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Full Length Research Paper

The *Igaraçu* fluvial mobile clinic: Lessons learned while implementing an innovative primary care approach in Rural Amazonia, Brazil

Michele Rocha Kadri[1], Debra Rose Wilson[2]*, Julio Cesar Schweickardt[3], James G. Linn[4], Lisandra N. Guimarães Farias[5], Adriana Moreira[6] and Rodrigo Tobias Lima[7]

[1]Oswaldo Cruz Foundation - Amazonia, Leonidas e Maria Deane Institute, Rua Terezina, 476 - Adrianópolis, 69057-070, Manaus, Amazonas, Brazil.
[2]Walden University, USA.
[3]Oswaldo Cruz Foundation - Amazonia, Leonidas e Maria Deane Institute, Brazil.
[4]University of Valparaiso, Chile.
[5]Municipal Health Department of Borba, Brazil.
[6]Secretaria Estadual de Saúde do Amazonas, Brazil.
[7]Oswaldo Cruz Foundation - Amazonia, Leonidas e Maria Deane Institute, Brazil.

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In Amazonia, which includes regions in eight South American countries (and an enormous area in Northern Brazil) many of the inhabitants live in small communities scattered across a vast territory? Since too often they cannot be accessed by road, health services must be brought to them on specially constructed river barges, which are floating comprehensive primary care clinics. To effectively deliver health services to vulnerable populations living deep in the Amazon Rain Forest, the Municipal Health Authority of Borba, Brazil piloted the innovative technology of the *Igaraçu* Fluvial Mobile Clinic, a boat with full primary care services. The aim of this investigation is to do a case study of the pilot implementation of an innovative technology, *Igaraçu* the fluvial mobile clinic, which delivers primary care services in rural, Amazonas, Brazil. In Borba, the implementation of the *Igaraçu* has increased the number of people receiving primary care by over 10% and improved the quality of primary care provided, in particular, health promotion, maternal and child care, and treatment of chronic disease. Before the *Igaraçu* fewer people used services for the following reasons: (1) Insufficient professional healthcare staff (e. g. medical doctor and advanced practice nurses); (2) Lack of privacy during consultations; (3) Loss of exam samples; and (4) No continuity of care. Implications of this successful healthcare delivery innovation for the importance of coordination between national health authorities and local policy makers are discussed.

Key words: Amazonia, inhabitants, mobile clinic, primary care clinics.

INTRODUCTION

Frequently, the demographic characteristics of a region are associated with poor health outcomes for the local population. This is the case with the Amazonian region of Brazil. Except for a few large cities, the population is dispersed over a vast area in small isolated communities located on riverbanks. This situation is a challenge to the

National Health System, which has a mission of providing universal coverage for 200 million Brazilian citizens wherever they reside. The aim of this investigation is to do a case study of the pilot implementation of an innovative technology (Burns and Grove, 2016), *Igaracu*, the fluvial mobile clinic which delivers primary care services in rural Amazonas, Brazil (Paim et al., 1979).

In this case study, we describe an innovative strategy that has demonstrated the potential for providing comprehensive primary care services for the rural Amazonian population, and we discuss the importance of dialogue between the Ministry of Health (MOH) and the local health authority in the implementation of effective alternative models of care (WHO, 2013). The *Igaraçu* Fluvial Mobile Clinic is a healthcare delivery innovation that was piloted in the rural Amazonian community of Borba, Brazil.

Local setting

Since 1993, Brazil has delivered its primary care program through its Family Health Strategy. The development of the Unified Health System increased access to healthcare for a substantial proportion of the population, but universal coverage has not been realized (Victora et al., 2011). This is particularly the case in Northern Brazil where people in the metropolitan areas have good access to healthcare, but those in rural communities have more limited access to these necessary services (Paim et al., 1979). The rural/urban disparity in healthcare in this region has spurred innovation in the model of health service delivery through a collaborative process involving the MOH and local governmental authorities (Fraxe, 2000).

The municipality of Borba is on the Madeira River, about 208 km from Manaus, the capital of the state of Amazonas. The Madeira is a large tributary of the Amazonas River. Travel from Manaus to Borba by an "express" boat takes 6 h. A small commercial plane carrying 5 passengers takes 50 min to fly between the cities. In Amazonia, it is more accurate to measure distances by time than by kilometers. A river journey's time varies by season and direction (going up or down river). It is less when waters are rising and more when they are receding. In times of flooding water, riverboats can take advantage of "shortcuts" that open up (Fraxe, 2000).

The most recent National census reported that Borba had 34,961 residents (5,931 were self-declared indigenous people) living in a territory that is slightly larger than Switzerland and twice as large as the state of New Jersey in the US. There is a scattered distribution of residents, 60% of whom live in rural areas (Ministério da Saúde, 2013). Population density is low with 0.79 inhab/km^2. GDP per capita is low, around U.S. $800 per year (Instituto Brasileiro de Geografia e Estatística, 2010; Ministério da Saúde, 2013). Also, the HDI is depressed (0.560) which is in the low human development range (Ministério da Saúde, 2015). About 20% of the population above 25 is illiterate.

