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User patterns of the Safe Delivery App; explorations from a cluster randomized controlled trial in Ethiopia

Clara B. Parellada[1], Ida Marie Boas[2], Henriette Svarre Nielsen[2,3], Bjarke Lund Sørensen[1,4], Stine Lund[1,5]

[1] *Department of Public Health, University of Copenhagen, Copenhagen N, Denmark*
[2] *Maternity Foundation, Copenhagen O, Denmark*
[3] *Fertility Clinic and Recurrent Pregnancy Loss Unit, Rigshospitalet, Copenhagen O Denmark*
[4] *Department of Obstetrics and Gynecology, Roskilde Hospital, Denmark*
[5] *Department of Pediatrics, Global Health Unit, Rigshospitalet, Copenhagen 0, Denmark*

Abstract

Background Given the rapidly evolving field of mobile health to improve the quality of low-resource health services, we aimed to evaluate the user patterns of the Safe Delivery App, mHealth clinical training tool in Basic Emergency Obstetric and Neonatal Care, among health workers in Ethiopia.

Methods Sixty-one health workers were included from the intervention arm of the cluster randomized controlled trial of the Safe Delivery App, a teaching aid using animated movies to improve quality of obstetric and neonatal care. Observational data on user patterns was collected from November 2013 to November 2014 in five rural districts in Ethiopia and automatically registered by GPRS (General Packet Radio Service) or GPS (Global Positioning System) network. The registered information included topic of movie and the movie sub chapter being watched as well as the date, time and location of the usage.

Results During the 12-months trial period, 61 health workers watched in total 20,049 training sub chapters. The app was used frequently with an average of 26 sub chapters viewed per health worker in a month. A sustained level of usage throughout all 24 hours of the day was seen. The health workers were particularly interested in strengthening their ability in giving an uterotonic drug and managing the newborn's airway with almost twice as many views when compared to the other videos.

Conclusions User patterns showed consistent and frequent usage of the Safe Delivery App throughout the 12 months trial period. Our findings highlight the relevance of innovative training methods for health workers in low-resource countries.

Keywords: Health workers; Digital health; maternal health; perinatal health; Childbirth; mHealth; Mobile phone; E-health.

[1]Clara Barfod Parellada ; Department of Public Health, University of Copenhagen, Oster Farimagsgade 5, 1014 Copenhagen K, Denmark; Email: clarabparellada@gmail.com

1. Introduction

Within the past decades, there has been a substantial growth in the number of mobile phones in low- and middle-income countries. Since 2005, mobile phone subscribers in Africa has increased by 690 million [1]. With this rapid growth, opportunities for mobile technology to play a substantial role in improving resource-limited healthcare systems are increasingly being recognized [2-4]. According to the World Health Organization (WHO), the use of mobile phones for health issues (mHealth) constitutes a promising trend, which could have significant impact in reducing maternal and neonatal mortality in health systems challenged by inadequately skilled birth attendants [5]. It provides an opportunity to increase access to information and overcome barriers to otherwise underserved and remote regions [6, 7].

Despite the increased focus on maternal and child health globally, Ethiopia and many other low-income countries still have a significant rate of stillbirths as well as perinatal and maternal deaths. Therefore, there is an urgent need to ensure universal access to adequately qualified and trained birth attendants providing Basic Emergency Obstetric and Neonatal Care (BEmONC) [8, 9]. These challenges in sub-Saharan Africa prompted the development of an instructive and educative mHealth tool referred to as the Safe Delivery App (SDA). The purpose of the app is to improve the quality of BEmONC of birth attendants in low-income countries. Existing studies on mHealth interventions mainly provide information about feasibility and effectiveness through the antenatal, intrapartum, and postnatal periods. Little is known about the health workers' usage of mHealth as an education tool in low-income countries. The aim of this study is to evaluate and describe user patterns of the Safe Delivery App among health workers in West Wollega Region, Ethiopia.

