



Evaluation of the Liga Inan Pilot program in Manufahi Municipality

Implementation and Impact results from a Knowledge, Practice, and Coverage Survey

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Health Alliance International



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Background

In September 2011, Health Alliance International (HAI) was awarded funding by USAID to implement a maternal and newborn care project in two municipalities of Timor-Leste, Manufahi and Ainaro. The goal of the project was to reduce maternal and neonatal morbidity and mortality by improving the health and care-seeking behavior of pregnant women and improving the quality of maternal health services delivered through the government health system. The program had three key approaches: 1) to support health volunteers (PSFs) to promote demand for skilled birth attendance and improved maternal behaviors through home visiting; 2) to improve and support the skills of district midwives to provide basic emergency obstetric care; and 3) to design and implement Timor-Leste's first ever mHealth program to provide health messages to pregnant women and connect them to their midwife. The overarching theme has been one of connection: connecting the community to important health information, connecting health staff to training and coaching on critical clinical skills, and connecting midwives to pregnant women through mobile phone technology. The first two approaches were carried out equally in both Manufahi and Ainaro Municipalities while the mHealth innovation was only implemented in Manufahi.

The mHealth component, called Liga Inan ("connecting women" in the local Tetun language) was developed in partnership with Catalpa International (a not-for-profit software development and services firm) and was launched in Manufahi Municipality in early 2013. Liga Inan includes an innovative approach to connecting pregnant women to health information and with midwives who serve them by means of mobile phones, both through text messaging and facilitated voice communication. Rapidly growing ownership of mobile phones, even by relatively impoverished families, makes mobile technology a viable option for delivering health information and improving use of services, such as delivery with a skilled provider and in a health facility.

KEY FEATURES OF THE LIGA INAN MHEALTH PROGRAM

- **Registration:** MoH health staff are trained to register pregnant women at their first antenatal care visit; pregnant women are registered into the Liga Inan system using their mobile phone number
- **SMS (text) messages:** Pregnant women receive twice weekly SMS messages with health information relevant to their stage of pregnancy, continuing until the baby is 6 weeks old (soon to be expanded to 6 months)
- **Community messages:** Midwives can send SMS announcements or broadcast messages to all pregnant women registered in their catchment area, such as anticipated absences from health posts or reminders about SISCa outreach health services
- **Liga Hau (Call me):** Pregnant women who have questions or concerns can use this function to request a call from their midwife

- **Follow-up:** Midwives are prompted by the Liga Inan service to call all pregnant women three weeks before their estimated due date to check on the families' preparation and planning for delivery
- **Emergency:** Pregnant women can find emergency telephone contact information on a sticker placed in their mother and child booklet by their midwife during Liga Inan registration

WHO IMPLEMENTS LIGA INAN?

Government midwives are the main implementers of the Liga Inan program and are responsible for registering women into the program at their first antenatal (ANC) visit and interfacing with other Liga Inan service features. Doctors are also implementers in health posts where there is no midwife. Clinic managers play a key role in mobilizing emergency transport and managing health staff to ensure that the program runs smoothly. Between 2013 and 2015, HAI and Catalpa trained 36 health staff in Manufahi in how to register and interact with women through the Liga Inan service and use the features effectively. The program has been operating in 10 health facilities. Each facility is provided with one smart phone and monthly phone credit dedicated to the Liga Inan program. Annual review meetings were held each year for all municipality health staff engaged in the Liga Inan program to refresh training, examine relevant data, and share program implementation successes and challenges.

LIGA INAN RESEARCH HYPOTHESES AND OBJECTIVES

The hypotheses we are testing are: pregnant women in the active Liga Inan program municipality (Manufahi) will be more likely than women prior to the Liga Inan launch and than women in the control municipality (Ainaro) to: 1) have increased maternal health knowledge; 2) adopt recommended home care behaviors, 3) seek assistance from a health care provider before, during and after delivery, and 4) go to a health facility for their delivery.

Research objectives were as follows:

1. To determine whether the potential exposure of women to the Liga Inan program in Manufahi Municipality is independently associated with significant improvements in maternal health knowledge and home care behaviors, compared to women in the same municipality at baseline and to women in the control municipality (Ainaro).
2. To determine whether the potential exposure of women to the Liga Inan program in Manufahi Municipality is independently associated with significant improvements in use of maternal health services, compared to women in the same municipality at baseline and to women in the control municipality (Ainaro).

This report describes the final survey and compares the results of that survey with baseline findings, as well as with findings in the control area, to identify changes in key program indicators that have occurred since the launch of the Liga Inan mHealth program.

Methods

HAI developed an operations research plan to evaluate the effects of the Liga Inan program on maternal knowledge and behaviors. The design included intervention and control municipalities with a baseline and final Knowledge, Practice and Coverage (KPC) survey comparing pre- and post-intervention time periods. The Liga Inan mHealth intervention was carried out only in Manufahi Municipality; Ainaro served as the control site where the mHealth program was not implemented. HAI carried out the baseline KPC survey in 2012 prior to launching Liga Inan; the final survey was conducted in 2015 after Liga Inan had been operational in Manufahi in all Administrative Posts for at least two years.

QUESTIONNAIRE DEVELOPMENT

The 2012 baseline survey questionnaire was modeled on USAID's KPC Rapid Catch Survey, a standardized questionnaire used worldwide that includes questions on antenatal care, birthing practices, breastfeeding, postnatal care, child spacing, and contraceptive use. It was adapted by HAI to include additional questions on media and mobile phone ownership and use. The final survey questionnaire for 2015 was based on the baseline survey tool, with additional questions added related to the women's experience, if any, with the Liga Inan project. Both questionnaires were field tested and translated into the Tetun language. All interviews were conducted in Tetun.

SAMPLING DESIGN

The survey was conducted in both Ainaro and Manufahi Municipalities and employed stratified cluster sampling. The sample was stratified at the Administrative Post level and 8 Enumeration Areas (EA) were drawn from each Administrative Post using population data from the Timor-Leste 2010 Census. Nine women were interviewed from each EA.

All *aldeia* (hamlets) within each EA were sampled according to population size. Occasionally an alternate community was chosen when the first EA was 1) not accessible by road or was further than a 1 hour walk from a road, or 2) the originally selected *aldeia* did not contain enough participants. When the former occurred, a backup EA was randomly selected from within the same *suco* (village) from a list of accessible EA. When the latter occurred, the survey team continued with the next nearest *aldeia*.

After the *aldeia* was identified, the starting household was determined by one of two methods. For urban settings, all households were counted and two starting households were randomly selected. For rural settings, supervisors would identify the center of the community, and the two teams would follow as straight a line as possible in opposite directions indicated by the spun bottle (or pen) to the edges of the *aldeia*. As they walked, they would number the houses within ~15 feet from their path, and then use a random number to identify the initial house per team. For both methods, additional houses were identified as the nearest visible door from the doorway of the initial house.

SELECTION PROCESS AND CONSENT

Women were included in the survey if they were between the ages of 15-49 and had a child who was under 24 months old. If two women fit that description within one household, we interviewed the mother of the youngest child. If a woman meeting the selection criteria was absent from the house, the study team would return if possible. Informed consent was given by each participant and refusals were rare.

SURVEY TEAMS

Enumerators came from HAI staff as well as some hired short term interviewers. HAI staff served as field supervisors. Training took place for both baseline and final surveys over four days, and covered interviewing skills, random sampling, confidentiality and consent, and detailed review of the survey questionnaire. The interviews were conducted for baseline in February and March 2012 and for final survey in September and October 2015.

ETHICAL REVIEW

HAI received Internal Review Board (IRB) approval for baseline and final KPC surveys from both the University of Washington Human Subjects Division and the National Institute for Health in Timor-Leste.

DATA ENTRY AND ANALYSIS

Data entry was done using EpiInfo 7.0, and analysis was conducted using Stata Version 14 statistics package.

The results of this survey have been weighted to accommodate for differences in population size between Administrative Posts and between the Ainaro and Manufahi Municipalities. In the baseline survey, we were not always able to find 9 women to interview due to the small population size of some aldeias or inclement weather prohibiting a full day of interviewing. In these cases, we weighted the data within those Administrative Posts where cluster size was unequal. In the final survey we found 9 women in all 8 clusters in every Administrative Post so weighting within Administrative Posts was not needed. Because each Administrative Post has a different population size, municipality-level coverage rates were weighted by Administrative Post population sizes. Program area totals were weighted by the relative size of the two municipalities.