Residents of rural Amazonas experience the same chronic diseases as other Brazilians (e. g. cardiovascular illnesses, cancer, and diabetes). Children from poorer families often show health conditions (e. g. anemia and stunting related to poor nutrition). However, residents in these tropical areas also suffer from illnesses which are still endemic in the region (e. g. tuberculosis, malaria, and other mosquito borne illnesses, STDS, and leprosy). Individuals who have good access to primary care, and if needed, more complex care, respond well to treatment (Instituto Brasileiro de Geografia e Estatística, 2010). However, many do not and consequently experience high morbidity and mortality from these diseases (Lancet, 2011).

Borba is served by 17 public health units, which are part of the National Health System. These include 12 facilities that are managed by the municipality. Besides that, there are 2 hospitals of medium complexity and 3 federal health units managed by the State of Amazonas and MOH respectively. Nine of the municipal facilities are primary care health centers, including Fluvial Mobile Clinic (United Nations Development Program, 2010).

MATERIALS AND METHODS

This investigation used a case study design (Burns and Grove, 2016). It is an intensive historical exploration of the development and pilot implementation of the *Igaraçu*, the fluvial mobile primary care clinic used in Amazonas Brazil. Following this study design, researchers at the Oswaldo Cruz Foundation-Amazonia: (1) Collected historical information on the policy making relationship between the Brazilian Ministry of Health (MOH) and local health authorities in Amazonas: (2) Studied traditional methods of primary care health service delivery and outcomes in their region; (3) Developed a comprehensive description of the planning, financing, building, supplying and staffing of the fluvial mobile primary care clinic-- *Igaraçu*; and (4) Compiled descriptive information and preliminary outcome data on the pilot implementation of the *Igaraçu*.

All of this information is essential for the case study and is reported in the results section of the manuscript. Therefore, relationships between municipal health authority and the Federal MOH, traditional primary care service delivery, the planning and development of the *Igaraçu*, and the initial outcome data collected on the pilot implementation of the fluvial mobile primary care clinic will be reported.

*Corresponding author. E-mail: debrarosewilson@comcast.net.

RESULTS

Before *Igaraçu,* the healthcare team used a common wooden boat rented by the municipal health authority to deliver primary care services to people living in isolated riverbank communities. Consultations were done in community leaders' houses, churches or schools. There was very little privacy. To complete many exams, such as those for cervical cancer, the nurse had to do home visits and collect their specimens in patients' homes while children and other family members were present. Sometimes the specimens were lost before being analyzed. The mobile health team went to the community every 60 days, six times each year. Rarely a physician accompanied the team.

Dissatisfactions with this model of care delivery resulted in the Borba Health Authority to propose a pilot project to the MOH for the construction of a ship that could provide self-contained full primary care services. In 2012, the MOH responded with additional services and within a year *Igaraçu* Fluvial Mobile Clinic was launched. Currently, *Igaraçu* serves several river bank communities along the Madeira and its affluent. An *Igaraçu* roundtrip in this “liquid” territory takes 20 days. There is an interval of 40 days between trips. The health team includes one nurse unit manager, two nurse assistants, one physician, one dentist, one biomedical technician and twelve community health workers (community based).

In addition, there are six crew members. The community workers have a key role planning the agenda for each *Igaraçu* trip and serve as a communication link between the clinic and the local population. With the nurse supervision, they also develop patient tracking maps with all of the people who must be followed-up with special services such as pregnant women, children and adults with chronic disorders. Patient records are organized according to a therapeutic plan, e.g. maternal and child health, hypertension, diabetes, and geriatric issues (Figure 1).

The mobile health unit is 24 m in length and has two floors. The first deck is devoted to clinical activities, which includes offices for doctor, nurses, dentist and rooms to accommodate a pharmacy, laboratory, immunization and sterilizing suites. The upper deck includes the team's bedrooms, kitchen and administrative space. A typical workday begins at 7:00 a.m. and lasts until the last patient is seen. During the night, *Igaraçu* travels on the river to the next community where it begins seeing patients early in the morning.

Simple tests such as blood, urine, and stool analyses are completed in the *Igaraçu* laboratory while samples from more complex exams are sent to a laboratory in the largest community in Borba or to a clinical laboratory in Manaus. In cases where a patient must be referred for specialized care, sometimes they can be treated in the local hospital in Borba, however, when they require more complex treatment, the municipal health authority assists them, so that they can obtain this needed specialized care in Manaus.

Two constraints on this new model of primary healthcare delivery were identified. First, there had to be an increase in Federal funding (in Brazil, the MOH provides funding for primary care, which is delivered locally). Second, a more effective method of collecting and processing samples and tracking patients had to be developed.

