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Use of Mobile Phones for Infant and Young Child Feeding Counseling in Sri Lankan Tea Estates: A Formative Study

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Abstract

Despite the availability of free health services, children residing in Sri Lanka's less developed plantation sector are more likely to be undernourished than children in urban and rural sectors. Hence, we need new approaches to improve their nutritional status. One promising approach involves mobile health initiatives, which is used effectively in other countries in primary health care settings. We studied the nature of mobile phone use in this community, and their perceptions on using m-health counseling for infant and young child feeding. Focus group discussions and in-depth interviews were the study methods. We found that mobile phone usage is common in this community hence; m-health platform could be a promising initiative to strengthen the existing face to face nutritional advice provided by the field health workers to improve the nutritional status of children.

Keywords

Asia, South, Children, Growth and Development, Communication, Health Promotion, Malnutrition, M-Health

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Despite the availability of free health services, children residing in Sri Lanka's less developed plantation sector are more likely to be undernourished than children in urban and rural sectors. Hence, we need new approaches to improve their nutritional status. One promising approach involves mobile health initiatives, which is used effectively in other countries in primary health care settings. We studied the nature of mobile phone use in this community, and their perceptions on using m-health counseling for infant and young child feeding. Focus group discussions and in-depth interviews were the study methods. We found that mobile phone usage is common in this community hence; m-health platform could be a promising initiative to strengthen the existing face to face nutritional advice provided by the field health workers to improve the nutritional status of children. Keywords: Asia, South, Children, Growth and Development, Communication, Health Promotion, Malnutrition, M-Health

Sri Lanka saw a slow decline in childhood undernutrition during the last decade (Department of Census and Statistics and Ministry of Healthcare and Nutrition, 2009), despite the availability of free health service and education for over eight decades. The nutritional status of children living in the estate sector is poor compared to urban and rural sectors in Sri Lanka. The estate sector, which comprises tea plantations, continues to report high rates of undernutrition (stunting 40.2%, wasting 13.5%, underweight 30.1%), and relatively poorer performance on infant and young child feeding (IYCF) indicators (exclusive breast feeding rate 57.7%, dietary diversity 50.7%, minimum acceptable diet 41.8%), than national averages (Department of Census and Statistics and Ministry of Healthcare and Nutrition, 2009; Senarath, Siriwardena, Godakandage, Jayawickrama, Fernando, & Dibley, 2012; Senarath, Godakandage, Jayawickrama, Siriwardena, & Dibley, 2012). There is an ongoing debate on the effectiveness of traditional methods of nutritional interventions to bring desired outcomes to this population (Weerasinghe & Bandara, 2015). Hence, it is worthy to seek new approaches for improving nutrition and overall health status.

Mobile health initiatives have been effectively used in many primary health care settings for different needs such as patient compliance for insulin therapy, HIV treatment and

pediatric dental appointment reminders (Franklin, Waller, Pagliari, & Greene, 2006; Nelson, Berg, Bell, Leggott, & Seminario, 2011; Puccio et al., 2006). M-health is the use of portable electronic devices for mobile voice or data communication over a cellular or other wireless network to provide health information (Kahn, Yang, & Kahn, 2010). With the evolution of mobile phone technology and wider usage, many view m-Health as a promising tool to foster behavioral change. Systematic reviews of m-health behavioral change communications found almost no trials conducted in the low and middle income countries except for a single trial in China (Free et al., 2013; Krishna, Boren, & Balas, 2009).