2. Material and Methods

2.1 Study Design and Setting

The information collected for this study has been extracted from the Safe Delivery App Trial; a cluster-randomized, controlled trial with the healthcare facility as the unit of randomization [10]. The trial was initially designed to assess the effects of the intervention on perinatal mortality as well as the health workers' skills and knowledge after using the Safe Delivery App. The data presented here are user patterns extracted from the app distributed to the intervention group in a 12-month period from 1st November 2013 to 14th November 2014 in all five districts in West Wollega Zone in the Oromiya region of Ethiopia: Gimbie, Haru, Nole Kaba, Genji and Homa. With 73 healthcare facilities as the unit of randomization in the Safe Delivery App Trial, half of the study population (n=65) was randomized to the intervention arm and the other half to the control group. From the intervention arm, a total of 61 health workers with data on user patterns on the SDA were included in the following.

The intervention group received a smartphone with the SDA installed and went through a 1-day training course learning how to use the phone and the app. Each individual was given a smartphone and the health workers were allowed to bring it home and use it both when at work and outside working hours. Both groups were provided with a basic delivery kit including soap, sterile gloves, gauze, a self-inflating mask and bag for neonatal resuscitation, and

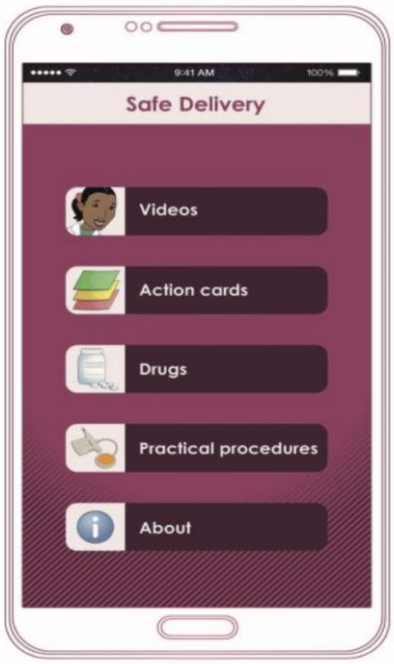
misoprostol or oxytocin for prevention and treatment of post-partum hemorrhage.

The study participants included midwifes, nurses and health extension workers (HEW). A HEW is a frontline health worker with a minimum of a grade 10 educational level and has completed a one-year certificate training course in safe and clean delivery [11]. The majority of the clinical nurses and midwives have completed a three-year diploma program which combines theory and clinical practice [12].

2.2 The Safe Delivery App

The Safe Delivery App (Figure 1) was designed to train midwives and other birth attendants in sub-Saharan Africa in the management of complicated birth deliveries through visual guidance in animated videos and voiceovers in the local language. The version of the SDA that was tested in the current study contained four animated training videos with clinical instructions on active management of third stage labour (AMTSL), manual removal of placenta (MRP), neonatal resuscitation (NR) and management of post-partum hemorrhage (PPH). The clinical content was developed following international WHO guidelines but focusing on key essential lifesaving interventions. The app offered the opportunity to watch the entire animation video (5-7 minutes long) as well as choosing a sub chapter, which could be watched separately to see a specific procedural step of each film. The app also contained a catalogue with essential drugs and equipment. To remind health workers of its content, the application provided weekly notifications with quiz questions and a direct link to the films where the information to answer the question was found. It did not require having network connection or Internet access and language could be selected between English and the local language, Oromiffa. The SDA is available on both App Store and Google Play [13, 14].

Figure 1. Screen view of the Safe Delivery App



2.3 Data Collection and Statistical Analysis

An individual identification number were given to health workers included in the study. Use of the Safe Delivery App was automatically registered via GPRS (General Packet Radio Service) and GPS (Global Positioning System) network. The registered information included the sub chapter being watched as well as the date, time and location of the usage. This information was automatically sent to a central server whenever the phone had network. The data was stored as comma separated data files (.csv) that were easy to extract and process in Microsoft Excel. Data analysis was conducted using SPSS version 25 and was presented graphically by Qlick View 11 and Tableau 9.3. Descriptive data were presented as absolute frequencies and were presented as medians and ranges.