The development and testing of *Igaraçu* was part of a regional program supported by the MOH. Based on Borba’s outstanding success, in 2012 the MOH implemented a program to build 64 Fluvial Health Units to be used in the nine Brazilian states of the Amazonian region[1]. Federal funding was also allocated to the local health authorities for the maintenance of these floating clinics. Furthermore, the National Primary Care Policy was updated to address this new model of “Ribeirinha” Population Health. “Ribeirinha” is a riverside population that is deeply influenced by the cycle of waters (floods and droughts), in a type of dependence and symbiosis, traditional beliefs and subsistence family-based agriculture

The cost of providing approximately 3,400 persons with comprehensive primary care including pre-natal, pediatric, chronic disease (especially hypertension and diabetes), infectious disease, immunization, health education and epidemiologic surveillance through the *Igaraçu* is U.S. $26,500 monthly. When this budget is broken down, 65% is for personnel, 23% is for fuel and 12% is for crew food and housing expense. Expenditures for laboratory supplies and pharmaceuticals are not additional because they are no more with the fluvial than the traditional health unit. The overall building cost for one Fluvial Health Unit was US$530,000, which is equal to the cost of constructing four traditional land-based primary care clinics. However, because the population is spread over a vast territory, having 4 additional clinics would not substantially increase the healthcare coverage of the population. In addition, it would cost an estimated U.S.$12,000 more per unit in maintenance expenditure. In Borba, the implementation of the *Igaracu* has increased the number of people receiving primary care by over 10% and improved the quality of primary care provided in particular in the areas of health promotion, maternal and child care and diagnosis and treatment of chronic disease. Before the implementation of the fluvial mobile clinic, fewer people in rural Amazonas used services because of (1) insufficient professional healthcare staff, e. g. advanced practice nurses and medical doctors; (2) lack of privacy during consultations; (3) loss of examined samples; and (4) no continuity of care.

The Ministry of Health of the Federal Government of Brazil had advised that a systematic evaluation of 10 fluvial mobile clinics in the state of Amazonas and Para should be conducted (MOH Communication, January,

Figure 1. The "Igaraçu" Fluvial Mobile Clinic. A pilot project in Borba, Amazonas, Brazil. Source; Photo from Communication Oswaldo Cruz Foundation (2017).

2017).

DISCUSSION

The Borba pilot project helped the Brazilian MOH to refine and make more effective its Fluvial Mobile Clinic initiative. Key issues that must be addressed for the sustainability of this innovative model of care had been identified. These challenges are assumed to exist in rural areas that have similar characteristics to Amazonia, e.g. vast undeveloped rural regions and widely dispersed populations with low incomes and education levels living along navigable rivers, including other Amazonian countries in South America.

The scheduled predictable and more frequent arrival and functioning of the *Igaraçu* Fluvial Mobile Clinic dispels the community's perception of service unreliability. Families can now return for appointments more regularly because they know they will be assisted by a complete health team, including a medical doctor who have their detailed medical histories, and will be examined and treated as required.

Highly bureaucratic and rigid healthcare delivery models, which often provide fragmented care, must be replaced by more accessible and flexible mobile clinics that have patient oriented highly cohesive clinical staffs (WHO, 2013).

This new model of care requires adjustments in work processes for providing health services (Table 1), and because of crucial differences regarding traditional land-based health units; it is highly desired to keep the same health team and boat crew for no less than two years. This data in the table reflects information collected by the evaluation and monitoring team at the University of the Amazonis.

Conclusions

In countries with vast underdeveloped rural regions and widely dispersed populations with low income and education living on navigable rivers, national health authorities should work with local policy makers to develop innovative models of primary care delivery such as the "Igaraçu" Fluvial mobile clinic. Committed and cohesive teams of primary healthcare workers focused on the family unit, rather than the individual, will more effectively resolve problems of patient tracking, absences, and follow up. The scheduled, predictable, and more frequent arrival and functioning of the "Igaraçu" mobile fluvial clinic dispels the community perception of the unreliability of primary care services.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

FUNDING

The initiative was supported by the Brazilian Ministry of Health.

Table 1. Changes in work process to provide care between a landed based clinic and fluvial mobile clinic.

Parameter	Traditional health clinic	Fluvial mobile clinic
Patient approach	Focuses on individual assistance. Because the service is always available, people usually come to the health center alone or bring one or two family members. The rest of the family stay at home with other children or are doing domestic/agricultural activities	Focuses on familiar assistance. The service is not available full-time, all the family members come for consultation. The quality of care is improved because the clinician knows more about the familiar support, compliance with treatments etc.
Monitoring system	The clinical production can be reported to the national health system databases on a daily basis by internet	There is no internet connection available on board. Data are reported when Igaraçu returns to Borba city. The MOH datacenter has a flexible deadline for the fluvial mobile clinics.
Team	All are health care workers and a community member with basic health training.	In addition to a traditional team, there are the crew members (a captain, navigation assistants, cooker)
Delivering service	Community search for health service. High level of absences and loss follow up.	Health service seeks patients. Patient absences and losses to follow up are reduced.
Cost	About US$ 4.00 per person/month	US$7.80 per person/month
Territory	Land-based. To serve approximately 3.000 people, the unit must cover a large territory, consequently the service is not well accessed	Demographically based. In this “liquid territory” the service is based on the quantity of people, no matter how they are distributed in the territory.

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Full Length Research Paper

Breastfeeding skills in Arba Minch Zuria: The positioning and attachment initiatives

Dessalegn Tamiru[1] and Hunduma Jisha[2*]

[1]College of Public Health and Medical Science, Arba Minch University, Ethiopia.
[2]College of Health Science, Jimma University, Ethiopia.

