PRENACEL: Development and Evaluation of an M-Health Strategy to Improve Prenatal Care in Brazil

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Abstract—The quality of prenatal care is key to reduce maternal morbidity and mortality. Communication between the health service and users can stimulate prevention and care. M-health has been an important and low cost strategy to health education. The PRENACEL programme (prenatal in the cell phone) was developed. It consists of a programme of information via SMS from the 20th week of pregnancy up to 12th week after delivery. Messages were about prenatal care, birth, contraception and breastfeeding. Communication of the pregnant woman asking questions about their health was possible. The objective of this study was to evaluate the implementation of PRENACEL as a useful complement to the standard prenatal care. Twenty health clinics were selected and randomized by cluster, 10 as the intervention group and 10 as the control group. In the intervention group, women and their partner were invited to participate. The control group received the standard prenatal care. All women were interviewed in the immediate post-partum and in the 12th and 24th week post-partum. Most women were married, had more than 8 years of schooling and visit the clinic more than 6 times during prenatal care. The intervention group presented lowest percentage of higher economic participants (5.6%), less single mothers and no drug user. It also presented more prenatal care visits than the control group and it was less likely to present Severe Acute Maternal Mortality when compared to control group as well as higher percentage of partners (75.4%) was present at the birth compared to control group. Although the study is still being carried out, preliminary data are showing positive results of the compliance of women to prenatal care.

Keywords—Cellphone, health technology, prenatal care, prevention.

I. INTRODUCTION

THE quality of prenatal care is a key to improve maternal and perinatal health [1]. The low quality of women's health care during prenatal, birth delivery and postpartum is a factor that contributes to the maternal e perinatal mortality in Brazil [2].

Morbidities and mortality developed during pregnancy are associated with low quality of care as it is the case of Severe Acute Maternal Morbidity (SAMM) defined as severe complications of pregnancy, birth or post-partum occurring until 42 days after birth [3]. Some factors such as age, caesarean section, previous abortion or miscarriages as well as low compliance to prenatal care are pointed out as associated to the development of SAMM and maternal mortality [4].

Maternal Mortality rates in Brazil in 1990 was 143,2 deaths by 100,000 living born and the Millennium Development goal was to reduce in 2015 to 35 deaths by 100,000 living born [5], [6] However, in 2013, the country reached 58.1 maternal deaths by 100,000 living born, a reduction of 59% [7].

Besides maternal mortality rates being not compatible with Brazilian development there is also a high incidence of congenital syphilis in Brazil [8] and other indicators point out to low the quality of care during pregnancy: 75% of Brazilian women had no access to educational groups during prenatal care, 64% had no guarantee of having an companion during birth delivery, as stated by low, 95% had the birth in lithotomy and a vaginal birth with excessive manipulation, oxytocin use or episiotomy [9], [10]. In addition to this picture there is a high dissatisfaction of women with birth assistance since one in four revealed that suffered abuse or violence during the hospitalization for the birth delivery [11].

The quality of health care is a multidimensional concept including among other factors, the use of effective health initiatives, sufficient health infrastructure and appropriate attitudes from health professional [12]. Taking in consideration the characteristics of prenatal assistance in the public health system in Brazil (short and superficial medical consultations) the task of improving maternal and perinatal outcomes and produce satisfaction among pregnant women can be considered a challenge [13], [14]. Another challenge is to overcome the situation of powerless and the lack of information of the users of health system since many do not know their rights. This contributes to the low demand for interventions and the improvement of quality of care.

To establish a communication channel between the health service and its users can stimulate the compliance to the prenatal program, increase the demand for preventive and therapeutic actions, provide information, dissipate doubts, receive complaints and have positive impact in women's mental health. Furthermore, prenatal is an important moment to orientate about breastfeeding, to discuss family planning and contraceptive use, especially due the fact that increasing the interval among pregnancies can protect women's and child health [15], [16].

It has been shown that short message (SMS) disseminated via mobile phone have a positive effect on the health, particularly in the prevention and management of chronic conditions [17]-[23]. This new research and innovation field known as m-Health (mobile health) is considered promising

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[23]. The use of mobile phone technology could improve the quality of the prenatal care follow up and it is expected that an effective communication channel could be a facilitator of better maternal perinatal outcomes and satisfaction [17]-[22]. However, a recent literature review revealed that few studies were carried out in developing countries and are scarce the application of m-Health to improve maternal and perinatal health [24].