MULTIVARIATE ANALYSIS AND MODEL CONFIGURATION

The purpose of the multivariate analysis was to assess the extent to which potential exposure to the mHealth intervention – that is, giving birth in Manufahi after the launch of the mobile phone project – predicted improved maternal health knowledge and behaviors when compared to the previous time period and to those same outcomes in the comparison area, Ainaro. Analysis was by ‘intention to treat,’ meaning that the entire population of

women who gave birth in Manufahi during the intervention period was assessed for changes, not only women who were enrolled in the program.

To assess these effects we used multilevel mixed-effects logistic regression models separately for each knowledge and behavior outcome with a dichotomous response. The unit of analysis was the individual woman’s survey responses. The predictor of interest is the intervention delivered at the municipality level, where the outcome is women’s maternal health knowledge or behavior as measured both at the pre- and post-intervention periods. We adjusted for Administrative Post clustering of measurements by using random effects at the Administrative Post level in all models. Control variables considered in these models included age group (15-24, 25-29, 30-34, and 35+ years), years of education, and minutes of travel time to a health facility. For postpartum, postnatal, and early initiation of breastfeeding we added skilled birth attendance as a control variable.

For the logistic models, odds ratios are used to show the treatment effect, in other words the expected number of women who would have a given outcome for each woman not having that outcome. The odds ratios in these results thus indicate that a given effect of the intervention for women in Manufahi is x times greater than the same effect in Ainaro or in Manufahi prior to the intervention.

Main Outcomes

DEMOGRAPHIC AND HOUSEHOLD CHARACTERISTICS OF SURVEY PARTICIPANTS

Women in Manufahi and Ainaro Municipality were eligible to participate in both the 2012 and 2015 surveys if they were between the ages of 15-49 and had a child under the age of two. The average age of the survey population was very similar in the 2012 and the 2015 surveys. In 2015, the participants reported on average more schooling compared to 2012 in both Manufahi and Ainaro, and higher rates of women reported the ability to read the Tetun language. In the 3½ years between the surveys, the average number of children per participant dropped from 3.7 to 2.9 in Manufahi and 4.4 to 3.9 in Ainaro (Table 1).

Table 1: Survey Participant Demographics

	Manufahi		Ainaro	
	2012	2015	2012	2015
Average age of women	27.0	27.0	28.5	27.9
Average years of school	7.0	9.0	5.9	6.9
Average number of children	3.7	2.9	4.4	3.6
Percent women who can read the Tetun language	73%	86%	59%	71%
Total number of survey participants	293	288	288	288

There were significant increases in the possession of some household commodities between 2012 and 2015 (Table 2). In Manufahi in 2012, only 46% of households reported access to electricity compared to 62% in 2015; this increase was even more striking in Ainaro where it increased from 24% to 60% between the two surveys. Ownership of televisions and motorbikes also increased in both municipalities between the two time periods. In 2012, 69% and 66% of households in Manufahi and Ainaro, respectively, owned a mobile phone. In 2015, this increased to 96% of households in Manufahi and 85% in Ainaro. The penetration of smart phones remains low, with only 17% of women in Manufahi and 12% in Ainaro reporting they own a ‘smart’ versus a ‘simple’ phone.

Table 2: Household Commodities

<i>Percent of households that. . .</i>	Manufahi		Ainaro	
	2012	2015	2012	2015
have electricity in the home	46%	62%	24%	60%
have a television	21%	39%	19%	30%
have a motorbike	17%	43%	18%	33%
have a car or truck	1%	3%	2%	5%
have a mobile phone	69%	96%	66%	85%

LIGA INAN IMPLEMENTATION

Women who had access to a mobile phone in Manufahi were registered into the Liga Inan program at their first antenatal care (ANC) visit by their midwife who was trained in how to use the Liga Inan service by HAI and Catalpa staff. Health staff were responsible for providing clear information about the program and following up with women before they delivered. Health staff could further use the program’s broadcast function to send announcements to their patients. In order to learn more about the implementation of the Liga Inan program, the 2015 KPC survey asked women if they had participated in the Liga Inan program and other questions specific to their experiences with the program.

Participation in the Liga Inan Program

Enrollment in Liga Inan is conditioned on women having access to a mobile phone and attending at least one ANC visit where midwives or doctors can enroll them into the program. The high rates of both phone ownership and participation in ANC facilitated high rates of enrollment. The 2015 survey revealed that of all women surveyed in

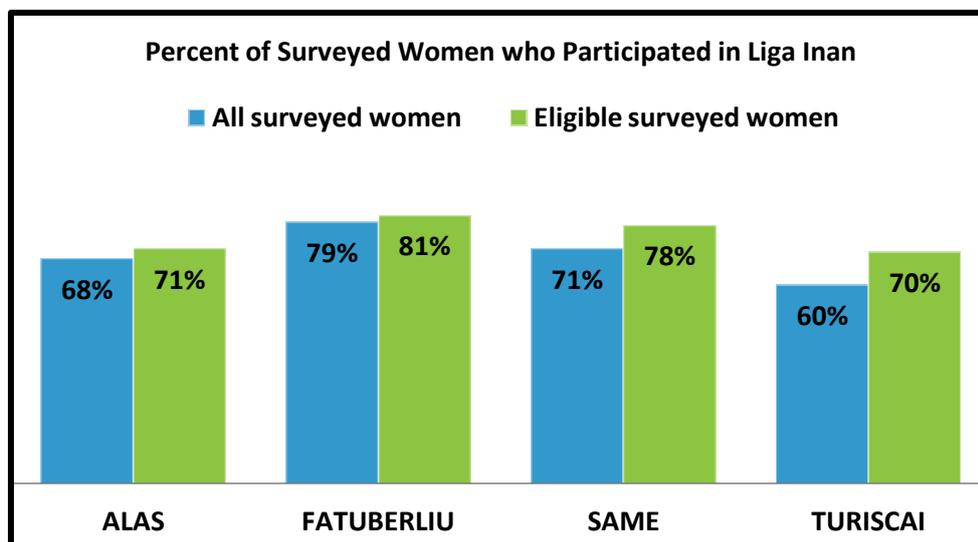
A woman was determined *eligible* to enroll in Liga Inan if she had access to a mobile phone and attended at least one ANC visit. Rates of enrollment in Manufahi among *eligible* women:

- ✓ **71% in Alas were enrolled**
- ✓ **81% in Fatuberliu were enrolled**
- ✓ **78% in Same were enrolled**
- ✓ **70% in Turiscaï were enrolled**

Manufahi (288), 70% reported they participated in the Liga Inan program. However, when looking at only eligible women—those with access to a phone and attending at least one ANC—77% of eligible women reported participating in Liga Inan. Rates of enrollment were high across all the four Administrative Posts in Manufahi (Figure 1) with minor variability noted. It was highest in Fatuberliu (81%) and lowest in Turiscaï (70%).

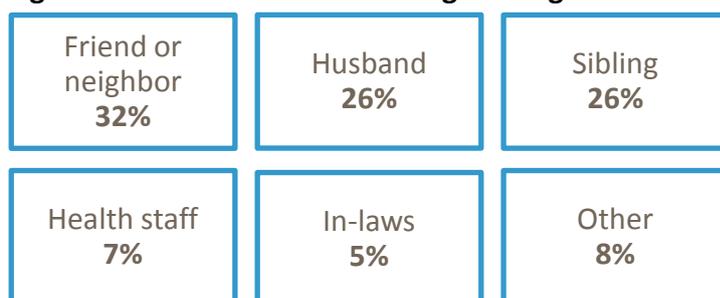
To determine whether women with disability were equally accessing Liga Inan, we analyzed whether the 10 women who reported major challenges with vision, hearing, walking, or concentration and the 89 women reporting minor to major challenges had participated. Seven of the 10 (70%) with major challenges and 58 of the 89 (65%) with minor to major challenges participated in Liga Inan. Among those without disability 70% participated, so there was no significant difference in participation rates between women with disabilities and those without.