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Proper child positioning and attachment initiates the production of optimal amounts of breast milk and contribute to the comfort of a child during suckling. Poor breastfeeding practices like early cessation and poor breastfeeding skills, introduction of unclean artificial feeding have been widely documented in the world. This cross-sectional community based study was carried out between October 7 and 25, 2013 in Arba Minch Zuria. Structured questionnaires and observational-checklist were used to collect data. The missing values and outliers, data, were checked and entered in double. Multivariable logistic regression was done to identify the predictors of poor and good positioning and attachment to breast. More than one-fifth of 384 (20.1%) infants was poorly positioned and attached to breast. Poor attachment of children to the breast were negatively associated with infant's age below 6 (AOR=0.03 (0.01, 0.11)), attending breast feeding education (AOR=0.42(0.19, 0.93)) and positively associated with having an uneducated husband (AOR=0.07(0.01, 0.51)). Poor child positioning were also negatively associated with infant's age below 6 (AOR=0.03(0.01, 0.10)), lack of information on breastfeeding (AOR=0.42(0.19, 0.94)), and early introduction of additional food (AOR=0.44(0.20, 0.97). Overall, in more than one-fifth of mothers (20.1%), the breastfeeding attachment and positioning were found to be lower than the national and global recommendations. It is highly related to infant's age, paternal educational and an exposure to breastfeeding education. Thus, continuous community based nutritional health education were needed to promote optimal breastfeeding skills using health workers, religious leader and local community resource people as key actors.

Key words: Positioning, attachment, breastfeeding, Arba Minch.

INTRODUCTION

There is a universal consensus on the dietary benefit of optimal breastfeeding practices for children's optimal growth and mental health benefits. Currently, breastfeeding is the focus of multi-professional interest because of its nutritional value and psychological benefits for both mother and her child. Breastfeeding benefits are short-term and long-term protection of children against malnutrition and infectious disease (WHO, 2002, 2003).

Effective breastfeeding is achieved when the mother and baby are properly positioned and child is attached to the mother's breast. Breastfeeding is an art that could be learned. It has been documented that very few women

*Corresponding author. E-mail: hunjisha@gmail.com.

breastfeed without difficulty from the first day, but majority encounter problems somewhere along the way (FMOH, 2004; WHO and UNICEF, 2008). These difficulties are due to limited feeding time, lack of sureness or poor attachment of the baby at the breast. Study showed an unsettled, hungry and angry baby, breast engorgement, and maybe obstructed milk ducts and reduced milk production are the most common cause of ineffective breastfeeding (FMOH, 2004; WHO and UNICEF, 2008; Belachew, 2003). Mothers and babies should be comfortable during breastfeeding. Proper child positioning and attachment initiate the production of adequate amounts of breast milk and give comfort to a child during sucking and it helps in preventing sore nipples, engorgement and mastitis. For good attachment and successful breastfeeding, it is important to properly position the baby's body (ThaKre et al., 2012; Goyal et al., 2011; CSA, 2012; FMOH, 2005).

Right positioning and attachment of the baby at the breast are critical in establishing and effective breastfeeding. Early initiation of breastfeeding, skin to skin contact between mothers and babies, breastfeeding on demand, and help with positioning and attaching the baby increase the opportunity of successful breastfeeding. Successful breastfeeding is a result of the appropriate positioning and attachment of the child to the breast (ThaKre et al., 2012; Goyal et al., 2011; CSA, 2012; FMOH, 2005, 2008; Kimani-Murage et al., 2011).

Poor breastfeeding practices have been well documented both in emerging and developed countries. Suboptimal breastfeeding practices like discarding colostrum, overdue initiation of breastfeeding, introduction of dirty and unreliable artificial feeding and poor breastfeeding skills are common constraints to tackling an infant and child mortality in developing countries like Ethiopia (CSA, 2012; FMOH, 2005, 2008; Kimani-Murage et al., 2011).

The baby's head, neck and trunk should be positioned in neutral alignment to optimize breastfeeding performance. Otherwise it compromises an infant's ability to feed effectively, as it disturbs respiratory mechanisms, oral motor control and swallowing. If the baby is not properly attached to the breast, it might cause nipple pain and even damage. Limited feeding can result in engorgement of breast, which in turn can lead to poor attachment (WHO, 2002; FMOH, 2008; Kimani-Murage et al., 2011; WHO and UNICEF, 2009; Heck et al., 2006). Although, many scholars recommend that a proper positioning and attachment technique reduces breastfeeding related problems and increases long-term breastfeeding, no studies have been done in the area of Arba Minch Zuria.

METHODS

Study setting and sample

A cross-sectional community based study was conducted from October 7 to 25, 2013 in Arba Minch Zuria in GamoGofa zone, in the southern part of Ethiopia. The district has an estimated total population of 165,680 of which 82,751 were males and 82,929 were females as it was shown by 2007 published Central Statistical Agency (2008). Nine administrative units (kebeles) were randomly selected from 31 kebeles of the district.

A total of 384 breastfeeding women were included in the study through a single population proportion formula. Since there has been no study done in this area, an estimated 50% prevalence of proper breastfeeding skill and practice was considered with a 5% margin of error, 95% confidence interval. The study included mothers who had children in the last two years and were permanent resident of selected kebeles. Breastfeeding women were randomly selected using a simple random sampling technique.

