Factors associated with pregnant women's participation in a mHealth intervention in Timor-Leste

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Abstract

Background:

Mobile health (mHealth) programs have become increasingly popular as a method of harnessing the power of technology to improve health, yet there remains a deficit of rigorous analyses to determine the uptake and effectiveness of these initiatives. This study aims to contribute to a better understanding of the potential impact of mHealth for improving maternal and newborn health as part of an evaluation of a mobile phone project called *Liga Inan* in Timor-Leste. We analyze demographic and service utilization factors that are associated with women's participation or non-participation in the project to explore what barriers might prevent women from enrolling in such programs. We also analyze the extent to which women's enrollment is associated with utilization of maternal health services.

Methods:

A total of 315 women ages 15-49 who had a child under two years old were surveyed in Manufahi municipality of Timor-Leste in 2015. The survey included knowledge, practices, and health services coverage information, including questions on antenatal and postpartum care, birthing practices, and postpartum care, as well as information about mobile phone ownership and usage. Bi-variate and multi-variate logistic regression models were used to examine the association of enrollment of eligible women in the mHealth program with key demographic variables and maternal health service utilization.

Findings:

Women who were wealthiest (Odds Ratio [OR]: 2.2, 95% Confidence Interval [CI]: 1.1-4.3), had less than 5 children (OR: .37, CI: .16-.81), and could read (OR: 2.5, CI: 1.2-5.2) were significantly more likely to enroll in the program. There was no association between program enrollment and woman's age, the distance from nearest health facility, phone ownership, or phone reception in the home. Controlling for wealth, literacy, and parity, enrollment was positively associated with attendance at four antenatal care visits (OR: 3.7, CI: 1.8-7.3), having a skilled birth attendant present at delivery (OR: 3.1, CI: 1.7-5.7), and giving birth in a health facility (OR: 2.0, CI: 1.0-3.9). No significant association was found between enrollment and receiving postpartum or postnatal care within two days of the birth.

Conclusion:

Our study found that women who were poorest, were unable to read, or had many children encountered barriers making them less likely to participate in an mHealth program in Timor-Leste. Other mHealth programs may need to take extra steps to reach out to such women so that they too can benefit from the critical health services being promoted. By contrast, certain groups expected to participate at lower rates overcame barriers to participation, including women who were older, lived far from a health facility, did not own their own phone, and did not have reception in their home. Finally, we found that enrollment in this mHealth program was associated with substantial benefits to participants, including an increased likelihood of attending at least four antenatal care visits, utilizing a skilled birth attendant, and giving birth in a health facility. Barriers to women's enrollment in mHealth programs should be addressed to maximize the benefit to all women.

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Introduction

Mothers, children, and the human processes of birth and parenting are expressly protected in the Declaration of Human Rights and Convention of the Rights of the Child.[1,2] The Millennium Development Goals also identified improving global maternal and child health (MCH) as important priorities.[1] Yet, despite the importance placed on MCH, almost 290,000 women died in pregnancy and childbirth in 2013, and 6.3 million children under five years old died in the same year – 44% of whom were in the postnatal period of the first 28 days after birth.[3,4] Almost all (nearly 99%) of these deaths occur in low- and middle-income countries (LMICs), and most of them are preventable with proper care and treatment.[5–7]

Primary causes of maternal mortality include severe bleeding, infections, pre-eclampsia and eclampsia, complications during delivery, and unsafe abortions.[5,8] Primary causes of infant mortality include infections, pre-term delivery, and birth asphyxia.[6] Mortality from these conditions can be dramatically reduced by providing adequate antenatal care, delivering with a skilled birth attendant present, and delivering in a health facility.[5,6] However, in most LMICs only 40% of pregnant women receive the recommended four antenatal care visits with a skilled health worker, and 50% of mothers and newborns do not receive skilled care during birth and in the postpartum period.[5,6] Addressing these issues could do much towards ending unnecessary mortality among women and children.[5,9]

One potential avenue for increasing connections between mothers and skilled health workers is offered by the proliferation of mobile technology worldwide. With half of the global population estimated to own a mobile phone in 2014, health professionals have turned to mobile platforms as an avenue for health messaging to impact services utilization, promote behavior change, and provide other essential health communication.[10] These new mobile health (mHealth) projects are increasingly abundant, and may offer promise for improving maternal and child health indicators worldwide.