According to statistics of the telecommunication regulatory commission in Sri Lanka, the number of mobile phone subscriptions by June 2014 was 21 million. Furthermore, mobile subscriptions per 100 people were 102.5, compared to fixed phone services, which were 13.1 per 100 inhabitants (Telecommunication Regulatory Commission in Sri Lanka, 2014). At individual level, 45%-50% of people in Sri Lanka own a mobile phone, which is higher than the average for the South Asian region. Expansion of mobile networks within the last decade achieved over 90% coverage of 2G and 70% of 3G facilities. In addition, the competition of several providers has reduced the prices of the services (GSMA intelligence, 2013). Current ownership of mobile phones in rural areas is less than of urban setting (53% to 42%). However, annual subscriber growth is estimated to be 7%. While coverage not-spots (signal dead zones) and digital literacy lowers usage, affordability also presents an important factor, especially in rural areas (GSMA intelligence, 2013). Still, m-health nutritional counseling has the potential to be a promising application for health care in Sri Lanka. The aim of this study is to understand the nature of mobile phone use and perceptions of m-health for IYCF counseling among the mothers, their family members, and service providers in the estate sector of Sri Lanka for establishing a mobile platform for counseling.

Estate Sector and Health Services

In the early 19th century, the predominant subsistence agrarian economy in Sri Lanka, transformed into a commercial type, with the introduction of the plantation (estate) sector to the country by the British Colonial Rule. Among the key cultivation crops in Sri Lanka, tea became the major export crop. In the failure of recruiting sufficient labor from the indigenous Sinhala community, colonial rulers brought thousands of laborers from the South India for employment. Estate owners settled those Indian laborers in a peculiar type of housing scheme called "line rooms" in the estates. Those shelters were of low standard with poor water supply, and lack of sanitary facilities. Illiteracy and their status as a minority group further pushed them to poor health conditions. At present, there are over 839,000 hectares of tea, rubber and coconut estates in the country. In 2013, total population and families in the estates were 977,781 and 249,061, respectively. Twenty-three corporate plantation companies manage around five hundred large estates. In addition, there are many individual companies and private owners managing estates (The Planters' Association of Ceylon, 2013).

Sri Lanka provides free healthcare to all the citizens in government facilities. Accordingly, the estate community also has access to the free health care offered by the government facilities at present. This includes both curative and preventive care. During the historical development of estate sector in the country as a separate entity, estate management had the major responsibility of providing health care to the residents. The government during the last five decades gradually undertook this responsibility. However, the original structure of care delivery still exists to some extent in larger estates managed by corporate sector. Those facilities also offer care free of charge. The government recognizes the healthcare delivery mechanism of estates and uses it for providing services, particularly maternal and child health. Under the estate management, a separate unit facilitates welfare and health care delivery.

Within the estate health system, the health care team consists of an estate medical assistant (EMA), welfare officer, public health midwives (PHM), child development officers (CDO), crèche assistants, dispensers, and other minor staff helping to deliver the services. The EMA leads the team under the direction of estate management.

A corporate plantation company managed both estates studied for this project and had a functional health team. The first contact level for any illness is the estate dispensary operated by the EMA and the assistants. The PHM is responsible for maternal and child health (MCH) provision at the community level. The PHM is the direct link between government health services and the estate in respect to MCH services. However, CDOs play a pivotal role in MCH care in the estate. The CDO on most occasions becomes the intermediate agent between the mother and the PHM due to easy access and historically developed bonding over generations, as they are mostly from the same or similar communities. Mothers interact with the CDO on a daily basis at the crèche. Therefore, crèche is the focal point for delivery of MCH care in the estate including IYCF activities. The PHM is the technical person who provides care and advice to mothers, and is responsible for a larger population than the CDO. Thus, the PHM has less contact with the community as compared to the CDO (Weerasinghe & Bandara, 2015).

Mothers keep infants from 45 days of age to school age in the crèche during the daytime under the care of a CDO and assistants. Generally, there is an unwritten rule to restrict crèche facilities for children of mothers or fathers working in the estate. However, certain estates waive this rule depending on the decision of the management. In all estates, PHM designate the crèche as the field weighing post of infants and children for growth monitoring. All children, whether enrolled in the crèche or not, are evaluated for growth and development on a monthly basis. This provides an opportunity for the PHM and the CDO to give advice on IYCF to mothers or other relatives caring for children. In addition to the crèche, mothers get IYCF advice at immunization and antenatal clinics held each month by the medical officer of health (MOH) and PHM. There are three hundred and twenty smaller health units designated as MOH areas to deliver preventive health care across the country; the MOH is the head of this unit and conducts outreach clinics to provide MCH and other preventive care. The MOH conducts outreach clinics in the estate dispensary in case of large estates. When there are no clinic facilities, they use community halls or other public facilities close to the community to deliver services. When necessary, MOH refer children to secondary or tertiary care centers during the clinic visits. Secondary and tertiary care facilities are generally located in urban settings away from estates.