Data collection procedure

Structured questionnaires and observational-checklist were used to collect socio-demographics characteristics, child feeding practices and environmental health characteristics. Moreover, women's knowledge on breast milk and breastfeeding skills was also included in the questions. Questionnaires were prepared in English and translated to Amharic, then retranslated back to English by language experts who can speak both languages to check its reliability. The questionnaires were pre-tested for simplicity and clarity. Based on pre-test, additional adjustment was made in terminologies and formatting questionnaires.

Statistical analysis

The data were checked for missing values and outliers and entered in double and analysed using SPSS version 16.0. Descriptive statistics like frequencies and proportion were used to describe the study population in relation to relevant variables. Bivariate associations between predictors and breastfeeding skills were described to see the strength of association using odds ratios and 95% of confidence intervals. Then, to identify the predictors of positioning and attachment grade, only variables that were significantly associated with bivariate analyses were entered into the multivariable logistic regression model with good positioning and attachment as a dependent variable. Multicollinearity among independent variables was checked and no multicollinearity was detected (Egata et al., 2013). All tests were two-sided and $P<0.05$ was considered as statistically significant.

The observation was evaluated in accordance with criteria set by national breastfeeding recommendations. If infant body and head is straight; head and body is facing breast and well supported with skin-to-skin contact and if the infant's whole body is supported and all of these four signs are present, breastfeeding skills were graded as well positioned. Missing one or two criteria was graded as average and achieving one criteria or missing all was considered as poor positioning. A child is well attached, if the chin touches the breast and lip is opened widely; lower lip turned downward and areola is more visible above than below. If one of the criteria was not fulfilled, it was considered as an average attachment and achieving one criteria or missing all was considered as poor attachment.

Ethical considerations

Ethical clearance and official permission was obtained from an ethical clearance committee of Arba Minch University and Arba Minch Zuria Woreda administration before the study commenced. And an informed verbal consent was obtained from each study participant for their willingness of participation.

Table 1. Breastfeeding skills in Arbaminch Zuria, 2013.

Breastfeeding skills	Categories	Number (n)	Percent (%)
Positioning grade	Poor positioning	77	20.1
	Average positioning	196	51.2
	Good positioning	110	28.7
Attachment grade	Poor attachment	77	20.1
	Average attachment	197	51.4
	Good attachment	109	28.5

RESULTS

From 384 breastfeeding women, 98.2% gave complete response. The mean (±SD) age of the mothers was 25.08 years (±6.65) with the range of 15 to 40 years. More than one-fourth of infants were well positioned and attached to breast. Inversely, more than one fifth of mothers poorly positioned and attached their infants to breast (Table 1).

Women who had infants below 6 months and 6 to 12 months were 99.92 (AOR=0.03(0.01, 0.11)) and 99.77% (AOR=0.08(0.02, 0.27)) that poorly attached their infants to breast than who had one year and above, respectively. Women who had infants below 6 months were 8 times more well attached (AOR=8.54(8.44, 84.39) than those that had 12 months and above infants (Table 2).

Women who have been informed about the dietary importance of breastfeeding and poorly attached their children to breast were 58% less (AOR=0.42(0.19, 0.93)) than who had no information. Similarly, women who had uneducated husband and poorly attached their children to breast were 99.93% (AOR=0.07(0.01, 0.51)) more than those that had educated husband (Table 3).

Similar to breastfeeding attachment, women who had infants below 6 and 6-12 months were 14% times (AOR=8.14(3.04, 1.87)) more well positioned and 99.02% (AOR=0.08(0.02, 0.26)) less poorly positioned than those that had 12 months and above. Women who had information on breastfeeding and attached their children (AOR=0.42(0.19, 0.94)) poorly to breast were 58% less than those that had no information. Women who gave additional food before 6 months and poorly positioned (AOR=0.44(0.20, 0.97) their children to breast were 56% more than those that did not give additional food (Table 4).

DISCUSSION

The promotion of optimal breastfeeding has been recognized as a global public health concern. Effective breastfeeding is crucial in getting all the benefits of breastfeeding. Breastfeeding has a unique combination of nutritional and immunological benefits for infants and their mothers. Only 28.5% of women appropriately attached their children to breast during breastfeeding, which was relatively low as compared to the study done in Arjo, were 35.97% mothers well attached their children to breast (Tamiru et al., 2012). Similarly, small number of women (28.8%) appropriately positioned their children during breastfeeding which is less than the findings from Jimma Arjo were 33.79% of women appropriately positioned their children during breastfeeding (Rea et al., 1999). As compared to the study done in india, child positioning and attachment during breastfeeding were also relatively low which might be due to lack of knowledge on optimal child feeding practices (ThaKre et al., 2012).

Breastfeeding skills were significantly associated with infant's age, breastfeeding education and paternal educational levels. Women who had infants aged less than 6 months were more appropriately attached and positioned their infants during breastfeeding as compared to those who had one year and above. This might be due to the size of a child, easy to hold and poor breastfeeding skills. This study also showed that an exposure to breastfeeding education had a significant input for proper child attachment to breast. Women who had information on breastfeeding practised relatively less child attachment to breast. This might be due breastfeeding education given along with other health issues for women. Studies from india and other countries also showed that pre-education is a determinant factor of appropriate child feeding practices (WHO, 2002, 2003; Tamiru et al., 2012).

