Original Research Article

The role of m-health in providing antenatal care in rural areas

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ABSTRACT

Background: The maternal mortality rate is high in India and many deaths are due to preventable causes related to pregnancy. Mobile-health is an innovative strategy wherein, mobile phones are used for pregnancy tracking and giving support during the antenatal period. Aims and objectives of the study was to know the role of m-Health in providing antenatal care in rural areas.
Methods: This was a prospective, comparative study carried out at Kamineni Hospital, LB Nagar, Hyderabad and the Primary Health Centres (PHC) of Uppal and Narapally, Ranga Reddy district over a period of one year nine months and consisted of 204 registered antenatal cases divided into study and control groups. Both groups received routine antenatal support and the study group, in addition received mobile health support also. Various parameters were compared in both the groups.
Results: The study group had more antenatal visits, better correction of anemia, less number of patients who were lost to follow-up, and more number of Caesarean deliveries.
Conclusions: Mobile health helps in pregnancy tracking and increasing the antenatal visits. It helps in timely referrals for high-risk pregnancies in remote areas and it has the potential to provide obstetric care and consultations to both low risk and at-risk women in rural areas where specialist care is not always available.

Keywords: Antenatal care, High-risk pregnancies, Mobile health

INTRODUCTION

Globally about 800 women die every day of preventable causes related to pregnancy and childbirth and 20 % of such deaths are from India. It is estimated that per year, 55,000 women die due to preventable pregnancy-related causes in India.[1] The United Nations' Millennium Development Goal (MDG5) was to reduce maternal mortality rate (MMR) by 75% between 1990 and 2015.[2] In order to achieve these goals and accelerate their progress, newer strategies like m-Health are required. India faces several challenges in meeting the needs of pregnant women, particularly those related to complications of pregnancy and obstetric emergencies. Besides medical causes, other factors that may contribute to maternal deaths are delay in care-seeking due to delay in identifying the complication, deciding to seek care, transportation to a health facility, and delay in receiving appropriate treatment.[3] Mobile health (m-Health) denotes using small portable and wireless communication devices like mobile phones, personal digital assistants, based on web applications to facilitate the health needs of health care providers and consumers. The basic idea of m-health application for expectant mothers is that community health workers collect data about pregnant women and send to a specialist. The specialist views the patient information and provides feedback to the mobile of community health worker.[4] It works as a good support system and is operated by rural health workers to improve point of care diagnostic support. It is also useful for screening of patients who need specialist care and to provide advice for routine cases.

According to International Telecommunications Union, mobile coverage has increased to reach 90% of the world's population and 80% of the global population living in rural areas.[5] Thus, m-Health intervention can be effectively used to deliver antenatal care in developing countries with limited resources. In this context, this study was done to know how m-Health helps in improving antenatal care in rural areas in primary health centres.

Aims and Objectives of the study was to know the role of m-Health in providing antenatal care in rural areas. Improving attendance for antenatal visits and to ensure full antenatal care. Detection of high-risk pregnancies and timely referrals.

METHODS

This was a prospective, comparative observational study carried out at Kamineni Hospital, LB Nagar, Hyderabadand the Primary Health Centres (PHC) of Uppal and Narapally, Ranga Reddy district over a period of one year nine months from July 2014 to April 2016. The study group consisted of a total of 204 registered antenatal cases. Informed consent was taken from all the subjects.

Inclusion criteria

All pregnant women willing to participate in the study and registered at Uppal PHC and Narapally PHC during the study period

This was a comparative study which included randomly selected 204 antenatal women (102 in study group i. e., m-health group and 102 in control group, non-m-health group).

Complete clinical details were collected like last menstrual period, expected date of delivery, previous deliveries, date of first check-up, followed by initial examination of height, weight, vitals, general and systemic examination, and antenatal investigations of blood grouping and typing, hemoglobin, blood sugar, urine test.

The study group individuals were initially registered in the mobile application by community health worker after taking their informed consent. The antenatal women were then given the follow up date according to the period of gestation (pregnancy tracking).

