Will district health centres use preloaded cell phones for pre-referral phone calls for women in labour: a randomized pilot study at Mbarara Regional Referral Hospital in southwest Uganda

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Introduction

Uganda is one of the developing countries with high maternal and infant mortality rates; maternal, 336 per 100,000 live births and infant, 43 per 1000 births respectively in 2016 (UDHS 2016). Adverse maternal-fetal outcomes in developing countries are primarily related to three delays: time to decision to seek health care, access to health services, and timely intervention at the health facility (Pacagnella et al. 2014; Thaddeus and Maine 1994).

Given the high mortality rates in Uganda, there is a big need for improvement. Cell phone technology has been used in other African settings to potentially improve maternity care and referral systems (Oyeyemi and Wynn 2015; Lund et al. 2014; Murray and Pearson 2006). However, these interventions have centred on providing pregnant women with cell phones, an expensive intervention. Resources for such a large scale intervention are not readily available in our setting in southwest Uganda. We therefore piloted a more modest intervention, providing a mobile phone and recharged credit to the local health centre for the purpose of a pre-referral phone call to a dedicated number at the major regional referral hospital.

The main objective of this pilot study was to assess whether health centres given SIM cards and cell phones would make pre-referral phone calls to Mbarara Regional Referral Hospital (MRRH).

Materials and methods

MRRH is a tertiary referral centre in southwestern Uganda with approximately 7300 deliveries per year. Of these, 2555 (35%) are referrals from neighbouring districts. In this pilot prospective study, 12 health centres in Isingiro district, approximately 50 km from MRRH, were randomized to receive loaded mobile phones with recharge credit for the purpose of a pre-referral phone call to a dedicated number at MRRH or not.

The health centres were all government owned, run by midwives and sometimes by medical officers but not specialists. None of the centres had ambulance vehicles. Prior to randomization, pairs of health centres that had similar characteristics in terms of numbers and type of patients referred, staffing and distance from MRRH were identified. Subsequently, one health centre was randomly selected from each pair and provided a cell phone with which to contact MRRH prior to maternal referral. The study patients were pregnant women arriving in labour at MRRH between August 2016 and December 2016. The women were grouped with respect to whether they were referred from a Loaded Health Centre, i.e. Loaded Group, or not, i.e. Non-Loaded Group. These two Groups were each further subdivided into a phone call arm for those who actually had a phone call placed before referral and no phone call arm for those with no call.

All study pregnant women received routine labour and delivery care according to existing protocols at MRRH maternity unit. The women were followed up to document maternal and fetal outcomes and interviewed to determine the timing of

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Table 1 Relationship between loaded cell phone group and pre-referral calls

Loaded cell phone	Called (number/percentage)		p value
	Yes	No	
Yes (48)	32 (66.67)	16 (33.33)	0.001
No (18)	1 (5.56)	17 (94.44)	

referral and possible reasons for delay at home, delivery mode, birth outcome and any complications following delivery as well as delay in their referral. Data analysis was done using STATA 11. Within each main study arm (phone call and no phone call), maternal characteristics were summarized with means and frequencies. The proportion of women in each study arm who experienced a poor maternal-fetal outcome was compared/estimated using Fisher's exact test. We calculated the median times from presentation at a health centre to referral to MRRH; referral to arrival at MRRH; and presentation at a health centre to initial intervention at MRRH and then delivery.

Results

A total of 66 pregnant women were included in the pilot study; 48 from the Loaded Group and 18 from the Non-Loaded Group. As shown in Table 1, there was a significant difference in the pre-referral phone calls to MRRH between these two groups (32 (67%) called versus 1 (6%); $p < 0.001$).

Pre-facility level delays identified from the interviews included waiting for labour to advance (35%), lack of means of transport (35%) and lack of money (19%). The rest delayed because they were unsure whether to go to the local health centre and/or had no birth plan (Table 2).