2.4 Ethical Approval and Consent to Participate

Ethical approval procedures followed the standards of the University of Copenhagen, Denmark, requiring ethical approval from the country where the research was performed, in this case Ethiopia. Ethical clearance for this study was provided by The Ethiopian Oromiya Regional Health Bureau on 7th May 2013 who approved the fact that the study was conducted by foreign researchers, reference BEFO/ HBTT4/11-8/7315. The trial is registered with ClinicalTrials.gov, NCT01945931. All health workers were informed about the nature and purposes of the trial and that part of the study was to analyze the usage of the Safe Delivery App including recording date, time and location monitored by GPRS and GPS, as summarized in the consent form written in the local language. All health workers provided their consent either by signature or fingerprint prior to their inclusion in the study. The Ethics committee approved the informed consent procedures including the use of fingerprints. Health workers were free to drop out of the study at any time without a change in the quality of care provided. All study results were kept strictly confidential and were not accessible to people outside of the research team.

3. Results

Table 1 shows the socioeconomic characteristics of the health care workers in the intervention clusters. Most were females working as a HEW, and between 20 to 24 years of age. Of the 61 intervention health workers, 42 (68.9%) worked in health posts, 13 (21.3%) in health centers and six (9.8%) in hospitals. The majority worked in Gimbie (42.6%) and the rest in Genji (19.7%), Nole Kaba (18%), Haru (9.8%) and Homa districts (9.8%). The majority (67.2%) had never tried using a smartphone before (Table 1).

Overall, the most viewed training video was clinical instructions in active management of third stage of labor, followed by managing post-partum hemorrhage, neonatal resuscitation and lastly manual removal of placenta. Figure 2 illustrates the total number of each sub chapter viewed by the health workers during the trial. Instructions in giving an uterotonic drug, managing the newborns airways and assessing the newborn were the top three viewed sub chapters of the clinical instruction videos. During the 12-months trial period, the health workers watched in total 20,049 training sub chapters. They were found to use the app throughout the 12 months, with an average of 1,604 (689-2,923) sub chapters viewed per month, corresponding to 26 sub chapters viewed per health worker in a month. The number of monthly views peaked in the beginning of the study period, followed by a continuous level of views

ranging between 1,200 and 2,000 views per month (Figure 3). A sustained level of usage throughout all 24 hours of the day was seen, though the use was higher during daytime (Figure 4). Ten of the 61 health workers watched less than 50 sub chapters during the 12-months trial period.

Table 1. Baseline Characteristics of Healthcare Workers in the Intervention Cluster (n=61)

[a] Percentages have been rounded and may not total 100; [b] Two healthcare workers were missing data; [c] Two healthcare workers were missing data; [d] Three healthcare workers were missing data; [e] Seven healthcare workers were missing data; [f] Three healthcare workers were missing data.

Characteristic	Intervention cluster, No. (%)[a]
Sex[b]	
Female	52 (88.1)
Male	7 (11.9)
Age[c]	
18-20	3 (5.1)
20-24	47 (79.7)
25-29	6 (10.2)
>30	3 (5.1)
Place of work	
Health post	42 (68.9)
Health center	13 (21.3)
Hospital	6 (9.8)
Region of work	
Gimbie	26 (42.6)
Genji	12 (19.7)
Nole Kaba	11 (18)
Haru	6 (9.8)
Homa	6 (9.8)
Educational level[d]	
Health extension worker	43 (74.1)
Clinical nurse or midwife	15 (25.9)
No. of deliveries in past month[e]	
1-5	45 (83.9)
6-10	4 (7.1)
>10	5 (8.9)
Knowledge of smartphone[f]	
Tried using one	19 (32.8)
Never tried using one	39 (67.2)

Figure 2. Distribution of sub chapter views in relation to their popularity understood as the number of views during the 12-months trial, n=61

The sub chapters are classified corresponding to their training video category: Active management of third stage labor (AMTSL), manual removal of placenta (MRP), neonatal resuscitation (NR) and post-partum hemorrhage (PPH)