Paternal education level was significantly associated with good attachment of child to breast. This might be due to the influences of husband involvement and psychological support to optimal breastfeeding practices. Fathers with more education are better informed and aware of the benefits of breastfeeding and encourage their wife on optimal breastfeeding. Women need full support of their families and government to feed their children and family appropriately. Studies also found the positive trends of optimal child feeding improvement with paternal education status (Tamiru et al., 2012; Rea et al., 1999; Tamiru et al., 2012; Law et al., 2007; Kristiansen et al., 2010).

Women who attended breastfeeding education and

Table 2. Maternal characteristics and breastfeeding skills in Arba Minch Zuria, 2013.

Characteristics	Categories	Positioning grade			Attachment grade		
		Poor	Average	Good	Poor	Average	Good
		No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)
Marital status	Married	75(97.4)	193(98.5)	108(98.2)	75(97.4)	194(98.5)	107(98.2)
	Unmarried	2(2.6)	3(1.5)	2(1.8)	2(2.6)	3(1.5)	2(1.8)
Family size	< 5	39(50.6)	104(53.1)	60(54.5)	39(50.6)	109(55.3)	55(50.5)
	>5	38(49.4)	92(46.9)	50(45.5)	38(49.4)	88(44.7)	54(49.5)
Maternal age (in years)	>20	10(13)	13(6.6)	5(4.5)	10(13.0)	13(6.6)	5(4.6)
	20-24	44(57.1)	117 (59.7)	69 (62.7)	44(57.1)	120(60.9)	66(60.6)
	> 25	23(29.9)	66(33.6)	36(32.8)	23(29.9)	64(32.5)	38(34.9)
Attended Antenatal Care	Yes	66(85.7)	162(82.7)	91(82.7)	66(85.7)	162(82.2)	91(83.5)
	No	11(14.3)	34(17.3)	19(17.3)	11(14.3)	35 (17.8)	18(16.5)
	TBA	35(45.5)	98(50.0)	64(58.2)	35(45.5)	99(50.3)	63(57.8)
Delivery Assistant	Health Workers	12(15.6)	14(7.1)	15(13.6)	12(15.6)	16(8.1)	13(11.9)
	Relatives	30(39.0)	84(42.9)	31(28.2)	30(39.0)	82(41.6)	33(30.3)
Child Age (in months)	0-6	14(18.2)	108(55.1)	46(41.8)	14(18.2)	109(55.3)	45(41.3)
	7-12	41(53.2)	84(42.9)	60(54.5)	41(53.2)	84(42.6)	60(55.0)
	13-24	22(28.6)	4(2.0)	4(3.6)	22(28.6)	4(2.0)	4(3.7)
Delivery Type	Caesarean section	1(1.3)	3(1.5)	2(1.8)	1(1.3)	3(1.5)	2(1.8)
	Vaginal delivery	76(98.7)	193(98.5)	108(98.2)	76(98.7)	194(98.5)	107(98.2)
Place of delivery	Home	71(92.2)	191(97.6)	108(98.2)	71(92.2)	192(97.5)	107(98.2)
	Health institution	6(7.8)	5(2.5)	2(1.8)	6(7.8)	5(2.5)	2(1.8)
Maternal education	No education	48(62.3)	122(62.2)	65(59.1)	48(62.3)	122(61.9)	65(59.6)
	Read and write	14(18.2)	38(19.4)	27(24.5)	14(18.2)	39(19.8)	26(23.9)
	Elementary & above	15(19.5)	36(18.4)	18(16.4)	15(19.5)	36(18.3)	18(16.5)
Ethnicity	Gamo	57(74.0)	149(76.0)	93()84.5	57(74.0)	154(78.2)	88(80.7)
	Wolaita	5(6.5)	12(6.1)	2(1.8)	5(6.5)	12(6.1)	2(1.8)
	Others *	15(19.5)	35(17.9)	15(13.6)	15(19.5)	31(15.7)	19(17.4)
Farm land owners	No	54(70.1)	154(78.6)	81(73.6)	54(70.1)	153(77.7)	82(75.2)
	Yes	23(29.9)	42(21.4)	29(26.4)	23(29.9)	44(22.3)	27(24.8)
Religion	Protestant	51(66.2)	119(60.7)	64(58.2)	51(66.2)	119(60.4)	64(58.7)
	Orthodox Christian	24(31.2)	71(36.2)	43(39.1)	24(31.2)	72(36.5)	42(38.5)
	Others**	2(2.6)	6(3.1)	3(2.7)	2(2.6)	6(3.0)	3(2.8)

*Zeyse, Amhara, Ganta, Gofa; ** Muslim, Traditional.

poorly positioned their children to breast were less than those that did not attend, this could be due to health extension support. This shows that basic education in the promotion of optimal breast-feeding should be heartened. Studies also showed health education given at different juncture regarding breastfeeding practices is the predetermining factors to promote optimal breastfeeding practices (WHO, 2002, 2003; Rea et al., 1999).