Studies have shown the potential of mHealth to impact health behaviors, knowledge, and interaction with health workers and facilities in a variety of geographical locations. A 2014 study in Ethiopia of 510 respondents who participated in an mobile video show found higher recall of MCH information after the videos were shown.[11] A 2010 study of 280 women and 544 children in Thailand found after an intervention using smart phones, women attended more antenatal care (ANC) visits and children's immunization appointments on schedule.[12] Lester et al (2010) conducted a randomized controlled trial with 538 participants showing that mobile phone program participation improved ANC attendance in Zanzibar.[13] In the United States, a 2013 study found psychological benefits and improved health communication with providers among 20 low-income pregnant women participating in a text message system.[14] Meta-analyses have also found evidence that mHealth projects show promise for influencing health behavior change, including antiretroviral therapy adherence, smoking cessation, and increasing physical activity.[15,16] Reviews have also noted that some programs have used text messaging notifications and reminders to produce a reduction in missed appointments, reduction in time to patient notification of diagnosis, and reduction in time to initiation of patient treatment.[17]

Despite these examples of success, many other analyses warn that mHealth approaches can have significant shortcomings. Noordam et al (2011) note that the improved communication provided by cell phones and other technology is only one of many approaches needed to improve MCH services.[18] Other diverse studies note that there is a paucity of evidence with regards to the effectiveness of mHealth programs, and that many lack sufficient monitoring and evaluation components as well as frameworks for adoption, theories of change, and sustainability.[19–23] One study from 2013 even found that an intervention in Uganda had the opposite of the intended effect – those who participated in an mHealth sexual information texting service saw an increase in risky sexual behavior, and "no shift in perception of norms."[24]

An added concern is that mHealth programs may exclude some of the women and infants most at risk of mortality due to common postnatal, postpartum, and birth emergencies, that occur in poorer and more rural populations.[21,25] As Nie et al found in a 2014 study in Timor-Leste, "Women with a mobile phone were more likely to utilize maternal and newborn health services than women without a mobile phone. Mobile phone ownership in this population [of women in Timor-Leste] is highly associated with socioeconomic status." [26] Jennings et al also found in a 2015 study in Nigeria that women with poorer health knowledge and less tendency to seek out health care services are also less likely to have phones, and drew the conclusion that women with the greatest health needs are excluded from mHealth programs.[27]

These findings indicate that when mHealth strategies are employed, they be need to be designed with extra caution, thought, and rigor, to avoid reproducing inequities or offering inaccessible services. If there is hope to achieve the Sustainable Development Agenda goal of reducing the maternal mortality from the current ratio 216 per 100,000 to less than 70 per 100,000 globally, we must design mHealth interventions that can effectively reach those women and children in the poorest and most remote settings.[5,9]

This study aims to expand understanding of uptake and effectiveness of mHealth programs for maternal and child health by exploring an mHealth program in Timor-Leste. We examine the extent to which demographic and other factors are associated with a woman's likelihood of enrolling in the program, as well as the utilization of health services for women who were and were not enrolled. This information can contribute to an improved understanding of the potential effects of this mHealth program in Timor-Leste and can also assist in the development and targeting of novel mHealth interventions in other settings so that they reach the populations most in need.

Methods

Study Setting & Design

Timor-Leste, an island nation north of Australia, is one of nine countries that had a maternal mortality ratio (MMR) of greater than 100 per 100,000 live births in 1990 that is reported to have achieved Millennium Development Goals 5 by 2015.[9] According to the 2009/2010 Demographic and Health Survey, the country had one of the highest maternal mortality ratios in the world, at 557 per 100,000 live births, and one in 16 children died before reaching the age of

five.[28] In 2010, fully 86% of women received at least one antenatal care (ANC) visit with a skilled health provider, but only one in five women delivered in a health facility and only 30% of births were attended by a skilled provider.[28] Furthermore, 68% of women did not receive a postpartum care visit.[28] In the mountainous central region of Timor-Leste, connecting women to the health system is difficult because many families live far from roads and transportation is often unavailable.[28]

