necessary.

1. Introduction

Collecting outcome data from rural communities is an enormous global health challenge, especially in communities in which there are low levels of literacy, limited access to care, and poor infrastructure. Consequently, it is difficult to assess the healthcare needs of such communities and the impact of health services interventions. The expansion of mobile technology worldwide has the potential to mitigate these challenges—especially in low-income countries, where the lack of adequate Internet connectivity can limit access to resources and real-time communication [1]. The adoption of information and communication technologies in the health services sector has led to the creation of telemedicine and decision support systems to facilitate clinical decision making—including mobile health (M-health), which relies on wireless devices such as cell phones in medical and public health practice [2,3]. M-health applications include remote diagnosis, treatment, and support services; generating and accessing longitudinal health data; remote compliance monitoring (e.g. medication adherence); surveillance of disease outbreaks; and mass dissemination of public health information [2]. In particular, text messages and images sent via Short Message Service (SMS) technology for diagnostic and monitoring purposes support the collection of longitudinal data regarding the course of illness through time trajectories associated with symptoms, improve communication between providers and patients, and increase patient compliance with treatment [1,4–13]. For example, a cell phone-supported and structured SMS messaging protocol positively contributed to treatment adherence and associated patient outcome in a population receiving antiretroviral therapy [9]. However, although cell phones have been used by some professional healthcare workers for these types of application, their use is not widespread; furthermore, usage by local non-professionals for collecting health-related information from rural communities has not been evaluated.

The aim of the present pilot study was to evaluate the use of cell phones by professional and traditional birth attendants (TBAs) for reporting postpartum hemorrhage (PPH) data (occurrence, management, and outcomes) from their communities.

2. Materials and methods

Ten birth attendants from the remote Sene District in Ghana participated in the study, which began on December 27, 2009. Two were professional nurse midwives employed by the Ghana Health Service; they were both asked to select 4 TBAs to participate in the study. All participants provided informed consent, in compliance with Institutional Review Board requirements, using verbal rendition in their native Akan language (Twi) via a bilingual proctor. Those who were unable to sign their name consented using a thumbprint.

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0020-7292/$ – see front matter
doi:10.1016/j.ijgo.2010.11.020

All birth attendants participated in a 2-day seminar designed to teach how to recognize PPH, perform bimanual uterine compression to manage bleeding, and report patient-related data using a cell phone. The TBAs had not received training in the recognition and management of PPH before the seminar and they had not used a cell phone, although they were familiar with the technology.

Global System for Mobile Communication (GSM) is the standard for cell phone systems worldwide, so basic GSM handsets were selected for their capability to send SMS text messages to a pre-programmed number. A reporting protocol was developed to include: a pre-assigned ID number; the age of the maternal patient; the patient's PPH status; whether bimanual uterine compression was applied; maternal death outcome; neonatal death outcome; whether prenatal care had been received; and the number of prenatal care visits (Table 1). Maternal age and the number of prenatal care visits were reported as discrete numbers (e.g. a maternal age of 23; 4 prenatal care visits). All other data were reported as "1" for "yes," "0" for "no," or "#" for "unknown." Messages were sent to a cell phone controlled by one of the authors (PA), then transferred to a database for archiving and analysis.

Training on how to use the cell phones and on text-messaging protocol took place in 2 2-hour sessions on consecutive days. The first day involved training on how to use the cell phone—using pictographic instructions (Fig. 1) and interactive exercises—which was conducted in small groups (3–6 participants) and facilitated by a bilingual (English and Twi) proctor. The birth attendants practiced sending messages to the targeted phone and obtained immediate feedback when their messages were received. The participants continued working in small groups until they could all send a text message to the receiver phone. All participants were provided with the pictographic instructions and given homework assignments for sending texts during the evening between the training days to reinforce what had been learned during the session.

The second day of training included details of the data collection protocol. Again, small groups were used, with bilingual proctors to facilitate instruction (Fig. 2). When all of the birth attendants could demonstrate the use of the protocol for a single-patient scenario, they practiced sending messages for different patient scenarios with varying contextual factors and outcomes. They were able to receive immediate feedback on their performance and make real-time corrections. When all of the participants could successfully send messages that accurately represented any patient scenario provided to them, they were provided with cell phones and phone cards to report data about their patients. The participants were asked to use the protocol to report all births they attended for 90 days following the training.

3. Results

The birth attendants ranged in age from 23 to 68 years. The self-reported average number of births managed per week was 1.75 for the TBAs and 10 for the professionals. The TBAs had a low literacy level, ranging from illiterate to able to recognize and write some words and numbers. None of the TBAs was fluent in English. Nine (90.0%) of the 10 birth attendants sent texts during the 90 days following the training, with the non-respondent birth attendant reporting that she had stopped attending births during the reporting period because of urgent family matters. Data reported over the 90-day period are summarized in Table 2 and indicate that both professional birth attendants and TBAs were able to use the specified reporting and text-messaging protocols to report clinical outcomes from their rural communities. In total, 425 births were reported during the study period, with PPH occurring in 13 (3.1%) cases.