Delays occurred in both arms (phone call and no phone call) even after arrival at MRRH. Most referrals (71%) took at least 3 h to be delivered by emergency caesarean section (CS) after the decision to deliver by CS was made at MRRH (Table 3).

The greatest delay was 6 h (for three patients). We did not observe any difference in the maternal-fetal outcomes between those who called and those who did not call prior to referral (Table 4).

Table 2 Reasons for pre-facility delay

Reason	Frequency	Percentage (%)
Money	12	19.04
No available transport means	22	34.92
Waiting for husband	1	1.58
Waiting for labour to advance	22	34.92
Undecided	5	7.93
Rainfall	1	1.58

Table 3 Follow-up of referred mothers at MRRH

Decision to time of delivery by CS ($N = 41$)	Frequency	Percentage (%)
1 h	1	2.44
2 h	11	26.83
3 h	14	34.15
4 h	10	24.40
5 h	2	4.88
6 h	3	7.32

Discussion

The results of the pilot study show that provision of a loaded mobile telephone to the peripheral lower health units with a dedicated contact number at the regional referral hospital was associated with a marked increase in calls pre-referral compared to the health units not given the phones and recharge cards. Personnel at health centres given phones and dedicated number to call were motivated and willing to make the pre-referral phone call. This link also supported the referral hospital in giving feedback concerning challenges of patient management before referral and feedback after referral. However, this pilot study was not powered to detect a difference in outcomes.

Beyond these findings, the study confirmed that more work is needed at the referral hospital to decrease time from arrival to decision for emergency caesarean section, and from decision to actual performing of a caesarean section procedure. The time from decision making to delivery was more than 30 min beyond the standard of 75 min (Gupta et al. 2017). Such delays are associated with adverse outcomes (Gupta et al. 2017; Ziraba et al. 2009). The causes of delay at MRRH, shortage of health workers and lack of equipment and supplies, were similar to findings of a survey in Nairobi which looked at the state of emergency obstetric care services (Ziraba et al. 2009).

Conclusion

Many trials of mobile technology in Sub-Saharan Africa have involved giving phones to pregnant women. Most have shown benefit with increases in prenatal attendance and calling if problems occurred. However, such programs have rarely been scaled up post-study as this is an expensive intervention. In contrast, our pilot study is very inexpensive—one loaded phone per health centre site and a dedicated number to call at the referral hospital. This study has shown this course of action to be feasible and acceptable, with a high rate of referral calls compared to centres not given phones. This pilot study sets the stage for a larger trial to determine whether this intervention has an impact on changing maternal-fetal outcomes. If

Table 4 Relationship between phone call and adverse maternal-fetal outcomes

Factor ($N = 66$)		Frequency	Phone call (%)	No phone call (%)	Correlation coefficient Rho (Φ)	p value
Adverse maternal outcomes	Obstructed labour	15	53.30	46.70	0.036	0.769
	Caesarean section	41	60.98	39.02	0.310	0.022
	Ruptured uterus	3	33.33	66.67	0.073	0.550
	Abdominal hysterectomy	2	50.00	50.00	0.001	1.000
	Sepsis	1	00.00	100.00	0.124	0.314
	Organ failure	1	00.00	100.00	0.124	0.314
	Death	2	50.00	50.00	0.001	1.000
	Apgar score < 7	12	58.30	41.67	0.078	0.523
Adverse fetal outcomes	Fresh stillbirth	5	60.00	40.00	0.057	0.642
	Early neonatal death	1	00.00	100.00	0.124	0.314
	Admitted to neonatal unit	6	66.67	33.33	0.105	0.392

effective, scaling up is likely within reach for all rural districts in Uganda in light of the small cost of this intervention that could be absorbed within district budgets. Given that more than half of babies are born in peripheral health centres in Uganda, when a problem occurs, more rapid informed referral might indeed lead to a decrease in maternal mortality and help Uganda work toward achieving Sustainable Development Goal 3.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

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