Figure 1: Participation of Women in Liga Inan



The majority of women (82%) reported that they used their own phone to receive Liga Inan messages; 14% used their husband’s phone and 4% reported using a phone of a family member or friend. Nearly all women (97%) reported that the messages were easy to understand, and nearly all enrolled women (99%) preferred the SMS messages be in the Tetun language. Women are also sharing the messages with others (Figure 2). Overall, 26%

Figure 2: Who are women sharing messages with?



of women are sharing their Liga Inan messages with their husbands, however, in Fatuberliu (57%) and Alas (52%) this was considerably higher. Women also share messages with their siblings (26%) and friends or neighbors (32%).

Empowered with permission and contact information for their midwife through the Liga Inan program, a majority of enrolled women were actively engaged in reaching out to their midwife with a question or concern during their pregnancy. The average woman in Manufahi during the Liga Inan program reported 5.6 times the odds of being able to contact a midwife by phone at the time of delivery than did the average woman in Ainaro. Women used different means to contact their midwife: 26% used the Liga Hau feature embedded in the Liga Inan service which sends a text message to their health provider requesting that the provider call the pregnant woman; 45% called their midwife directly; and 4% reported using a missed call where a phone call is aborted after allowing for a single ring to the midwife's number. Women reported that health staff were very prompt at returning their calls with 92% of women reporting their calls were returned quickly, 1% waited more than an hour for a call back, and 7% reported their calls were not returned.

Most women were enrolled into Liga Inan at a community health center (72%), and the remaining women at health posts. Administrative Post Alas was one exception, where most women were enrolled at a SISCa event (41%) or a health post (31%). In Turiscaï, almost all women enrolled at CHC because none of the health posts were staffed by midwives between 2013 and 2015.

Health Staff Engagement in Liga Inan

Health staff are trained to use several features of the Liga Inan program. For example, at the time of enrollment into the program, two stickers with health staff and emergency contact information are to be placed in the mother's LISIO maternal handbook. In addition, health staff are trained to send out broadcast SMS messages to enrolled women with helpful information about the SISCa health outreach schedule. Another Liga Inan program feature sends midwives a list via SMS of women three weeks prior to their estimated due date that is intended to trigger a phone call from the midwife to mother to inquire about birth preparations, including the planned site of delivery. And finally, health staff are also trained to confirm when a Liga Inan enrollee delivers by sending a "bebe" SMS message to the Liga Inan service so births among enrolled women can be tracked via the Liga Inan data dashboard. The 2015 survey collected information on how fully health staff are implementing these features of the program.

The 2015 survey reveals that health staff are actively engaged in the Liga Inan program (Table 3). They are enrolling women into the program at very high rates, as noted above. Most women had both stickers with Liga Inan and health staff contact information in their LISIO. Women reported that midwives are quick to respond when they reached out with a question or a concern. The 2015 survey also revealed that midwives are using the broadcast SMS feature to alert women about SISCa events with 90% of women reporting they received a SMS SISCa alert. However, only 52% of women reported they were contacted by their midwife three weeks before delivery, which varied by Administrative Post, with a high of 63% in Fatuberliu and a low of 30% in Turiscaï.

Table 3: Health Staff Engagement in the Liga Inan Program

	Alas	Fatuberliu	Same	Turiscai	Manufahi Total
LISIO had both Liga Inan stickers	79%	70%	82%	77%	80%
Health staff responded quickly to women who call	90%	89%	93%	100%	92%
Received a SISCa notification via SMS	90%	84%	91%	63%	87%
Health staff called women prior to delivery	51%	63%	53%	30%	52%

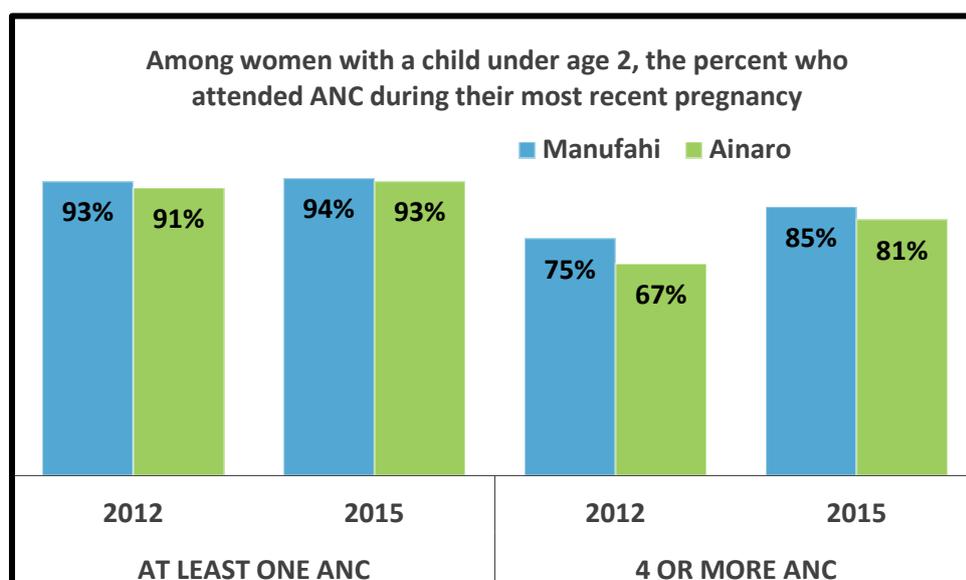
MATERNAL AND CHILD HEALTH PROGRAM RESULTS

The Liga Inan intervention aimed to improve maternal health knowledge and home care behaviors and increase utilization of maternal health services among women enrolled in Liga Inan in Manufahi Municipality. Women were asked a variety of questions about their knowledge and utilization of health services across the continuum of care through pregnancy, delivery and the postpartum period.

Antenatal Care

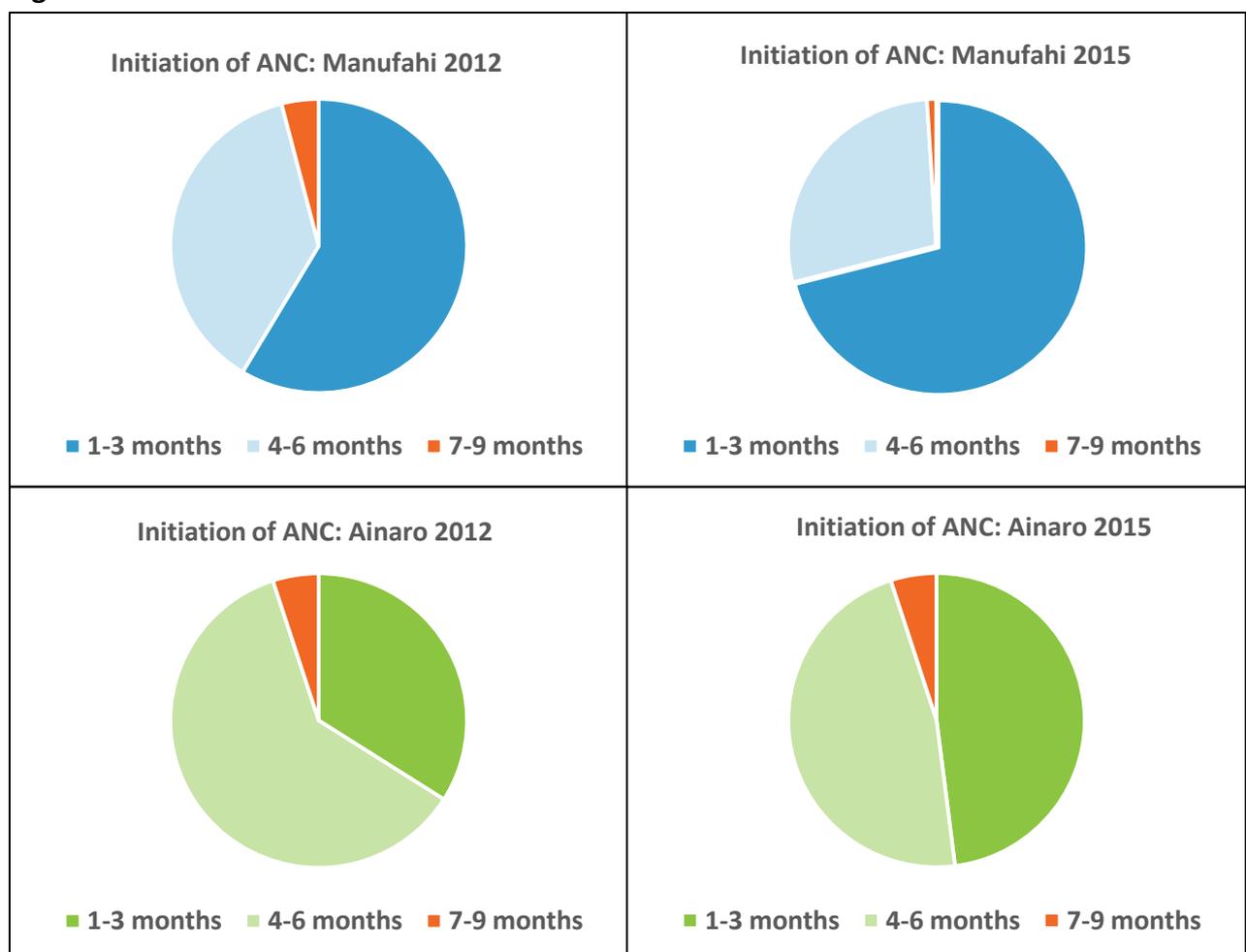
Antenatal care (ANC) is important to check on the health of mothers and babies and to provide women with important health information. The MoH encourages women to attend at least four ANC visits during her pregnancy. The rate of at least one ANC visit was high in both Manufahi and Ainaro in 2012 (93% and 91% respectively), and saw additional increases in these already high rates in 2015 (94% and 93% respectively).