The above information was displayed in the web and mobile application which were seen and analysed by the authors at Kamineni Hospital, LB Nagar, Hyderabad. The high-risk pregnancies were highlighted by an automated algorithm for which further recommendations /referrals were given accordingly. The control group received the routine antenatal care provided at PHC.

Statistical analysis

Summary statistics such as N, mean, median, standard deviation, minimum and maximum were computed for all continuous variables with non-missing observations and with Histogram. Count and percentages were computed for categorical data.

Percentages were calculated based on non-missing observations and with bar-graphs. Paired t-test for antenatal visits and Independent t-test for interventional and Control group was done for data at 5% level of significance and also providing p-values for appropriate statistic tests.

Table 1: Comparison of age groups.

Age (years)	Control group	Study group	Total
<20	10(9.80%)	16(15.69%)	26(12.75%)
20-25	67(65.69%)	58(56.86%)	125(61.27%)
26-30	22(21.57%)	24(23.53%)	46(22.55%)
>30	3(2.94%)	4(3.92%)	7(3.43%)
Total	102(100.00%)	102(100.00%)	204(100.00%)

RESULTS

The mean age for control and study group was 22.82 and 22.78 years respectively.

Comparison of literacy status

In study group, 14.7% were illiterates, 17%, 60%, and 10% had primary, secondary and graduation education. In

control group, 15.6% were illiterates and 28.4%, 53.9%, 53.9% had primary, secondary and graduation education respectively.

Mobile phone accessibility

All the antenatal women in study group (n=102) had accessibility to mobile phone. 18 (17.6%) had their own mobile phones, 84 (82.3%) used husband's or relatives'

mobile phone. Out of 102 women, 27 (26.4%) had internet accessibility on phone.

Comparison of gestational age at registration in both groups

Out of 102 antenatal women in study group, 9(8.8%), 55 (53.9%) and 38 (37.2%) were registered in first, second and third trimester. For the control group 2(1.9%), 59 (57.8%) and 41 (40.2%) were registered in the first, second and third trimester respectively.

Comparison of number of antenatal visits in both groups

In the control and study groups individuals having less than 4 antenatal check-ups was 38 (37.2%) and 25

(24.5%) whereas, those having more than 4 antenatal check-ups was 64 (62.7%)and 77 (75.4%).

Comparison of TT immunisations in both groups

In control group, all the antenatal women were immunised with two doses of TT. In study group 94 out of 102 women received 2 doses of TT immunisation (women with short ICP were given only one dose in third trimester and one aborted at 12 weeks).

Hemoglobin % comparison at first visit in both groups

In control group 89 (87.2%)women were anaemic with haemoglobin less than 11 gm/dl whereas, in study group 80 (78.4%) were anaemic at first visit.

Table 2: Hemoglobin %comparison at first and last visit in both groups.

Hb%	Control group		Study group		Total	
	First visit	Last visit	First visit	Last visit	First visit	Last visit
<11 gm%	89 (87.2%)	56 (54.9%)	80 (78.4%)	41 (40.1%)	169 (82.8%)	97
≥11gm%	13 (12.7%)	42 (41.1%)	22 (21.5%)	58 (56.8%)	35 (17.4%)	100
Total	102	98 (4 lost follow up)	102	99 (3 lost follow up)	204 (100%)	197
Corrected anaemia	-	25	-	37		62

Table 3: The N, mean, standard deviation, minimum and maximum values of Hb% of control and study groups.

	Control group					Study group				
Visit	N	Mean	SD	Min	Max	N	Mean	SD	Min	Max
First visit	102	10.16	1.09	6.4	12	102	10.34	1.37	6.3	13.8
Last visit	98	10.89	1.06	7.2	12.8	99	11.23	1.26	7.6	14.2

A significant difference exists between first and last visit of Control group in Hb%, since T-value is −11.55 and its p-value 0.001.

A significant difference exists between first and last visit of Study group of Hb%, since T-value is −8.67 and its p-value 0.001.