Women who introduced complementary food early and poorly positioned their children to breast were 56% more than those that did not introduce complementary food early. This might be due to complementing of breastfeeding with food and maternal gap of knowledge on the breastfeeding skills. Studies from Arjo and national report also demonstrated that maternal knowledge and their educational status has significant input on optimal child feeding practices (FMOH, 2005; Rea et al., 1999).

Conclusions

More than one-fifth of women poorly positioned and attached their children to breast as compared to national and international recommendations. Poor breastfeeding skills were significantly associated with infant's age, pre-education on the benefits of breastfeeding and educational status of husband. Hence, sustained community based nutritional education were recommended for pregnant and lactating mothers to encourage optimal breastfeeding skills during the period of attending health care and community meeting through education on breastfeeding using health extension

Table 3. Factors associated with breastfeeding attachment during breastfeeding in Arba Minch Zuria, 2013.

Variables	Categories	Attachment grade during breastfeeding					
		Poor attachment		Average attachment		Good attachment	
		COR	AOR (95%CI)	COR	AOR	COR	AOR (95%CI)
Maternal education	No education	0.74	0.40(0.07, 2.27)	1.51	1.44(0.36, 5.78)	1.11	2.01(0.25, 16.06)
	Read and write	0.54	0.39(0.07, 2.25)	1.23	1.24(0.30, 5.09)	0.81	1.77(0.21, 14.88)
	Elementary	0.83	0.65(0.11, 3.73)	1.67	1.43(0.34, 6.05)	2.00	2.23(0.29, 16.94)
	High school	1	1	1	1	1	1
ANC Follow up	Yes	1.21	1.32(0.48, 3.64)	0.83	0.80(0.37, 1.74)	1.42	2.44(0.71, 8.40)
	No	1	1	1	1	1	1
Child age	Below 6	0.05**	0.03(0.01, 0.11)**	1.96	1.59(0.36, 7.01)	1.99	1.05(1.01, 2.42)
	6 to 12	0.12**	0.08(0.02, 0.27)**	1.07	0.80(0.18, 0.49)	1.42	8.54(8.44, 84.39)
	Above 12	1	1	1	1	1	1
Maternal age	>20	3.00	4.23(0.68,26.35)	1.20	1.52(0.32, 7.16)	0.90	1.05(0.12,9.10)
	20-24	1.02	0.99(0.24, 4.19)	0.89	1.07(0.35, 3.31)	0.50	0.45(0.10, 2.12)
	25-29	0.89	0.69(0.15, 3.15)	0.71	0.77(0.24, 2.47)	0.56	0.48(0.10,2.42)
	≥30	1	1	1	1	1	1
Having a radio	Yes	0.86	0.77(0.37, 1.62)	1.14	1.16(0.66, 2.04)	0.68	0.65(0.26, 1.62)
	No	1	1	1	1	1	1
Breastfeeding refusal	Yes	0.87	1.10(0.29, 1.10)	1.34	0.96(0.37, 2.51)	2.16	2.71(0.75, 9.74)
	No	1	1	1	1	1	1
EBF knowledge	Yes	1.68	1.41(0.42, 4.76)	1.93*	1.93(0.69, 5.42)	3.53**	1.61(0.39, 6.70)
	No	1	1	1	1	1	1
EBF to 6 months	Yes	0.56	0.58(0.12, 2.90)	0.71	0.46(0.11, 1.90)	0.19(*	0.25(0.05, 1.19)
	No	1		1	1	1	1
Breastfeeding information	Yes	0.61	0.42(0.19, 0.93)*	1.18	1.16(0.59, 2.26)	0.44*	0.41(0.16, 1.07)
	No	1		1	1	1	1
Breastfeeding initiation	Within 1 hour	0.60	0.65(0.32, 1.33)	0.57	0.62(0.36, 1.07)	0.73	1.15(0.50, 2.68)
	After one hour	1	1	1	1	1	1
Giving additional food	Yes	0.92	0.69(0.25, 1.91)	0.47	0.59(0.28, 1.25)	0.48	0.47(0.16, 1.34)
	No	1	1	1	1	1	1
Twins	Yes	2.84	2.45(0.19,32.16)	2.12	2.34(0.21,25.60)	5.54	6.77(0.48, 96.53)
	No	1		1	1	1	1
Breastfeeding frequency	Below 8	2.25	2.73(0.19, 6.30)	1.01	0.90(0.50, 1.61)	1.12	1.37(0.56, 3.35)
	8 and above	1	1	1	1	1	1
Paternal education	No education	0.41	0.77(0.11, 5.43)	0.61	0.44(0.09, 2.23)	0.20*	0.07(0.01, 0.51)**
	Reading and writing	0.20	0.46(0.06, 3.39)	0.57	0.60(0.12, 3.11)	0.14*	0.08(0.01, 0.59)**
	Elementary	0.30	0.38(0.06, 2.36)	0.63	0.50(0.11, 2.37)	0.26	0.23(0.04, 1.35)
	High school &above	1	1	1	1	1	1
Deliver assistant	TBA	0.63	0.48(0.22, 1.02)	0.50*	0.49(0.27, 0.86)*	1.57	1.48(0.60, 3.66)
	Health Workers	1.02	0.58(0.19, 1.81)	0.53	0.54(0.22, 1.35)	0.25	0.23(0.03, 2.20)
	Relatives	1	1	1	1	1	1

*Significant at <0.05; **significant at <0.01; COR: crude odd ratio; AOR: adjusted odd ratio.