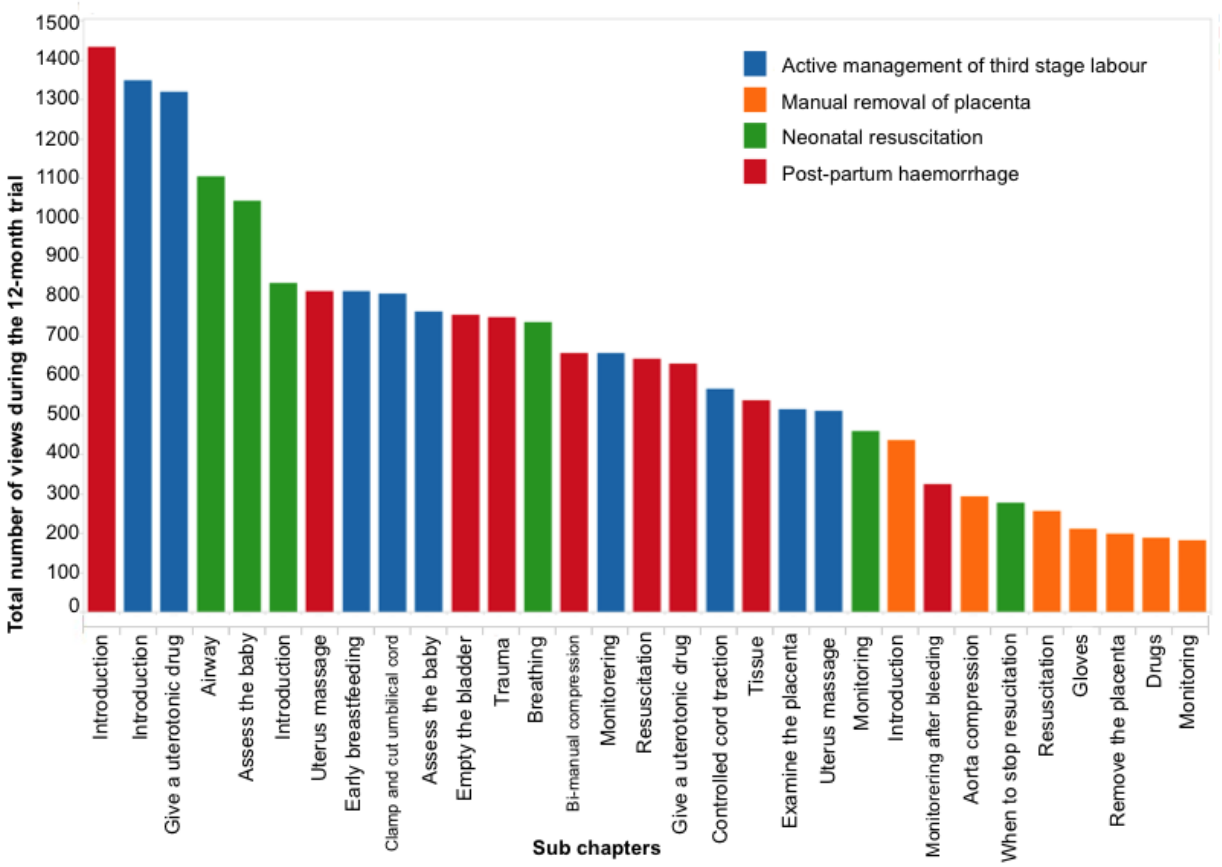


Figure 3. Median monthly video view from 1 November 2013 to 14 November 2014.