Figure 2: Antenatal Care Attendance



When women come in for the recommended four ANC visits it provides opportunities for midwives to check on the health of women during their pregnancy and deliver health information, such as the importance of taking iron pills and delivering in a health facility. Liga Inan SMS encourage women to return for all recommended visits. In the 3 ½ years between the two surveys there were impressive increases in the rate of four or more ANC visits in both districts (Figure 2): in Manufahi rising from 75% to 85% and in Ainaro from 67% to 81%. While the percent of women receiving four or more ANC visits remains slightly lower in Ainaro than Manufahi, there was a larger percent increase in that municipality between 2012 and 2015. Multivariate analysis showed that there were no significant differences in accessing four or more ANC visits between women who could have participated in Liga Inan than those who could not have participated.

Figure 3: Initiation of ANC 1



Coming in earlier during pregnancy for a first ANC visit means that women hear about key health messages and can choose good behaviors sooner in their pregnancy, such as taking iron tablets and eating well. For pregnant women in Manufahi, it also meant they could enroll in Liga Inan earlier in their pregnancy. Although not an indicator that the Liga Inan program was expected to impact, given that women were only registered into the program during the first ANC visit, knowledge of the program may have motivated women to come in

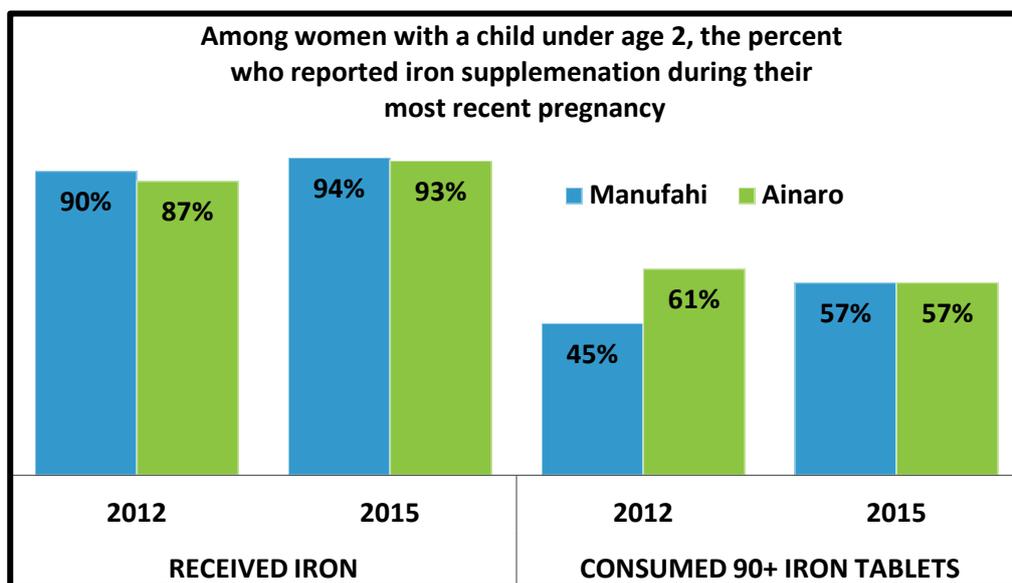
earlier for care. As shown in Figure 3, there was a shift in both municipalities to earlier initiation of first ANC among women surveyed. In Manufahi, women coming in for care in their first trimester increased from 58% in 2012 to 71% in 2015; and in Ainaro it increased from 34% to 48%.

Iron Supplementation, Tetanus Toxoid Immunization, and Anti-Parasite Treatment

During ANC women are informed by health staff of the importance of taking iron tablets and receiving Tetanus Toxoid immunization and anti-parasite treatment. Participants in the Liga Inan program also receive messages about the benefits of these services during pregnancy.

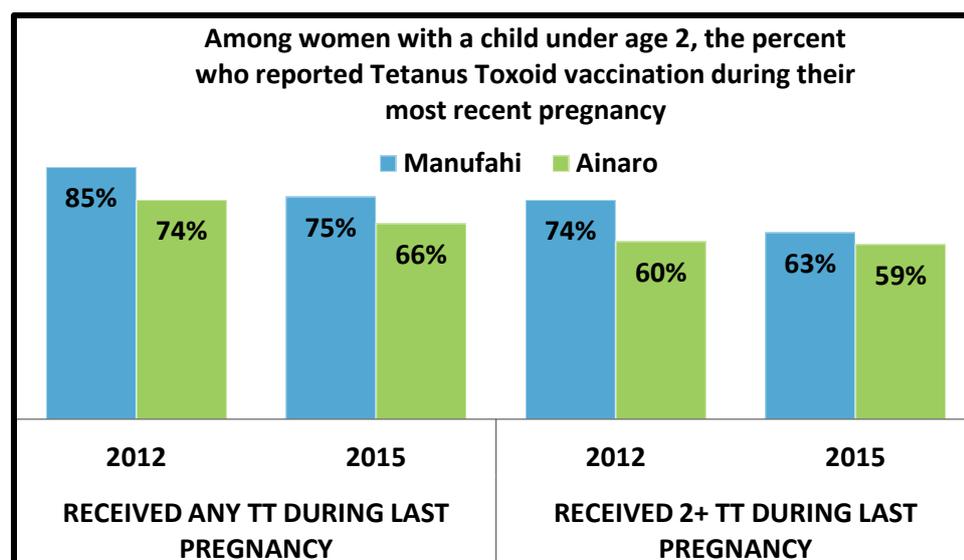
Iron supplementation during pregnancy is important to prevent anemia and is recommended by the MoH. In both Manufahi and Ainaro there were high rates of women who reported receiving iron tablets, and this was consistent and increased slightly between the two surveys. However, when looking at consumption of iron tablets (not just receiving them) the rate drops significantly in both the 2012 and the 2015 surveys. There was an increase in the reported rate of iron tablets consumed in 2015 by women in Manufahi, where it increased from 45% to 57%, as compared to Ainaro where there was a slight decrease (Figure 4). A multivariate analysis did not show significant improvements in iron uptake in Manufahi versus Ainaro.

Figure 4: Iron Supplementation



Tetanus Toxoid (TT) immunizations are provided during pregnancy to prevent neonatal tetanus. The rate of having had any TT immunization reported by women during their last pregnancy was reasonably high in both municipalities. However, in Manufahi and Ainaro women who reported receiving any TT during their last pregnancy and the recommended 2+ TT during their lifetime decreased from 2012 to 2015 (Figure 5). In Manufahi the rates went from 85% to 75% for any TT and 74% to 63% for 2+ TT. In Ainaro it went from 74% to 66% for any TT and 60% to 59% for 2+ TT.

Figure 5: Tetanus Toxoid Immunization



Women who report receiving anti-parasite treatment during their most recent pregnancy is very low. In 2015 only 12% of women in Manufahi and 16% in Ainaro reported they received treatment. While there was a slight increase in Ainaro between the two surveys, there was a decrease noted in Manufahi from 22% to 12%.