Table 4: The N, mean, standard deviation, minimum and maximum values of Hb% of control group versus study group.

Visit	Visit	N	Mean	Std	Min	Max	T test	P value
First visit	Control	102	10.16	1.09	6.4	12	-1.01	0.316
	Study	102	10.34	1.37	6.3	13.8		
Last visit	Control	98	10.89	1.06	7.2	12.8	-2.07	0.040
	Study	99	11.23	1.26	7.6	14.2		

From the above results, there is no significant difference between control and study group of First Visit of Hb% since T-value is −1.01 and its p-value is 0.316 but a

significant difference exists between control and study group for Last Visit of Hb% since T-value is −2.07 and its p-value is 0.040 which is less than 0.05.

Table 5: Comparison of high-risk pregnancies in both groups.

High-risk pregnancy	Study group	Control group	Referrals (study group)	Referrals (control group)
Anaemia	80	89	7(1 no follow up)	8(3 no follow up
Teenage pregnancies	16	10	5	2
IUGR	5	2	5	2
Previous LSCS	13	8	7	1
Multipara	6	1	-	-
Hypertensive disorders of pregnancy	9	2	9	2
Oligohydramnios	10	3	10	2
GDM	2	-	2	-
Heart disease	1	-	1	-
Placenta praevia	1	-	1	-
Hypothyroid	4	1	-	-
BOH	3	-	3	-
Rh negative	6	5	-	-

Comparison of follow up visits in both groups

In the study group 3 (2.95%) lost follow visits whereas, 9 (8.83%) lost follow up in control group. 80 out of 102 women in study group and 89 out of 102 in control group were anaemic with Hb% <11 gm%. Among them 7 were referred in study group and 8 were referred in control group for moderate and severe anaemia. In study group women with PIH were 9 whereas, 2 in control group. In study group 2 were diagnosed as GDM and one with placenta praevia and one with Heart disease. In study group 3 women were with bad obstetric history and 6 were Rh negative pregnancies and 4 were hypothyroid. In control group 5 were Rh negative pregnancies and one was hypothyroid.

Antenatal women with two or more risk factors in both groups

In study group, antenatal women with two or more risk factors were 43 (42%) when compared to 18 (17.6%) in control group.

Table 6: Comparison of outcome in both groups.

Outcome	Institutional deliveries	Full term	Preterm	Aborted	LSCS	NVD	AGA	LBW
Study group	101	95	6	1	37	64	95	6
Control group	102	98	4	0	26	76	95	7

Comparison of high-risk pregnancies referred in both groups

In control group 17 (16.67%) antenatal women were referred to higher centres whereas, in study group 34 (33.33%) antenatal women required referral to higher centre. In both groups, all were institutional deliveries. LSCS were high in study group (37 out of 101) when compared to control group (26 out of 102). This can be explained as number of high risk pregnancies and women with more than 2 risk factors in study group were more when compared to control group.

DISCUSSION

It has been identified that there is direct relationship between lack of pregnancy related care and maternal deaths.[6] Early detection of risk factors associated with mortality and morbidity can be used for effective interventions.[7] The main aim of antenatal care is to produce healthy mother and healthy baby.

Mobile phone usage has increased manifold in low- and middle-income countries (LMIC). Developing countries are responsible for more than 75% of mobile-cellular subscriptions globally.[8] The wide availability of mobile phones and their ease of use have given rise to the field of mobile health (m-Health), in which mobile phones and tablets support medical and public health practice.[9] m-Health interventions can be used to provide educational information, support, reminders, emergency response, and monitoring.[10] In LMIC this means m-Health could reduce time, distance, and cost of information delivery, and thus overcome issues of inadequate financing, poor access to information, and limited human resources.[11] m-Health interventions can be used to support pregnant

women during the antenatal, birth and postnatal period, so as to reduce the high maternal and neonatal mortality.[12]

In India, 69% of households have mobile phones and also smart phone adaptation has increased in recent years due to affordable prices.[13] In India, the rural areas have also witnessed an increase in mobile usage. Hence, this study was done to know how m-Health could help to improve antenatal care in comparison with routine antenatal care provided at PHC in rural areas.