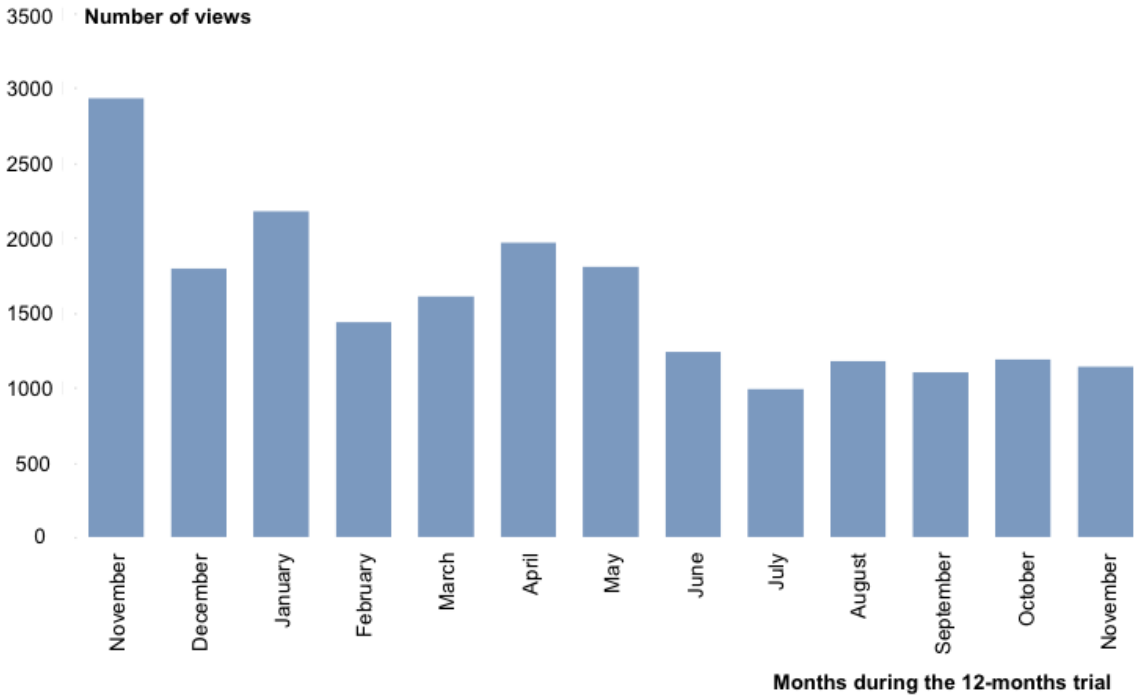
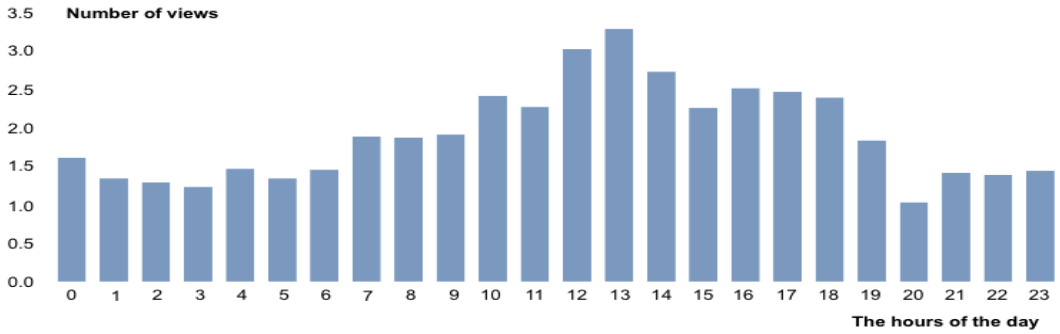


Figure 4. Distribution of all video views during the day



4. Discussion

This study describes the user patterns of mHealth as an education tool among birth attendants in a cluster randomized controlled trial in Ethiopia. The health workers were particularly interested in strengthening their ability in giving a uterotonic drug as well as managing the newborn's airway with almost twice as many views when compared to the other video sub chapters. Data also demonstrated consistent and frequent usage of the Safe Delivery App throughout the trial period as well as all hours of the day.