In order to address these gaps, Health Alliance International (HAI) partnered with Catalpa International and the Ministry of Health of Timor-Leste to implement a program called *Liga Inan*, meaning "Connecting Mothers" in the local language.[29] The program connects pregnant women and their midwives via a mobile phone system that includes regular text messages and facilitated voice communication. The program was launched in 2013 in one municipality, Manufahi, and three other municipalities in the two subsequent years. As of April 2016 over 9,000 pregnant women had been enrolled.[30] If expansion to other municipalities continues as anticipated, *Liga Inan* will be implemented in 12 of 13 municipalities by 2018.[30]

Midwives are trained to enroll women in *Liga Inan* when they attend their first ANC visit. Once enrolled, pregnant women are sent automated health information messages twice a week that are tailored to the gestational stage of their pregnancy. Women can send personal messages to their midwife, and midwives can also send personalized messages to their patients and are expected to call three weeks prior to the woman's estimated delivery date to discuss birth planning.[29] Twice-weekly messages continue for six weeks after the baby's birth.

A baseline survey was conducted in 2012 before the program was launched in the intervention municipality, Manufahi. A neighboring municipality, Ainaro, served as a comparison where *Liga Inan* was not implemented. A follow-up survey was completed in 2015 in both municipalities. The surveys assessed knowledge, practices, coverage of maternal health services, and was based on USAID's Rapid CATCH (Core Assessment Tool on Child Health) questionnaire.[31,32] Survey topics included demographic information, antenatal and postpartum care, birthing practices, postpartum care, child spacing and contraceptive use, *Liga Inan* program participation, as well as information about mobile phone ownership and usage.[31] This analysis focuses on the 2015 survey of women in Manufahi, which was conducted after at least two years of *Liga Inan* program implementation in all areas of that municipality.

Sample Size and Data Collection

The survey was conducted using cluster sampling, stratified at the sub-municipality level. From each of the four sub-municipalities in Manufahi and Ainaro, it was planned that eight Enumeration Areas (EAs) were to be sampled randomly according to population size, with nine women randomly chosen from each EA.[31] The same process was followed for the pre-intervention survey in February and March of 2012 and the post-intervention survey in September and October of 2015.

However, because inclement weather in 2012 rendered some selected areas in Manufahi inaccessible, three different EAs from the same sub-municipality were sampled. In 2015, the inaccessible areas were added. This analysis of data from the 2015 survey in Manufahi utilizes the entire sample, which includes three sub-municipalities from which eight EAs of nine women

each were sampled, and one sub-municipality from which 11 EAs of nine women each were sampled, for a total of 315 women (Table 1).

Within each EA, hamlets, called *aldeias,* were sampled according to population size. Within each *aldeia*, a starting household was chosen by numbering all households and then randomly drawing a number to choose the first house to visit. The survey team then went to the nearest visible doors from that of each house until they had completed the sample for that EA.

Women were eligible for inclusion if they had a child under 24 months old at the time of the survey and were between the ages of 15 and 49. If a woman who fit that description was out of the house when the survey team visited, they would return if possible at a later time to obtain an interview. The survey questionnaire was tested in the field, and interviewers used the local language of Tetun to conduct all surveys.[31] Informed consent was obtained from each woman before conducting the survey, and refusals were rare.[31]

Data Analyses

Data analyses consisted of two parts: first, we examined the association between certain variables and enrollment in the program and second, the association of enrollment with maternal health behaviors. We began by tabulating the data to determine variable classifications. Then, we conducted bivariate models adjusted for clustering at the sub-municipality level, to explore at the association between certain variables and enrollment. We then created a multivariate logistic regression model that included all the variables that were statistically significant in their bivariate analysis. Next, we conducted a bivariate analysis of the association between enrollment and utilization of maternal health services, adjusting for clustering at the sub-municipality level. Finally, we developed multiple logistic regression models that included covariates that were of particular interest after the bivariate analysis done in the first part of the analysis.

For both parts of the analysis, the association between the exposure and outcome variables was explored using logistic regression. All analyses were conducted using Stata 13.0 and an alpha value of 0.05. Bi- and multi-variable associations were assessed using logistic regression models with a fixed-effect adjustment for sampling clusters.

Explanation of Outcome and Exposure Variables

We examined the association between demographic variables of interest and whether a woman had enrolled in *Liga Inan* or not, to assess possible barriers to enrollment. We included only women in this analysis who had attended at least one antenatal care (ANC) visit, which is when women enroll in *Liga Inan*. Women were not excluded for lack of cell phone ownership in their household, even though the intervention is delivered through a mobile phone, because we noted that six women enrolled in the program despite not having a cell phone in their home. See Figure 1 for the study inclusion profile.