Knowledge of Danger Signs

It is important for women and their families to be aware of danger signs that signal the need to seek immediate care from a health provider during pregnancy, delivery, and the postpartum and postnatal periods. Because relatively limited contact with health staff during pregnancy does not always allow adequate time to convey these messages, the Liga Inan program attempted to communicate some of this complex information to enrolled women via SMS messages. The data from the surveys conducted in 2012 and 2015, however, found that women’s knowledge of two or more danger signs actually decreased in both municipalities, except for a slight increase in knowledge of postnatal danger signs in Ainaro (Table 4). Participation in Liga Inan did not appear to impact women’s ability to recall danger signs.

Table 4: Knowledge of Danger Signs

	Manufahi		Ainaro	
	2012	2015	2012	2015
<i>Knows 2 or more danger signs of . . .</i>				
pregnancy	54%	39%	55%	33%
delivery	32%	27%	33%	32%
postpartum	42%	35%	58%	33%
postnatal	42%	40%	37%	39%

Preparations for Birth

There are many important preparations that could be undertaken before birth, such as saving money, arranging transport to a health facility, and contacting health staff to alert them about the preferred location for delivery. Liga Inan SMS messages encouraged women to consider making these preparations. When asked whether they had saved money, prepared transportation, or selected a place to deliver, women in Manufahi consistently reported higher levels of preparation than women in Ainaro (Table 5).

Table 5: Preparations for delivery

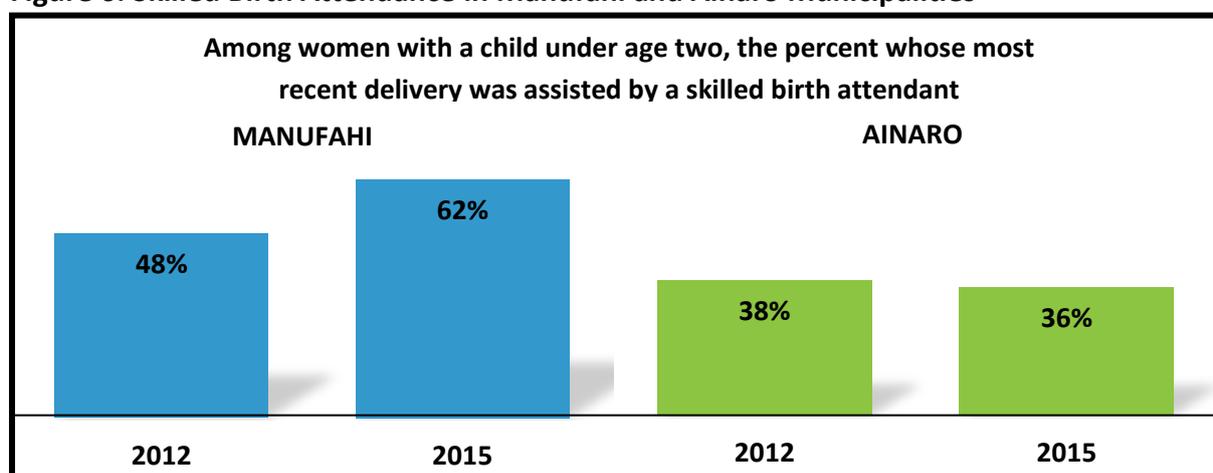
<i>Percent of women who . . .</i>	Manufahi	Ainaro
saved money during pregnancy	90%	85%
arranged for transport for delivery	63%	45%
selected a place to deliver	93%	78%

Delivery with a Skilled Birth Attendant

A skilled birth attendant (SBA) is defined in this survey as a doctor, midwife, or nurse being present at delivery. Delivering with a SBA improves the likelihood that a woman will survive complications that can arise during delivery and ensures women and newborns in greatest need are able to be quickly referred to a higher level health facility. Moreover, having a skilled health provider present at delivery and a hygienic environment can reduce the risk of complications and infections that can cause illness or death in the mother or newborn. The importance of having a SBA present at delivery was a key message delivered to women enrolled in Liga Inan and considered, along with having a facility delivery, to be a primary program outcome.

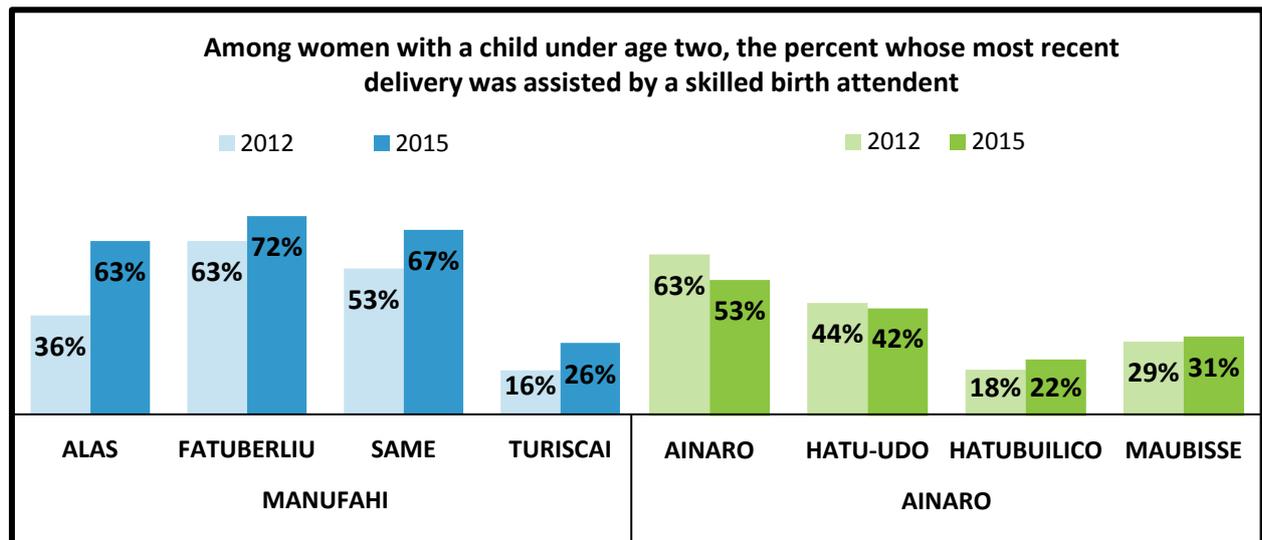
In Manufahi after the launch of Liga Inan there was a significant increase in use of a skilled birth attendant from 48% in 2012 to 62% in 2015, while in Ainaro there was a slight decrease. Figure 6 shows the rate of increase in the use of skilled birth attendance in Manufahi compared to Ainaro.

Figure 6: Skilled Birth Attendance in Manufahi and Ainaro Municipalities



Between 2012 and 2015, an increase in SBA was seen across all four Administrative Posts in Manufahi (Figure 7). The largest overall increase was seen in Alas where the rate of SBA went from 36% in 2012 to 63% in 2015. The highest rate of SBA was in Fatuberliu (72%) and the lowest in Turiscaï (26%). In Ainaro Municipality there was an overall decrease from 38% in 2012 to 36% in 2015. However, at the Administrative Post level, Hatubuilico and Maubisse saw small increases in SBA from 2012 to 2015.

Figure 7: Skilled Birth Attendance in Manufahi and Ainaro Administrative Posts



Multivariate analysis of skilled birth attendance

The multivariate model of deliveries with skilled birth attendant shows a strong effect of the mHealth intervention. The average woman in Manufahi who was pregnant during the time of the Liga Inan program had nearly twice the odds (OR 1.8, 95% CI 1.3-2.3) of having a skilled attendant at birth compared to the average woman in Ainaro during the same period. The statistical modeling controlled for the mothers' age, years of schooling, and reported distance to a health facility. The model found that in addition to the Liga Inan program, fewer years of school attended and longer distance to a health facility also contributed to a lower odds of a woman delivering with a skilled birth attendant.

Health Facility Delivery

Delivery at a health facility improves the likelihood that women and their newborns will survive if complications arise, and ensures that they can be more quickly referred to a higher level health facility if there is need. The more hygienic environment of a health facility can reduce the risk of postpartum or postnatal infections. The importance of having the delivery at a health facility was a key message delivered to women enrolled in Liga Inan and considered, along with having a skilled birth attendant, to be a primary program outcome.