In 2011 Brazil had 242 million of cell phone lines, based in this information is it was possible to develop an educational program using m-Health technology [25]. Considering the access, coverage and the low-cost the SMS constitute an ideal platform to the establishment of direct communication among health system and its users, based on these premises the PRENACEL programme (prenatal in the cell phone) was developed.

II. OBJECTIVES

This study aimed to determine if a program of health education supporting women and partners and disseminated via mobile phone is a useful complement to the standard follow up during pregnancy, birth and post-partum period.

III. METHODOLOGY

The study was designed as a cluster randomized trial to be carried out among clients of 20 Primary Health Care Clinics in Ribeirão Preto, a medium size city of São Paulo state in Brazil. The clinics were divided in two clusters: one group of ten clinics received intervention, were nominated as case, providing SMS messages + standard prenatal care program and the other group nominated control provided only the standard prenatal care program. Pregnant women received four times per week 148 SMS with information about the pregnancy, birth delivery, and postpartum and prenatal care and the partners received 64 messages. Messages were selected from the Global Initiative MAMA-Mobile Alliance for Maternal Action, an educational programme developed by the Whitehouse office in partnership with USAID reaching 266 organizations in 61 developing countries, and they were translated into Portuguese and adapted to Brazilian population.

Study population for the intervention group were pregnant women age 18 or older, with at least 20 weeks of pregnancy recruited in the period from April to June of 2015 and who agreed to receive the messages. A total of 157 women were interested in participating in the programme but only 116 met the inclusion criteria. During 33 weeks all women enrolled in the prenatal programme from the 20 health clinics were interviewed after birth in the four maternity hospitals of the city. Male partners were nominated by their partner to receive special messages during prenatal care and were interviewed by phone after birth.

Statistical analysis was carried out comparing the three groups: the total intervention group, PRENACEL group and control group using chi-square, with 95% of CI and p<=0.05.

IV. RESULTS

A total of 1210 women were interviewed at the maternity, 440 from the control cluster and 770 were from the intervention cluster including 116 women who received SMS messages. A total of 186 male partners participated of the study, 62 receiving SMS and 124 as part of the control group. Almost half of the women were from 25 to 34 years old, 81.5% lived with a husband, 47.9% were mulattos and 84.4% had more than 8 years of schooling. About 44% had one or previous pregnancy, 85.4% had more than 6 prenatal care visit to the clinic, 65.9% had vaginal birth and 97.6% had the intention to use contraception after birth.

As it can be seen in Table I, regarding social class a significant difference was found, being the group that received the messages the one with lowest percentage of higher economic participants (5.6%). In marital status a difference was found between intervention and control group, being the former less likely to have single mothers. The difference among drug use was also significant between the intervention group and control and as well as between PRENACEL and control group. The group that received the messages had any drug user as participant. Prenatal care defined as at least six visits to the health clinic also showed difference among the groups presenting higher percentage of participants in the group that received SMS. This group was less likely to present SAMM when compared to control group (Table II). Higher percentage of partners (75.4%) were present at the birth in the intervention compared to control group (52.9%) p=0,034.

V. CONCLUSION

Preliminary analysis shows that some important differences among those who received the message and positive results of the compliance of women to prenatal care. This low cost technology can be applied to other environment where mobile phone is available and can collaborate to the improvement of maternal health.

TABLE I
SOCIO DEMOGRAPHIC CHARACTERISTICS AND REPRODUCTIVE HISTORY, PRENACEL STUDY, 2015-16

| | Intervention Group | | Control Group | | |
	Total [1] (n=770)	PRENACEL [2] (n=116)	(n=440)	p-value (AIT)	p-value (APP)
Age					
18 - 19	86 (11.5%)	8 (6.9%)	46 (10.6%)	0.7624	0.2027
20 - 24	228 (30.4%)	37 (31.9%)	138 (31.9%)		
25 - 29	220 (29.3%)	44 (37.9%)	125 (28.9%)		
30 - 34	131 (17.4%)	18 (15.5%)	66 (15.3%)		
>= 35	86 (11.5%)	9 (7.8%)	57 (13.2%)		