One of the largest challenges faced by health workers in low-resource countries is the lack of access to training and reference materials in order to improve BEmONC [8]. Efforts in skills training as well as motivation and simulation programs have shown to help improve performance and impact health outcomes, while simple dissemination of printed clinical guidelines has been reported as ineffective [15-18]. Previous BEmONC quality assurance initiatives have incorporated self-directed learning with ongoing supervision to engage learners. Randomized trials have demonstrated high knowledge and performance just after these training programs took place [17, 19, 20]. However, the improvements were not necessarily sustained over time. Health workers who were not continuously supervised and supported at least annually returned to their original practices [19]. As with similar mHealth tools, the SDA allows learners to study at their own pace and to decide the relevant or convenient time to use the tools [21]. In the current study, the app was used consistently and frequently, even though the majority had never used a smartphone before. The app was most often used during the day. The sustained leveling on its usage reflects the health workers' continuous motivation for using the SDA as a relevant tool. Whether the health workers only watched a short segment of the videos was not possible to extract in this study but qualitative data from the Safe Delivery App Trial based on interviews with 56 birth attendants showed that the SDA is perceived as a useful tool [22]. Most health workers explained that they used the SDA either at home to update knowledge or while they were at work conducting deliveries, either in case of a complication occurred or to ensure that everything was done in accordance with the correct procedures [22]. Health workers in our study received weekly notifications with clinical questions and links to the animated films, which might have supported the recurrent use of the SDA. A cluster-randomized controlled trial in Zanzibar demonstrated that women who received motivational mobile phone text-messages had more than doubled the odds of attending the recommended four or more antenatal care visits during pregnancy in compared to those women who did not receive similar messages [23]. Based on our data, instructive mHealth tools such as the SDA might be a potential solution as training method to sustain high knowledge and performance over time.

mHealth tools allow health workers to tailor their learning to their specific needs. Post-partum hemorrhage (PPH) is the leading cause of maternal mortality worldwide [24]. Active management of the third stage of labor (AMTSL) describes a set of interventions aimed at the prevention of PPH [25]. AMTSL includes the administration of uterotonic drugs immediately after birth and delivery of the placenta by controlled cord traction and subsequent uterine massage [26]. The WHO recommends AMTSL to be performed for all delivered women [25]. Retained placenta or placental fragments is a major risk of post-partum hemorrhage and can be managed by manually removing the placenta [27]. Hence, it is a concern that the instruction video on how to manual remove the

placenta only had few views in this study.

Globally, neonatal resuscitation is also receiving attention, especially as a missed opportunity for saving lives for births and for improving morbidity outcomes [28]. Basic resuscitation with a bag-and-mask is required for approximately 3-6% of all newborns, and is sufficient to resuscitate most neonates with primary and secondary apnea. Bradycardia results from hypoxemia and in most cases, is treated by establishing efficient ventilation [28]. A previous study of the same Safe Delivery App Trial showed that health workers in the intervention group increased their knowledge and skills in neonatal resuscitation more than 2-fold compared to the control group six and 12 months after introduction to the SDA and that perinatal mortality was reduced with 33% [10]. In the present study, clinical instructions in managing the newborn's airway were one of the most popular video sub chapters. This illustrates the health workers' attention in preventing and managing neonatal resuscitation as part of becoming a skilled birth attendant. The high level of usage combined with the documented impact of the SDA suggest that mHealth tools such as the SDA can be effectively used for health education if health workers are prompted to watch videos corresponding to their needs. This will prepare them to detect and manage life-threatening complications faced by mothers and newborns.

This study is limited by only being conducted in only five districts in Ethiopia. Furthermore, our data was collected from a cluster-randomized trial of health workers, and it is uncertain how the SDA would be perceived and used in the more general population. Further studies need to determine not only if the results might differ in other districts and countries but also the long-term effects of its use. Currently, impact after the 12 months is unknown. Technology alone is not enough; it needs to be combined with innovations in processes to have the greatest effect [3]. We recognize that a mobile phone guide cannot prevent skills decay; however, having a handy mobile phone app might help health workers as an instructive tool in emergency situations, and also as an educative tool for continuous health education also for health workers in remote areas [3].

5. Conclusion

In conclusion, the SDA is a mHealth tool that has demonstrated that health workers were particularly interested in strengthening their abilities in giving an uterotonic drug as well as managing the newborn's airway. We found consistent and frequent usage tailored in a 12-month period by health workers in five districts in Western Ethiopia. Our findings suggest that health workers in peripheral areas accepts and will use a learning aid like the SDA and that mHealth has a role to play in bridging the outreach gap in quality assurance of emergency care. Further research on training modalities, user perceptions and effects on clinical outcome in resource-limited settings is needed.

6. Conflict of interests: None

7. Funding

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