After the launch of Liga Inan there was a significant increase in deliveries at a health facility in Manufahi Municipality, from 32% in 2012 to 49% in 2015 (Figure 8). During this same

time period in Ainaro there was a slight decrease from 29% to 28%. As was seen for SBA in Manufahi, the increase in facility delivery was seen across all four Administrative Posts while in Ainaro this varied with two Administrative Posts showing a decrease in facility delivery, one showing a substantial increase and another a very slight increase (Figure 9).

Multivariate analysis

The multivariate model for deliveries in a health facility showed that the average pregnant woman in Manufahi during implementation of Liga Inan had nearly twice the odds (OR 1.9, 95% CI 1.4-2.5) of giving birth in a facility compared to woman in Ainaro during this same period. The model found that in addition to the Liga Inan program, fewer years of school attended and longer distance to a health facility was also associated with lower odds of a woman delivering in a health facility.

Figure 8: Facility Deliveries in Manufahi and Ainaro Municipalities

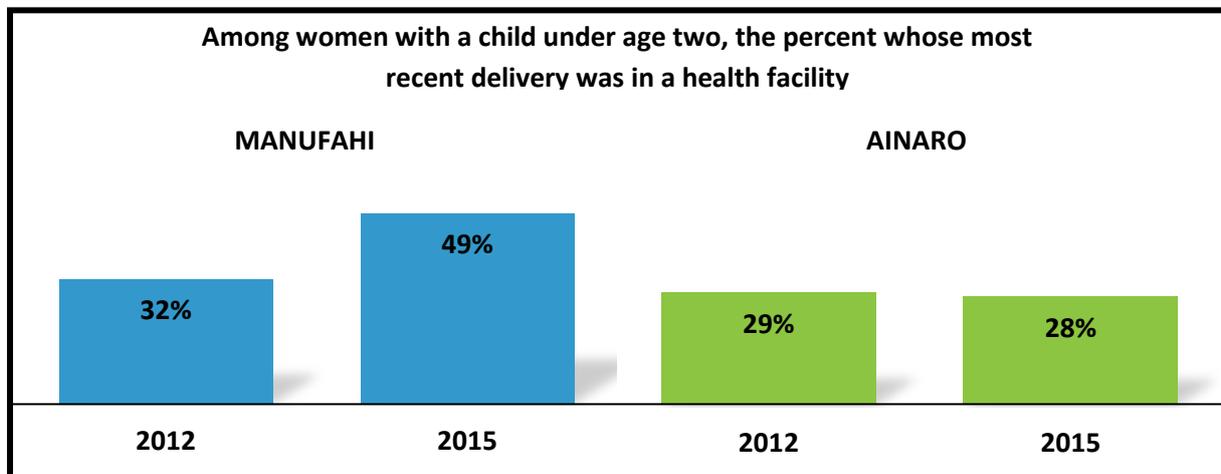
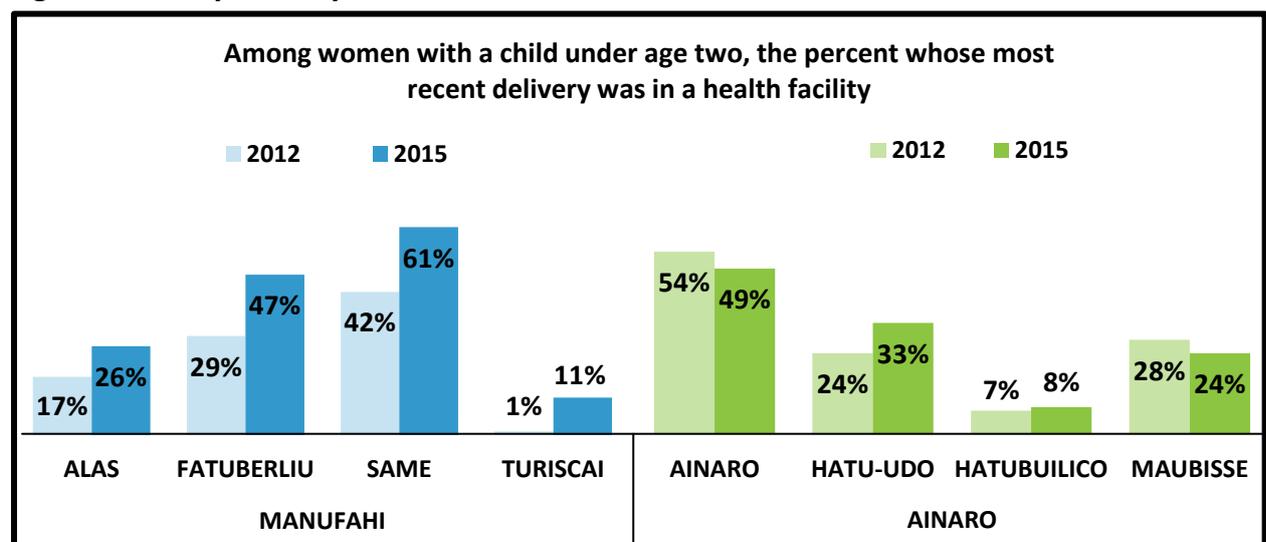


Figure 9: Facility Delivery in Manufahi and Ainaro Administrative Posts

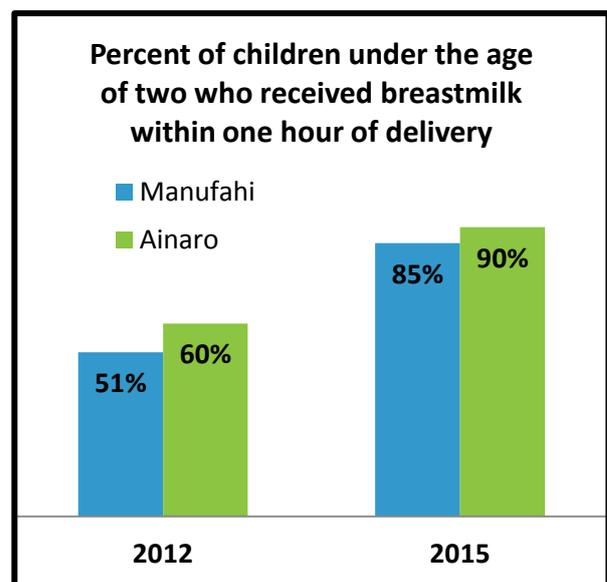


Breastfeeding

Immediate breastfeeding is important in order to provide essential nutrients to the newborn and also assists in completing labor and preventing postpartum hemorrhage for the mother. The Liga Inan messages promoted immediate breastfeeding and the provision of colostrum, the yellow-colored milk produced within the first few days after delivery.

The percent of infants whose mothers reported breastfeeding within the first hour after birth increased considerably, increasing by over 30% in both municipalities (Figure 10). A multivariate analysis did not show significant improvements in Manufahi versus Ainaro.

Figure 10: Immediate breastfeeding in Manufahi and Ainaro Municipalities



Postpartum Care

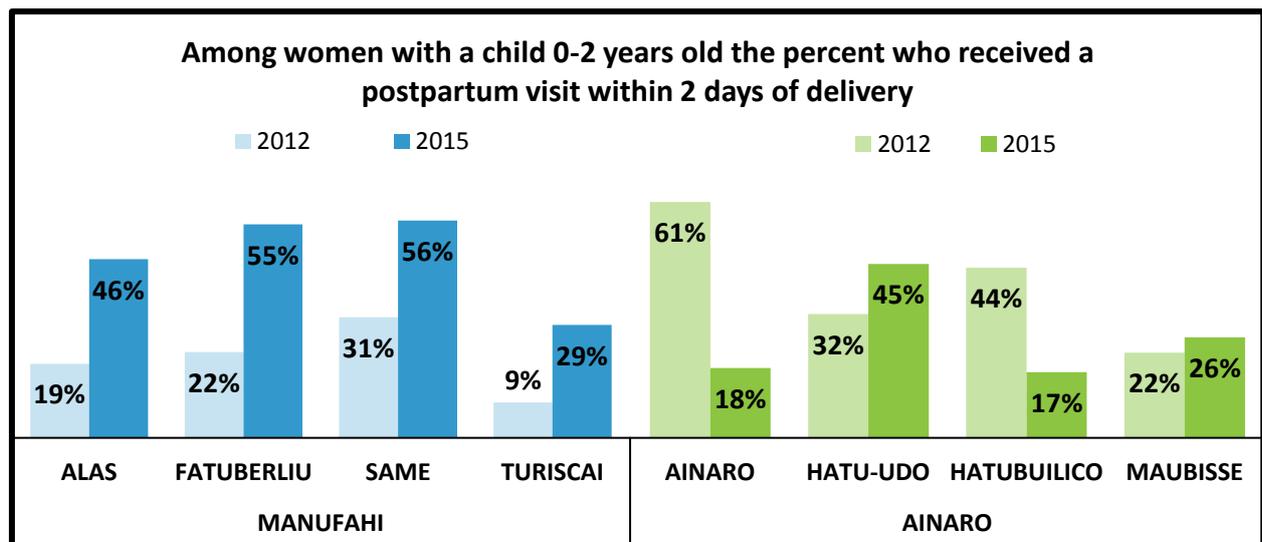
Because a large proportion of postpartum complications occur within two days of delivery, the MoH recommends that all postpartum women have a check of their condition by a skilled provider within two days of their delivery. The need for postpartum care was a key message delivered to women enrolled in Liga Inan and a primary program outcome.