| | Intervention Group | | Control Group | | |
	Total [1] (n=770)	PRENACEL [2] (n=116)	(n=440)	p-value (AIT)	p-value (APP)
Missing values	19	0	8		
Marital Status					
Living with a partner	609 (81.2%)	103 (88.8%)	345 (80%)	0.6835	0.0417
Not living with a partner	141 (18.8%)	13 (11.2%)	86 (20%)		
Missing values	20	0	9		
Schooling (years)					
< 4	29 (3.9%)	1 (0.9%)	14 (3.3%)	0.3027	0.1786
5-9	289 (38.9%)	41 (35.3%)	145 (34.1%)		
10-12	384 (51.7%)	63 (54.3%)	244 (57.4%)		
> 12	41 (5.5%)	11 (9.5%)	22 (5.2%)		
Missing values	27	0	15		
Paid work					
Yes	387 (53.1%)	56 (48.7%)	213 (52.3%)	0.8525	0.5267
No	342 (46.9%)	59 (51.3%)	194 (47.7%)		
Missing values	40	1	33		
Social Class					
A/B1-B2	64 (10.1%)	6 (5.6%)	51 (14.7%)	0.0002	0.0219
C1- C2	359 (56.8%)	70 (65.4%)	222 (64.2%)		
D-E	209 (33.1%)	31 (29%)	73 (21.1%)		
Missing values	138	9	94		
Colour					
White	281 (37.4%)	44 (37.9%)	177 (41.3%)	0.6643	0.7461
Mulattos	372 (49.5%)	60 (51.7%)	201 (46.9%)		
Black	88 (11.7%)	11 (9.5%)	46 (10.7%)		
Asian	8 (1.1%)	0 (0%)	3 (0.7%)		
Native	2 (0.3%)	1 (0.9%)	2 (0.5%)		
Missing values	19	0	11		
Previous Pregnancies					
0	241 (32.3%)	37 (31.9%)	146 (34.4%)	0.6246	0.9267
1	244 (32.7%)	37 (31.9%)	124 (29.2%)		
2	118 (15.8%)	19 (16.4%)	66 (15.6%)		
3 or more	143 (19.2%)	23 (19.8%)	88 (20.8%)		
Missing values	24	0	16		
Previous Births					
0	287 (38.5%)	45 (38.8%)	170 (40.1%)	0.4902	0.3707
1	241 (32.3%)	37 (31.9%)	130 (30.7%)		
2	128 (17.2%)	23 (19.8%)	63 (14.9%)		
3 or more	90 (12.1%)	11 (9.5%)	61 (14.4%)		
Previous Abortions					
0	619 (83%)	525 (83.3%)	94 (81%)	0.539	1
1 or more	127 (17%)	105 (16.7%)	22 (19%)		
Family Planning					
Wanted pregnancy	302 (43.1%)	58 (51.8%)	160 (41.7%)	0.6848	0.0734
Unwanted pregnancy	398 (56.9%)	54 (48.2%)	224 (58.3%)		
Missing values	70	4	56		
Pregnancy Risk					
Low risk	475 (67.6%)	77 (67%)	279 (71.5%)	0.1966	0.4063
High risk	228 (32.4%)	38 (33%)	111 (28.5%)		
Missing values	67	1	50		
Prenatal Care*					
yes	686 (89.1%)	112 (96.6%)	373 (84.8%)	0.0361	0.0013
no	84 (10.9%)	4 (3.4%)	67 (15.2%)		
Behaviour factors					
Smoking	89 (12.6%)	12 (10.3%)	59 (15.1%)	0.2807	0.2539
Alcohol	140 (19.8%)	14 (12.1%)	66 (16.9%)	0.273	0.2699
Drug use	14 (2%)	0 (0%)	17 (4.3%)	0.0345	0.017
Missing values	62	0	49		

[1] Includes all women from the cluster intervention
[2] Includes only women who received PRENACEL
* At least six visits to the clinic during prenatal care

TABLE II
SAMM AMONG WOMEN PARTICIPATING OF PRENACEL STUDY, 2015-16

| | Intervention Group | | Control Group | | |
	Standard PNC (n=659)	PRENACEL (n=116)	(n=443)	p-value	p-value
SAMM					
Yes	59 (9%)	3 (2.6%)	36 (8.1%)	0.632	0.037
No	600 (91.0%)	113 (97.4%)	407 (91.9%)		

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