Exposure variables examined included: age, parity, travel time to the nearest health facility, literacy, whether or not a woman owned her own cell phone (as opposed to a communal or shared phone), whether a woman had cell reception without leaving her house, and household wealth. The first four exposure variables were grouped into categories and the next three were binary. The household wealth variable was created using principal component analysis from questions about household items of value and floor and ceiling construction of the woman's

home, in a method consistent with other studies constructing wealth indices where direct measures were not feasible.[33–35]

For the second part of the analysis, the exposure variable was enrollment, and the outcome variables were utilization of health services, including: attendance at four antenatal care visits, having a skilled birth attendant present at delivery, delivery in a health facility, mother postpartum care within two days of giving birth, and infant postpartum care within two days of birth.

Ethical Considerations

HAI received Internal Review Board approval for the survey from the University of Washington Human Subjects Division and from the National Institute for Health of Timor-Leste.

Results

A total of 315 women participated in the survey; 19 (6%) were excluded from this analysis because they did not attend any ANC visits and were therefore not able to enroll in the program. Of those who attended at least one ANC visit, 203 (69%) enrolled in the program. Seventy-nine (27%) said they did not enroll, and 14 (5%) were unsure or the enrollment data response was missing. See Figure 1 for study inclusion profile.

Characteristics of women in the sample

The mean age of participants was 27, with the youngest 17 and the oldest 47. About half of women had two to four children (53%; n=148), while about one fourth of women had one child (25%; n=70) and nearly one fourth had five or more (23%; n=64) (see Table 2). Eighty-seven percent (n=246) of the women in the sample could read. Women were split approximately into wealth categories of low, middle, and high, according to the process described in the data analysis section. Sixty-four percent (n=178) of women lived one hour or less in travel time from the nearest health facility to their home.

Ninety-six percent (n=271) of respondents reported that they had a cell phone in their household. Of those women, 88% (n=237) said they had their own phone rather than the use of a shared family phone. Ninety-four (n=251) percent of women said they had reception in their home.

In our sample, we included only women who had attended at least one antenatal care visit. Eighty-three percent of women attended at least four antenatal care visits (Table 3). Over half of the women (58%) had a skilled birth attendant present when they delivered their baby; 37% gave birth in a health facility. Forty-four percent of women had a postpartum care exam within two days of delivery, while 41% of their babies received a postnatal care check within two days of birth.

Association of sample characteristics with enrollment

On bivariate examination, three of the characteristics of the women were significantly association with enrollment (Table 2). Women who were enrolled in *Liga Inan* had .37 lower odds of enrolling if they had five or more children compared women with only one child (95% Confidence Interval [CI]: .16-.81). If they could read Tetun, they had 2.5 times higher odds of

enrolling than if they could not (CI: 1.2-5.2). Women also had a 2.16 times higher odds of enrolling if they were in the wealthiest tertile of the population (CI: 1.1-4.3) compared to the lowest tertile. Variables that were not significantly related to women's enrollment were age, facility travel time, whether or not women owned their own phone, and whether or not they had reception in their home.

We then created a multivariate model that adjusted for all the variables that were significantly associated with enrollment in bivariate models, including: parity, literacy, and wealth. When including all these variables in the model, two factors retained statistical significance: women who had five or more children were less likely to be enrolled, compared to women with one child (Adjusted Odds Ratio [aOR] = .43; CI: .83-.98) and women who were in the highest wealth quintile were more likely to be enrolled, compared to women in the lowest wealth quintile (aOR = 2.0, CI: 1.0-4.1).

Association of enrollment with health services utilization

In bivariate examination of five indicators of utilization of health services among women who did and did not enroll in *Liga Inan*, three were positively and significantly related to enrollment. Women enrolled in the program had 3.4 times the odds of attending four antenatal care visits than those not enrolled (95% CI: 1.8-6.4), 4.0 times the odds of using a skilled birth attendant (95% CI: 2.2-7.1), and 2.7 times the odds of giving birth in a health facility rather than at their home (95% CI: 1.4-5.1).

After adjusting for parity, literacy, and wealth, women who were enrolled in the program retained higher odds of attending four antenatal care visits (OR = 3.7; 95% CI: 1.8-7.4), having a skilled birth attendant (OR = 3.1; 95% CI: 1.7-5.7), and giving birth in a facility (OR = 2.0; 95% CI: 1.0-4.0).