In this study, the mean age group of antenatal women in control group and study group was 22.82 and 22.78 years which was similar to the study done by Mushamiri et al where 34.8% were in 20-24 years age group and was low when compared to a similar study done by Roberts et al where mean age was 28.1 years.[14,15]

In this study, only 17.6% of antenatal women had their own mobile phone and 82.3% used their husband's mobile for communication. This is lower when compared to study done by Lund et al where 38% of antenatal women owned mobile phone in interventional group.[16] A similar study by Roberts et al had 42% of women having own mobile phones.[15] In this study, illiterates were 16% in study group and 15% in control group which was similar to a study done by Lund et al where illiterates were 16% and 18% in interventional and control group respectively.[16] Those with primary education were 17% and 19% in study and control group which was lower compared to study done by Lund et al 36% interventional and 37% control group.[16]

In this study 55% and 60 % of antenatal women in control and study group had their secondary education respectively which was high when compared to similar study done by Roberts et al which was 44% and Lund et al 45% in interventional group and 42% in control group.[15,16]

Women who were registered in first trimester were 2 (1.9%) in control group and 9 (8.8%) in study group which is lower than in a study done by Lund et al where first trimester registrations were 27% in control group and 20% in interventional group.[16] Women who were registered in second trimester in this study were 59 in control group and 55 in study group which is similar to a study done by Mushamiri et al (53.5%) and lower than in a study done by Lund et al (71% in interventional group and 66% in control group).[14,16] Women registered in third trimester were 41 in control group and 38 in study group which was higher than compared to study by Lund et al where 9% in interventional and 7% in control group registered in third trimester.[16]

In this study, women with more than 4 antenatal visits were 64 (62.7%) and 77 (75.49%) in control and study groups respectively. This is higher than the study done by Lund et al where women with 4 visits were 44% and 31% in interventional and control group respectively.[16]

In this study TT immunisation (2 doses) of primigravida in both control and study group was 100% which is higher than study done by Lund et al where it was 72% in interventional group and 56% in control group.[16]

In the present study, antepartum referrals for high-risk pregnancies were 17 (16.67%) and 34 (33.33%) in control and study group respectively. This is higher than the study done by Ivy et al where 27.5% referrals were done and in study by Lund et al where 10% of referrals were done in interventional group and 5% in control group.[17,16]

In the present study, 101 women out of 102 in study group (one woman aborted at 12 weeks) and 102 in control group had institutional deliveries which were high when compared to study done by Battle et al where 75% delivered at a facility and 78% delivered under skilled care.[18]

In our study, a significant difference was noted in Hb% in last visit in study group [p-0.004] when compared to a study done by Khorshid et al where no effect on anaemia was found, as there were no significant differences in hemoglobin and hematocrit in study group.[19]

There was no significant difference noted in both groups in this study in terms of age, risk factors, literacy status which is similar to study done by Lund et al.[16]

The limitations of m-health are that compliance of health workers for handling the software application may be low. Antenatal women who register late in last trimester will have less number of antenatal check-ups. Technological issues with respect to m-Health software application may need software experts to resolve the issues.

The above limitations can be overcome by proper training of health workers in understanding the usage of m-Health application. The application can be provided in local language for easy understanding by health workers and antenatal women. Developing voice messages and providing SMS based reminders for follow up visits and maternal health education will give better outcome. In India m-Health is still in seedling stage and hence more studies are required to prove its role in delivering maternal and new born health care in rural areas.

CONCLUSION

Mobile health helps in pregnancy tracking and increasing the antenatal visits by patients. It provides an effective intervention permitting timely referrals and recommendations of high-risk pregnancies in remote areas. One of the main advantages of m-Health is increased convenience for women and their families due

to decreased travel time and distance. From this study, it can be concluded that m-Health has the potential to provide obstetric care and consultations to both low-risk and at-risk women in rural areas with low resources where specialist care is not always available.

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