Table 4. Factors associated with child positioning during breastfeeding in Arba Minch Zuria, 2013.

Variables	Categories	Child positioning Grade during breastfeeding					
		Poor positioning		Average positioning		Good positioning	
		COR	AOR (95%CI)	COR	AOR (95%CI)	COR	AOR (95%CI)
Maternal education	No education	0.74	0.44(0.08, 2.53)	1.46	1.54(0.37, 6.34)	1.25	3.55(0.45, 27.66)
	Reading and writing	0.52	0.37(0.06, 2.17)	1.00	0.94(0.22, 3.96)	1.22	2.97(0.37, 23.41)
	Elementary	0.83	0.69(0.12, 3.99)	1.75	1.61(0.37, 6.87)	1.75	2.39(0.31, 18.30)
	High school	1	1	1	1	1	1
ANC Follow up	Yes	1.27	1.33(0.46, 3.65)	0.90	0.82(0.37, 1.82)	1.43	2.04(0.64, 6.42)
	No	1	1	1	1	1	1
Child age	Below 6	0.05*	0.03(0.01, 0.10)*	1.89	1.48(0.33, 6.57)	1.71*	8.14(3.04, 1.87)*
	6 to 12	0.12*	0.08(0.02, 0.26)*	0.97	0.69(0.15, 3.04)	1.63*	7.81(6.81, 8.81)**
	Above 12	1	1	1	1	1	1
Maternal age	>20	3.0	4.14(0.66,26.05)	1.20	1.47(0.30, 7.11)	0.90	1.29(0.15, 11.11)
	20-24	0.98	0.94(0.22, 3.99)	0.82	0.94(0.29, 2.97)	0.50	0.48(0.10, 2.26)
	25-29	0.95	0.75(0.16, 3.44	0.70	0.72(0.21, 2.40)	0.85	0.89(0.18, 4.38)
	≥30	1	1	1	1	1	1
Having a radio	Yes	0.81	0.68(0.32, 1.43)	1.07	1.00(0.55, 1.78)	0.62	0.44(0.18, 1.06)
	No	1	1	1	1	1	1
BF refusal	Yes	0.87	1.11(0.29, 4.26)	1.32	0.90(0.33, 2.44)	2.23	3.17(0.92, 10.84)
	No		1	1	1		1
EBF knowledge	Yes	1.21	1.62(0.48, 5.41)	2.46*	2.68(0.91, 7.89)	1.08	2.11(0.53, 8.33)
	No	1	1	1	1	1	1
EBF to 6 months	Yes	0.70	0.71(0.15, 3.37)	0.97	0.58(0.14, 2.41)	0.27*	0.39(0.08, 1.79)
	No	1	1	1	1	1	1
Breastfeeding information	Yes	0.66	0.42(0.19, 0.94)	1.34	1.24(0.62, 2.46)	0.55	0.47(0.18, 1.19)
	No	1	1	1	1	1	1
Breastfeeding initiation	Within 1 hour	0.57	0.61(0.29, 1.24)	0.53	0.57(0.32, 0.99)	0.60	0.86(0.38, 1.92)
	After one hour	1	1	1	1	1	1
Giving additional food	Yes	0.76	0.56(0.19, 1.58)	0.36	0.44(0.20, 0.97)	0.36	0.32(0.11, 1.90)
	No	1	1	1	1	1	1
Twins	Yes	1.42	1.27(0.14,11.11)	0.74	0.78(0.09, 6.68)	2.40	2.96(0.31, 28.61)
	No	1	1	1	1	1	1
Breastfeeding frequency	Below 8	2.13	2.55(0.10, 5.90)	0.97	0.85(0.46, 1.55)	0.89	0.99(0.43, 2.297)
	8 and above	1	1	1	1	1	1
Paternal education	No education	0.39	0.67(0.09, 4.73)	0.55	0.36(0.07, 1.85)	0.19*	0.04(0.01, 1.35)**
	Reading and writing	0.25	0.49(0.06, 3.66)	0.55	0.68(0.13, 3.63)	0.23	0.09(0.01, 1.66)
	Elementary school	0.31	0.38(0.06, 2.39)	0.62	0.49(0.10, 2.33)	0.33	0.27(0.04, 1.61)
	High school and above	1	1	1	1	1	1
Deliver assistant	TBA	0.58	0.46(0.21, 1.00)	0.45*	0.45(0.25,0.83)**	1.14	1.31(0.56, 3.04)
	Health Workers	0.83	0.50(0.16, 1.53)	0.41*	0.43(0.17, 1.09)	1.37*	0.74(0.07, 4.23)
	Relatives	1	1	1	1	1	1

*Significant at <0.05; **significant at <0.01; COR: crude odd ratio; AOR: adjusted odd ratio.

workers, religious personel and development army as key actors.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interest.

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