Discussion

Our study found that pregnant women in Timor-Leste were less likely to enroll in a novel maternal mHealth program if they had more children, were unable to read, or were from a poorer family. In contrast, age, distance from the nearest health facility, whether or not a woman owned her own phone, and whether or not women had reception in their home did not appear to be significant barriers to enrollment. Enrollment in the *Liga Inan* program was associated with higher subsequent utilization of health services, including attending four antenatal care visits, having a skilled birth attendant present at delivery, and giving birth in a health facility, but was not associated with receiving postpartum or postnatal care within two days of the birth.

Our findings indicate that some factors hypothesized to be barriers to uptake of mHealth programs were not barriers in the case of the *Liga Inan* progam. Women's age, distance from the nearest health facility, whether or not she owned her own phone, and whether or not she had phone reception in her home were not associated with enrollment – or non-enrollment – in the program. In fact, six women enrolled in the program despite not having a phone in their household. Separate programmatic assessments found that these women enrolled in the program were using phones that belonged to close neighbors, friends or family. This is an important finding, as other studies have found that mobile phone ownership is correlated with women who

are already more likely to seek health services and come from higher socioeconomic households.[26,27] Our findings indicate that even without a mobile phone, women can be engaged in mHealth programs. Women who live a considerable distance from health facilities can be included, as well as older women. The *Liga Inan* mHealth program was effective at including some typically more difficult to reach groups. This could have been due in part to intensive program outreach and marketing at the community level, including events with local village leaders, posters, and staff devoted to program implementation and outreach.

However, we did identify some barriers to women's participation in this mHealth program. If a woman had more children, was unable to read, and was from a poorer household, she was less likely to enroll. These results confirm a potential health equity issue with mHealth programming: women who are the most in need of services may be least likely to engage with mHealth programs. Other studies have noted these issues. Vesel et al (2015) bring up concerns about access and equity in their review of mHealth programs, and Noordam (2011) also cites literacy as a barrier to accessing mHealth programs, particularly for women. [18,36] If mHealth programs are to achieve their promise of improving health outcomes for women in LMICs, careful planning must be undertaken to ensure that the most vulnerable women are able to participate. For example, such programs could take extra steps to reach out to women who are poorer, and to identify community resources that would facilitate their participation. Program design could consider ways to be accessible to women who cannot read, by engaging family members who may be literate. During recruitment, programs could emphasize benefits of the program to a woman even if she has already given birth to many children.

In addition to questions of accessibility of mHealth programs, it is also important to determine the benefits to participants of mHealth programs. An objective of the *Liga Inan* program was to increase health services utilization, thus improving women's connection with the health system and subsequent health outcomes. We found that women's participation in the program was associated with a substantially higher likelihood of their attending four antenatal care visits, having a skilled birth attendant present when they delivered, and giving birth in a health facility. These results are consistent with previous findings, which have shown that mHealth interventions can impact health behavior change.[12,13,15,16,37,38] Our study adds to this literature suggesting that carefully designed interventions can impact health seeking behaviors among participants.

Program participation in this study, however, was not associated with whether women received postpartum care within two days of delivery or whether their baby received a postnatal checkup within two days of birth. This was the case despite the strong association between postnatal and postpartum care and having a skilled birth attendant present and giving birth in a facility (see supplementary Table 4). The WHO points out that this postnatal period - the first four weeks after birth – is when most maternal and infant deaths occur, yet this period is also the most often-missed opportunity for care in LMICs.[39] Rates of postnatal care within two days were relatively low in Timor-Leste (32%), so the fact that program enrollment is not associated with increase in utilization of those services is a concern.[28] Further exploration of approaches to increasing postnatal and postpartum care in Timor-Leste could clarify this gap in program effects.

Limitations

There were limitations to our study. The finding that women who enrolled in the program were more likely to utilize certain health services could be either because a) women who are more likely to use health services are also more likely to enroll in health programming or b) women who enrolled were more likely to utilize health services because of their participation in the program. However, the exclusion of women who did not attend any antenatal care visits helps correct for this bias, because all women included in this study had utilized at least one maternal health service, ANC.