4. Discussion

Cell phones have significantly improved communication in resource-limited settings and are transforming African society, especially where they constitute a powerful tool for health-related purposes [2]. The results of the present study indicate that it is possible to train community-based healthcare providers with low levels of literacy to use cell phones to report health-related outcome data via a specified protocol. The fact that the study involved rural-based providers reporting in real time means that it may present a more accurate picture of what happens in remote communities; however, any self-reported data are subject to under- or over-reporting. The present data reflect an incidence of PPH below that reported in the literature [14]. Although the reported outcomes may be accurate and reflect the proximity of the targeted communities to the Sene District Medical Center, they may also reflect underreporting biases of birth attendants who may have omitted reports of patients when outcomes were less favorable. Future studies should include secondary monitoring to ensure data accuracy, which could be facilitated through the development of a team approach to building M-health networks between all levels of providers treating patients in rural communities—all of whom would contribute cross-verifiable data.

Cell phones provide a direct and individualized medium for integrating social groups and sustaining networks. Their wide use could be practical for developing M-health networks, especially during emergency situations, because they enable quick and direct access to others, regardless of physical location. For example, calls from cell phones are typically directed to an individual who responds to the contact, rather than placed to a shared phone located at an institution or professional office—which would then require transfer to an individual provider or would be left as a message for the provider to respond to when available. Cell phone interactions can be initiated spontaneously wherever there is cell coverage, which would enable communicants to determine the location of a variety of people, resources, and services in real time. For example, birth attendants could send requests for help to their community of providers and subsequently receive messages back informing them of the whereabouts of support people in transit to their patients' locations, suggestions for care management, and whether resources had been requested. The birth attendants could then manage their patients

Table 1
Examples of structured SMS text message data-reporting protocol.

Example text 0422110013 indicates the following:							
04	22	1	1	0	0	1	3
Phone ID, 04	Age, 22 years	PPH, yes	BMC, yes	Maternal death, no	Neonatal death, no	Prenatal care, yes	Prenatal visits, 3
Example text 0718000016 indicates the following:							
07	18	0	0	0	0	1	6
Phone ID, 07	Age, 18 years	PPH, no	BMC, no	Maternal death, no	Neonatal death, no	Prenatal care, yes	Prenatal visits, 6
Example text 033610111# indicates the following:							
03	36	1	0	1	1	1	#
Phone ID, 03	Age, 36 years	PPH, yes	BMC, no	Maternal death, yes	Neonatal death, yes	Prenatal care, yes	Prenatal visits, unknown number

Abbreviations: BMC, bimanual uterine compression; PPH, postpartum hemorrhage; SMS, Short Message Service.