After the launch of Liga Inan there was a large and significant increase in postpartum care in Manufahi, from 26% in 2012 to 51% in 2015; a similar increase was not seen in Ainaro during this same period and in fact, it decreased overall from 38% to 25%. Similar to SBA and facility delivery in Manufahi, increases in postpartum care were seen across all Administrative Posts. In Ainaro, postpartum care varied across Administrative Posts with a steep decline in Ainaro Villa and Hatubuilico and increases noted in Hatu-Udo and Maubisse (Figure 10).

Multivariate analysis

Multivariate models of postpartum visits within two days shows a strong effect of the Liga Inan intervention. The average woman who delivered in Manufahi during the program period had seven times the odds (OR 7.1, 95% CI 4.9-9.3) of having a postpartum visit within two days compared to the average woman in Ainaro. Age, years of school, and distance to a health facility were all controlled for in the model but did not have a significant effect on whether women received postpartum care. Women who delivered with a skilled birth attendant, however, had almost 13 times the odds of receiving postpartum care.

Figure 11: Postpartum Care in Manufahi and Ainaro Administrative Posts



Postnatal/Newborn Care

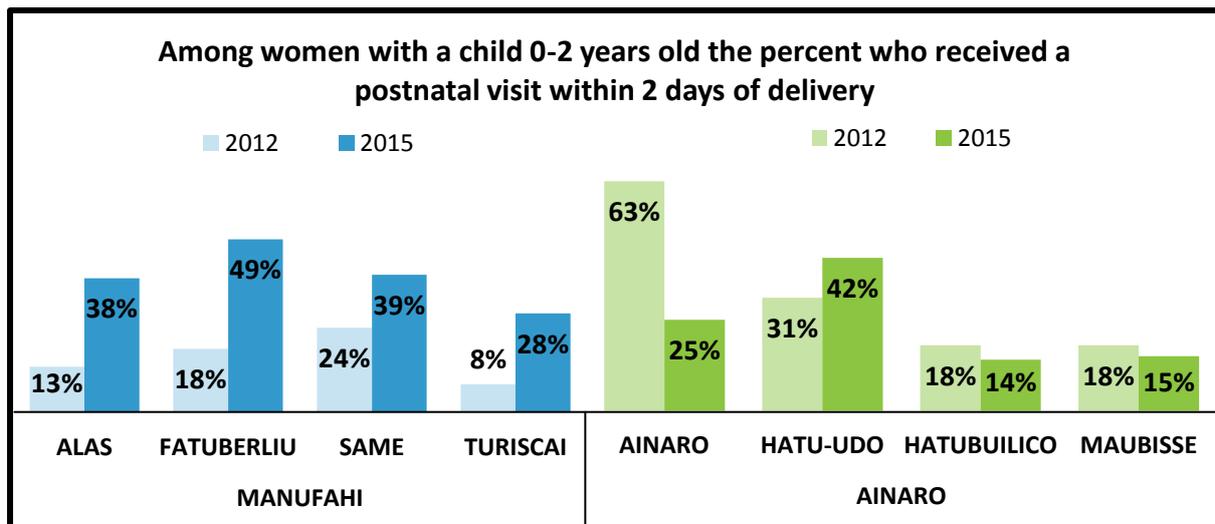
A large proportion of newborn complications and deaths occur within the first day or two of delivery. For this reason, the MoH recommends that all newborns have a check of their postnatal condition by a skilled provider within two days after their birth. The importance of a newborn check was a key message delivered to women enrolled in Liga Inan and a primary program outcome.

In Manufahi after the launch of Liga Inan there was a significant increase in postnatal care from 20% in 2012 to 39% in 2015, while in Ainaro there was a significant decrease from 32% to 22%. Increases in postnatal care was seen in all four Administrative Posts in Manufahi. Similar to postpartum care in Ainaro, there was variation across Administrative Posts with Ainaro Villa showing a significant decrease, less significant decreases in Hatubuilico and Maubisse and an increase in Hatu-Udo (Figure 11).

Multivariate analysis

Models of postnatal visits within 2 days also show a strong effect of the intervention. The average child born in Manufahi during the program period had over five times the odds (OR 5.5, 95% CI 3.7-7.2) of having a postpartum visit within two days compared to the average child in Ainaro. Age of mother, years of schooling of the mother, and distance to a health facility were all controlled for in the model but none had a significant effect on whether children received postnatal care. Children whose mother delivered with a skilled birth attendant, however, had almost 13 times the odds of receiving postnatal care.

Figure 12: Postnatal Care in Manufahi and Ainaro Administrative Posts



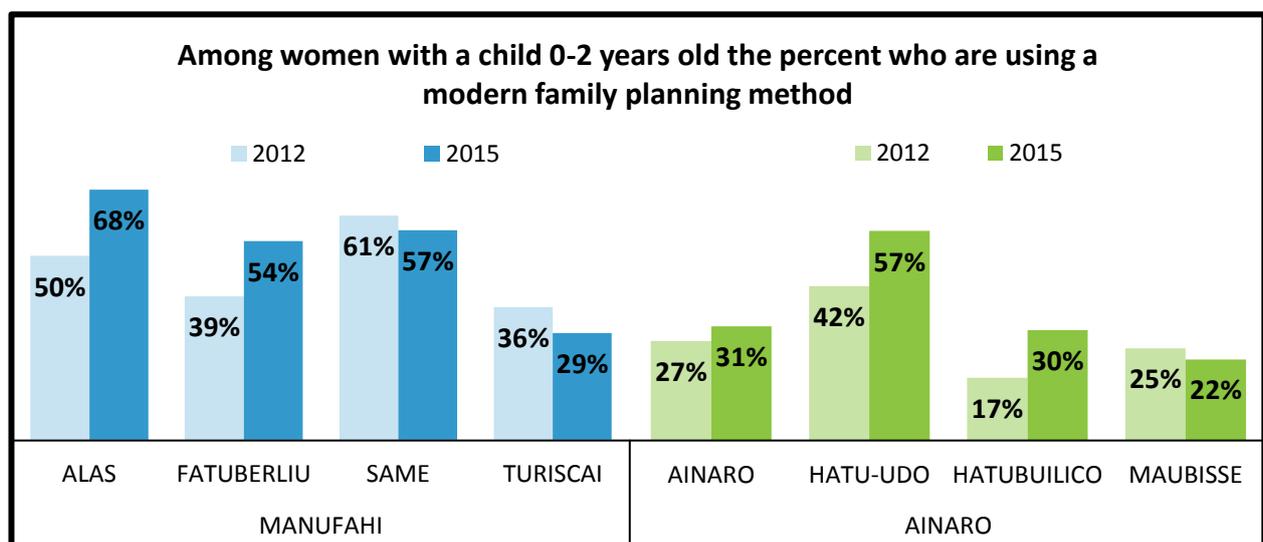
Family Planning

The use of family planning to space or limit childbearing is an important predictor of both maternal and newborn health. Women’s understanding of the benefits to spacing their births helps them make the decision to use family planning. The Liga Inan program delivered SMS to women about the benefits of spacing pregnancies.

The percent of women who understand that the ideal spacing between births is at least three years increased in both Manufahi and Ainaro between the two surveys: from 43% to 56% in Manufahi, and from 22% to 38% in Ainaro.

The use of a modern method of family planning by study women remained essentially the same between baseline and final surveys for the intervention district, Manufahi (54% in 2012 and 55% in 2015), while in Ainaro, although still lower than in the intervention area overall, it increased significantly from 23% in 2012 to 32% in 2015.