Another potential limitation of the study is sample size. Some of our variables had small numbers of women in some categories of interest, which could lead to a failure to reject the null hypothesis when there is truly an effect present (type II error or false negative).

Conclusions

As mHealth programs increase in popularity, it is essential to understand potential barriers to participation as well as to assess the benefits they provide to participants. This evaluation of *Liga Inan* demonstrates that mHealth programs can be inclusive of most women, and have the potential to improve the use of maternal health services. However, future mHealth programs should be attentive to potential barriers to enrollment in the design phase in order to maximize participation and benefits to all women in the communities served.

Acknowledgements

We would like to express gratitude to the women and their households who participated in the study, and the Ministry of Health of Timor-Leste.

Table 1: Manufahi sample in 2015 survey

Subdistrict	Number of EAs	Number of women
Alas	8	72
Fatuberliu	11	99
Same	8	72
Turiscai	8	72
Total	35	315

Figure 1: Study inclusion profile

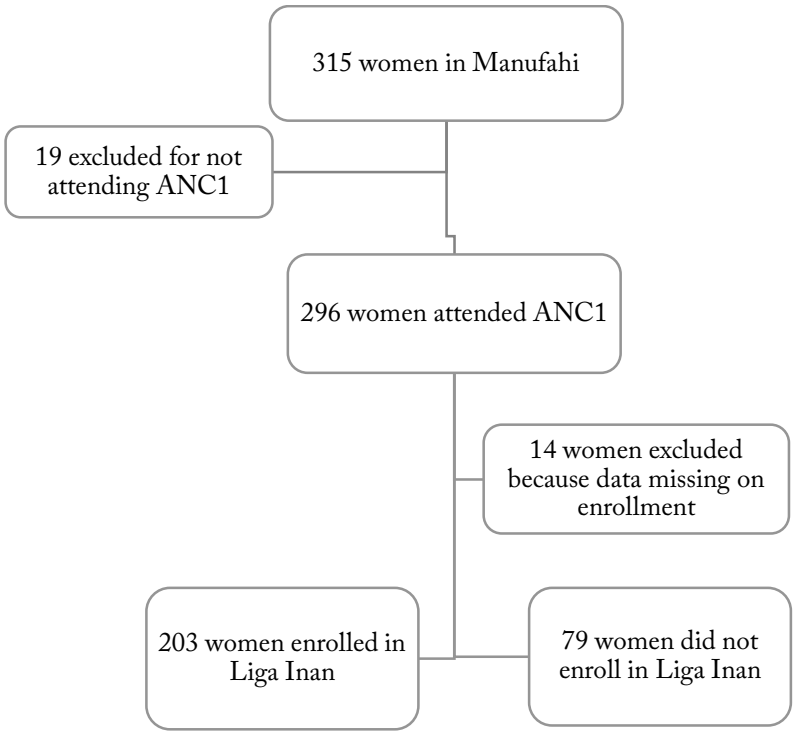

Table 2: Association of sample characteristics with enrollment among 282 women eligible for enrollment into an mHealth program in Manufahi, Timor-Leste, 2015