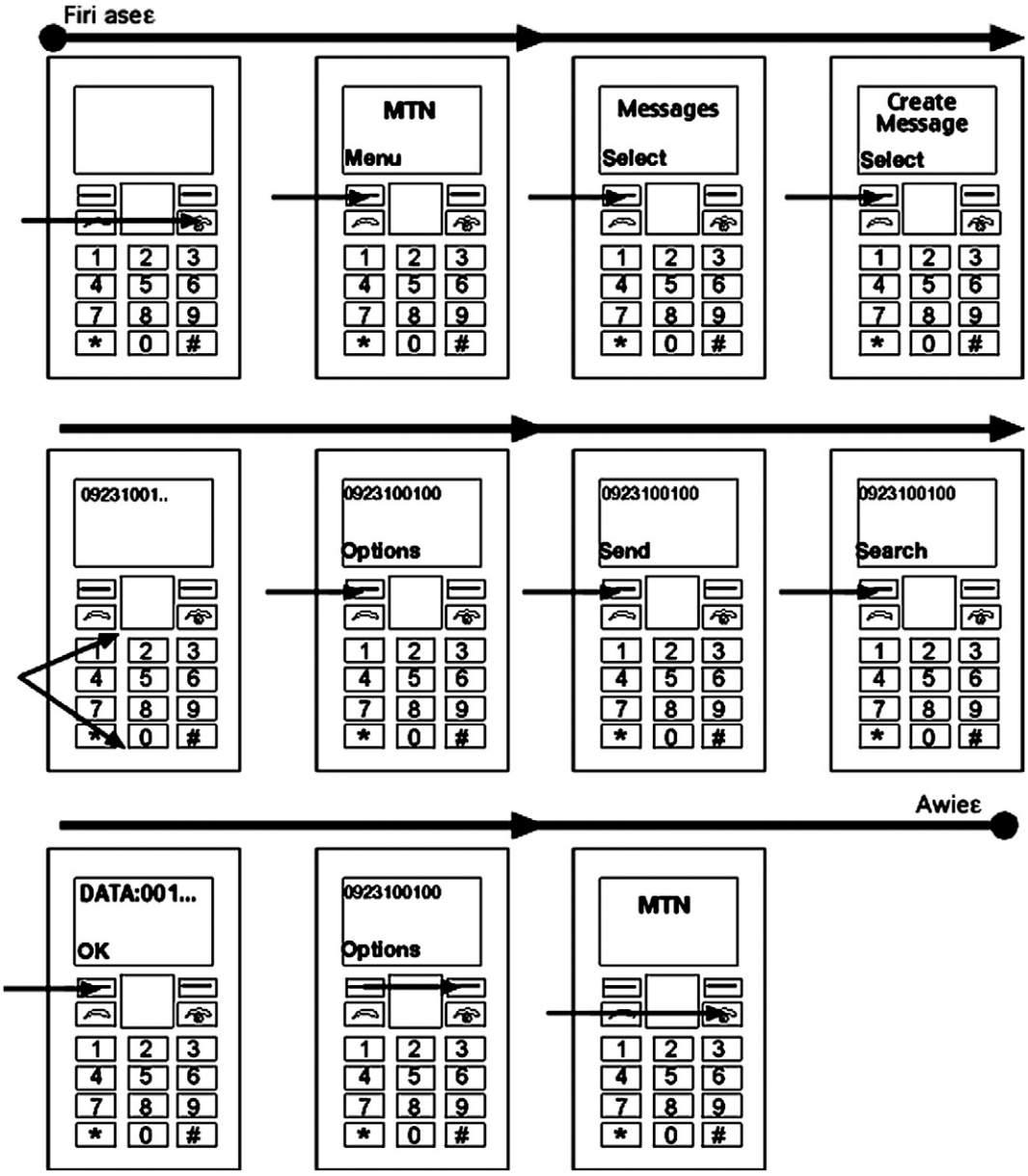

Fig. 1. Pictographic instructions for using cell phones.

Fig. 2. Using small groups to facilitate interactive learning.

knowing what additional support would be forthcoming and planning accordingly. Cell phones would also be an easy resource for mobilizing groups of care providers [15].

These findings could be exportable to other applications, in addition to healthcare, for which rural tracking of outcomes is

Table 2
Reported birth outcomes.[a]

Outcome	Value
Reporting birth attendants	9 (90.0)
Mean maternal age, y	26.57 ± 8.32
Births reported	425
Incidence of postpartum hemorrhage	13 (3.1)
Use of bimanual compression	13 (3.1)
Maternal death	0 (0.0)
Neonatal death	1 (0.2)
Prenatal care provided	405 (95.3)
Number of prenatal visits	4.76 ± 1.23

[a] Values are given as number (percentage) or mean ± SD.

necessary for program evaluation or other population monitoring. The present data-reporting protocol could be expanded to include tracking referrals, and sending text requests and images to definitive care providers to secure their rapid deployment to remote areas. Additionally, a network-served centralized reporting database where texts could be sent and accessed by healthcare administrators could facilitate the monitoring of health trends and epidemiologic concerns.

Establishing a text-messaging alert network is feasible, but its effectiveness would depend on the reliability of the system. For example, significant delays or failures in message transmission or receipt could adversely impact its use during an emergency situation [16]. System limitations could stem from human- and technology-related factors such as not hearing the phone notification or power outages temporarily disrupting network services. Additionally, health service providers could have concerns about unmitigated disruptions, being requested to provide advice without access to records, or providing services without adequate remuneration. However, by developing practice guidelines to establish and maintain remote accessibility, these concerns could be eliminated [17]. The benefits derived from this type of networking could encourage the formation of a group agenda, creative and productive group collaboration, and associated positive health-related outcomes [18].

The results of the present study demonstrate the feasibility of using cell phones to report health outcomes at the village level of a rural African community. This provides evidence that an M-health network could evolve into a practice consortium that encouraged community participation in resolving health-related issues. In rural communities with limited access to health services, M-health connectivity could impact life and death decisions in emergency situations. The limitations of the present pilot study include the small purposively selected sample and the uncertainty of data quality, which must be addressed in future studies; however, the results indicate that the use of a simple reporting protocol via cell phone text messaging has strong potential for collating health-related outcome data from rural communities.

Acknowledgments

This work was funded by the Bill and Melinda Gates Foundation as part of The Ghana–Michigan Collaborative Health Alliance for Reshaping Training, Education and Research (CHARTER), the Departments of Medical Education and Obstetrics & Gynecology at the University of Michigan, Sene District Hospital, and the Ghanaian Ministry of Health/ Ghana Health Service.

Conflict of interest

The authors have no conflicts of interest.

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