Figure 13: Use of modern family planning method by Administrative Post



Discussion

PARTICIPATION IN THE LIGA INAN PROGRAM

The two main criteria for participating in the Liga Inan program—attending at least one antenatal care visit and having access to a mobile phone—have increased since the program was launched in Manufahi Municipality in March 2013. Access to phones was a major concern with whether this program could reach a majority of women. The 2015 KPC survey revealed that 96% of mothers of young children in Manufahi and 85% of women in Ainaro had access to a mobile phone. We have no doubt these increases have been replicated throughout Timor-Leste and will pave the way for rolling out this program nationwide.

Seventy percent of all women surveyed in Manufahi in 2015 participated in the Liga Inan program. This figure increased to 77% among eligible women (those who had at least one antenatal visit and access to a phone). The health staff in Manufahi worked hard to ensure women were enrolled in Liga Inan and this is a great achievement. Of the surveyed women who were eligible to participate, 23% were not enrolled in the program. Based on other program source data and post-survey discussions with health staff and managers in Manufahi, we understand some reasons why eligible women who could have participated did not. For example, we know that women from all suco in Manufahi participated in Liga Inan, however enrollment sometimes dropped when SISCa events were not taking place in a community or a health post was not fully staffed when health staff took annual or maternity leave. Health staff should be encouraged to maximize every opportunity to inform eligible women about the Liga Inan program and encourage their participation. Administrative Post Alas has been a good example of how a site with limited health staff—only two midwives in the entire Administrative Post—can use SISCa events to explain Liga Inan to women and to enroll more women in the program.

The recent Liga Inan Annual Review Meeting in Manufahi provided a few additional insights. Health staff recalled that some women refused to provide or forgot their phone number when they attended ANC or SISCa making it impossible to enroll them into the program. Some health staff also admitted that they occasionally forgot to complete the registration process for a woman. The Liga Inan program will soon be offering health staff a phone application that will include a list of women already enrolled in Liga Inan so that health staff can check that they have completed all desired registrations. Further analysis will also be conducted on the survey data to examine whether there were additional reasons why women who could have enrolled did not.

HEALTH STAFF IMPLEMENTATION OF LIGA INAN AND COMMUNICATION WITH WOMEN

While registering women in Liga Inan is the most important step that health staff take to support the Liga Inan program, there are other tasks required. Health staff are asked to provide women with stickers with contact information in their LISIO, respond to requests for assistance by enrolled women, and call women before they deliver. They are also

encouraged to use the broadcast function to send announcements of SISCa events or other relevant information to their patients. The 2015 survey found that Manufahi health staff are very engaged in the Liga Inan program and conducting most of these additional tasks well. The majority of women had received stickers in their LISIO and reported they received SISCa announcements via the Liga Inan service. Some women had only one sticker; only a few had no stickers at all, which could be because women did not bring their LISIO to the clinic at the time of enrollment or health staff forgot to bring the stickers to a SISCa event. Women reported that health staff were quick to respond when women reached out with a question or a concern. The Liga Inan service sends midwives a SMS of all women in their catchment area who are within three weeks of their estimated due date. This alert to midwives is meant to trigger a call from the midwife to mother to check in about their birth plan; however, only 52% of women reported they were contacted by their midwife three weeks before delivery. This could have been due to women changing their phone numbers during their pregnancy without notifying their health provider, or health staff could have forgotten to call. Health staff should remember to ask women whether they have changed their phone number since their last visit so they can continue to stay in touch.

IMPACTS OF THE LIGA INAN PROGRAM

The survey results show that the Liga Inan program had a strong impact on key program indicators relative to behavior change in accessing maternal health services. The strongest impacts were observed with increasing the likelihood that a woman would deliver with a skilled birth attendant and in a health facility, and increasing the likelihood that both women and newborns received care within two days after delivery.

When age, years of schooling and distance to a health facility are controlled for in the analysis, women in the Liga Inan intervention municipality as compared to the control municipality were more likely to have had a SBA present at delivery and deliver in a health facility. When looking at postpartum and postnatal care and further controlling for SBA, the likelihood of receiving that care among surveyed women in the intervention municipality was further increased.

The Liga Inan program could have impacted these behaviors through a variety of channels. Program participants received regular information on the benefits of skilled care at delivery and immediately postpartum. These repeated tips and reminders delivered via SMS appear to have served as a call to action for women to come in for maternal services. Additionally, the Liga Inan program provided enhanced access to health staff by giving women contact information for midwives, providing them with the “Liga Hau” request to access their midwife, and the provision of phone credit to midwives in order to call women three weeks before delivery and if requested at any other point in her pregnancy. Seventy percent of women enrolled in Liga Inan reached out to their midwife with a question or a concern, and midwives are promptly returning their calls. Women in Manufahi had more than five times the odds of women in Ainaro to say they could call a midwife at the time of delivery. The

twice weekly SMS that women receive while enrolled in Liga Inan combined with increased access to health providers appear to have increased rates of key maternal services in the intervention municipality.

Increasing the number of ANC visits per pregnancy was another key objective for this program. The percent of women in Manufahi who attended four or more visits increased from 75% in 2012 to 85% in 2015. More women in Ainaro, however, also reported attending four or more visits, with coverage increasing from 67% in 2012 to 81% in 2015. Because improvements were seen in both municipalities, it is impossible to tell whether Liga Inan was associated with increases in Manufahi or whether there were other influencing factors.

There was no significant increase in knowledge of danger signs during pregnancy, delivery, or the postpartum period observed as a result of women's participation in the Liga Inan program. Increasing knowledge and awareness about critical danger signs was a stated objective of the program. There may have been limitations to the way the survey questions on danger signs were worded and the open-ended nature of the questions were not sufficient to capture women's knowledge on the subject. We also found that it was very challenging to adequately represent all possible danger signs along the maternal continuum from pregnancy to postpartum and do so in the 160 character limit required in a single SMS message. Furthermore, it is possible, as one midwife in Manufahi pointed out during the Liga Inan Annual Review Meeting, that women are less interested in this type of information unless it becomes relevant to them. Indeed, we found that when asked where they learned about danger signs, most women said through their own knowledge or experiences (HAI KPC Results, April 2016). It may also be true that text messages are not the best vehicle to convey more complex information about danger signs to women as opposed to one-on-one encounters with health staff during antenatal care visits.

The survey results did not show significant behavior change relative to the percent of women receiving iron tablets, anti-parasite medicine, or TT immunizations as a result of participation in the Liga Inan program. While the Liga Inan program sent text messages informing about the importance of receiving these services during pregnancy, women need to feel empowered to request these from their health providers if they are not offered during routine ANC, and importantly the stock of supplies need to be available at the health facility. It is unclear how other factors such as these could have played a role in the survey results. Health staff in Manufahi also recalled a national TT immunization campaign in 2012 that may have pushed the baseline coverage rates higher than what would have been otherwise expected.

The Liga Inan program delivered SMS to enrolled women about the importance of early initiation of breastfeeding and the benefits of healthy timing and spacing of pregnancies. Messages, particularly during the six-week postpartum period, encouraged women to discuss family planning methods with their health provider. There was a significant increase

in early initiation of breastfeeding noted between the 2012 and 2015 survey in both intervention and control municipalities, but the survey results did not show any impact related to women's participation in Liga Inan. Similarly, while increases in the use of modern family planning methods were seen in both intervention and control municipalities, the survey results did not show any impact in the intervention district for uptake of modern family planning methods related to participation in Liga Inan. Possible influencing factors could be the work in both districts by the Alola Foundation implementing breastfeeding initiatives and Marie Stopes International which has been very active in promoting the use of family planning services.

Conclusion

These results show a high rate of participation in the Liga Inan program in Manufahi Municipality and that health staff are highly engaged in the implementation of the program. Women who were pregnant and delivering during the time when the Liga Inan program was operating in Manufahi were much more likely to receive services from health staff at the most critical time for saving the lives of women and newborns: at birth and two days postpartum. Further evaluation is needed as to the effectiveness of SMS messages in promoting understanding of complex health promotion messages, such as maternal and newborn danger signs.

The program has contributed to lowering key health risks associated with pregnancy and childbirth for women in Manufahi and should continue to be rolled out to additional areas in Timor-Leste.