Exposure	Total n (%)	Enrolled n (%)	Did not Enroll n (%)	Bivariate OR* (95% CI)	p-value	Adjusted OR** (95% CI)	p-value
Total		**203 (72)**	**79 (28)**				
Age	Total: 282			Global test for significance:	.79		
20 and under	32 (11)	25 (78)	7 (22)	ref	ref	-	-
20-25	89 (32)	63 (71)	26 (29)	.73 (.28-1.9)	.53	-	-
26-30	87 (31)	62 (71)	25 (29)	.72 (.27-1.9)	.51	-	-
31-35	47 (17)	37 (79)	10 (21)	1.1 (.35-3.2)	.91	-	-
36 and over	27 (9.6)	16 (59)	11 (41)	.42 (.13-1.3)	.13	-	-
Parity	Total: 282			Global test for significance:	.047		
1 child	70 (25)	57 (81)	13 (19)	ref	ref	ref	ref
2-4 children	148 (53)	106 (71)	42 (28)	.58 (.29-1.7)	.13	.57 (.28-1.2)	.12
5 or more children	64 (23)	40 (63)	24 (38)	**.37 (.16-.81)**	**.014**	**.43 (.83-.98)**	**.046**
Literacy	Total: 282						
no	36 (13)	20 (56)	16 (44)	ref	ref	ref	ref
yes	246 (87)	183 (74)	63 (26)	**2.5 (1.2-5.2)**	**.015**	1.8 (.83-4.0)	.13
Wealth Index	Total: 279	201 (72)	78 (28)	Global test for significance:	.084		
low	101 (36)	66 (65)	35 (35)	ref	ref	ref	ref
middle	93 (33)	67 (72)	26 (28)	1.5 (.79-2.7)	.23	1.3 (.68-2.4)	.44
high	85 (31)	68 (80)	17 (20)	**2.2 (1.1-4.3)**	**.027**	**2.0 (1.0-4.1)**	**.046**
Health Facility Travel Time	Total: 278	200 (71)	78 (28)	Global test for significance:	.23		
<30 min	78 (28)	57 (73)	21 (27)	ref	ref	-	-
30-60 min	100 (36)	78 (78)	22 (22)	1.3 (.63-2.6)	.50	-	-
61-120 min	60 (22)	38 (63)	22 (37)	.60 (.28-1.3)	.18	-	-
Over 120 min	40 (14)	27 (68)	13 (33)	.79 (.33-1.9)	.59	-	-
Household Phone Ownership	282						
no	11 (3.9)	6 (55)	5 (46)	ref	ref	-	-
yes	271 (96)	197 (73)	74 (27)	2.1 (.61-7.2)	.24	-	-
Woman's Personal Phone Ownership	Total: 271	197 (73)	74 (27)				
no	34 (13)	22 (65)	12 (35)	ref	ref	-	-
yes	237 (88)	175 (74)	62 (26)	1.5 (.67-3.2)	.34	-	-
Cell Reception	Total: 268	196 (73)	72 (27)				
no	17 (6)	13 (77)	4 (24)	ref	ref	-	-
yes	251 (94)	183 (73)	68 (27)	.75 (.23-2.4)	.63	-	-

**Adjusted for cluster effect of sub-municipalities*
**Adjusted for parity, literacy, and wealth and cluster effect of sub-municipalities*

Table 3: Association of enrollment with health services utilization among 282 women eligible for enrollment into an mHealth program in Manufahi, Timor-Leste, 2015

	Total n (%)	Enrolled n (%)	Did not Enroll n (%)	Bivariate OR* (95% CI)	p-value	Adjusted OR** (95% CI)	p-value
Total		**203 (72)**	**79 (28)**				
ANC4	Total: 282						
no	49 (17)	24 (49)	25 (51)	ref		ref	
yes	233 (83)	179 (77)	54 (23)	**3.4 (1.8-6.4)**	**<.001**	**3.7 (1.8-7.4)**	**<.001**
SBA	Total: 282						
no	118 (42)	67 (57)	51 (43)	ref		ref	
yes	164 (58)	136 (83)	28 (17)	**4.0 (2.2-7.1)**	**<.001**	**3.1 (1.7-5.7)**	**<.001**
Facility Delivery	Total: 282						
no	178 (63)	117 (66)	61 (34)	ref		ref	
yes	104 (37)	86 (83)	18 (17)	**2.7 (1.4-5.1)**	**<.001**	**2.0 (1.0-3.9)**	**.038**
PPC 2 days	Total: 282						
no	157 (56)	106 (68)	51 (33)	ref		ref	
yes	125 (44)	97 (78)	28 (22)	1.7 (.96-2.9)	.073	1.4 (.82-2.5)	.21
PNC 2 days	Total: 280	202 (72)	78 (28)				
no	165 (59)	112 (68)	53 (32)	ref		ref	
yes	115 (41)	90 (78)	25 (22)	1.7 (.99-3.0)	.053	1.6 (.90-2.8)	.11

**Adjusted for cluster effect of sub-municipalities*
**Adjusted for parity, literacy, and wealth and cluster effect of sub-municipalities*

Table 4: Association between postnatal and postpartum care and having a skilled birth attendant present and giving birth in a facility among 282 women eligible for enrollment into an mHealth program in Manufahi, Timor-Leste, 2015

Exposure	Outcome	OR (CI)	p-value
SBA	PPC2	**11 (5.8-19)**	**<.001**
SBA	PNC2	**14.0 (7.3-27)**	**<.001**
Facility Delivery	PPC2	**8.2 (4.6-15)**	**<.001**
Facility Delivery	PNC2	**13 (6.9-25)**	**<.001**

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