Methods

We conducted the study in two tea estates during the first 6 months of 2014 in the district of Badulla, situated in the central part of Sri Lanka. The district has a total population of 815,253, of which approximately 18% live in the tea estates (Department of Census and Statistics Sri Lanka, 2012). The total population in the two estates is 11,101 (4924 and 6177 respectively). The number of pregnant mothers, children less than 1-year-old (infants), and aged 1-5 years were 71, 160 and 651 respectively. We used purposive sampling to select the estates based on differential access to transportation, the availability of diverse health care facilities in proximity, and distance to a city.

Both estates selected are similar in respect of most facilities they enjoy as well as the characteristics of the resident population apart from the distance to a city. We use English letters A and H to identify the two estates. The two estates are 30 kilometers apart and estate A is located in a difficult geographical terrain with less transportation facilities, and is far from any city compared to estate H. A majority (80%) of the workforce in estate A depends on the

estate itself for all economic activities. Estate H is located close to a small city with better access to transportation. Only fifty percent of workers in estate H employed in the estate itself. The population in both estates is predominantly Tamil. A few Sinhalese and Muslim families also live in the estates. In both estates, people walk long distances for their daily needs. A popular method of transport to distant places is a three-wheel vehicle. Apart from their work at the estate, a majority of the households maintain a vegetable plot as a second source of income and some do animal husbandry, mainly cattle. Most of the community has group housing. Few families in both estates enjoy single-family housing. About fifty percent of the population in each estate has their own toilet facilities. Estate welfare system provides the water supply at no cost and all houses have electricity. An estate demarcates several smaller geographical areas for administrative purposes, named as divisions. All field staff, welfare facilities, housing and other day-to-day activities of the estate functions under a division. Each division of the estate has a crèche to care for the children of working mothers. In these two estates, both working and non-working mothers can enroll their children to the crèche during the day. The crèche is open every day from 7:00 am to 4:30 pm. The estate management pays the salaries of CDO and the assistants operating the crèche. A crèche committee elected by the community does general administration of the crèche. The estate management, the Plantation Human Development Trust (PHDT), and other donations support the crèche. The PHDT is a government body established for the welfare of plantation workers. Parents pay a nominal fee on monthly basis to maintain the crèche.

In total, we conducted 27 focus group discussions (FGDs). Of those, 13 FGDs with mothers (7 FGDs in estate A and 6 FGDs in estate H, n=109), 7 with fathers (3 FGDs in estate A and 4 FGDs in estate H, n=30) and 7 with grandmothers/elderly females (4 FGDs in estate A and 3 FGDs in estate H, n=32). We conducted the FGDs until reaching saturation of information. Number of participants for an FGD varied between four to nine members. Average duration of an FGD was around one hour and forty minutes. We selected participants for FGDs from a draining area of a crèche. As stated above draining area of a crèche is all the housing units geographically located within a division. We used theoretical sampling to maximize pooling of experience on the research question (Mason, 1996). We selected mother, fathers and grandmothers of the children under the age of five brought for growth monitoring at field weighing post in the crèche. We solicited the support of the CDO to identify potential participants considering the age of the children, number of children in the family and enrolment or non-enrolment in the crèche for care. All those selected participated in the FGDs. In addition, we conducted 15 in-depth interviews with eight CDOs, 3 PHMS, 2 EMAs and 2 welfare officers. There were one EMA and one welfare officer for each estate in addition to two PHMs in the estate A and one from estate H. Of the eleven CDOs in the two estates, two were on maternity leave and one was on medical leave during the period of the fieldwork. Hence, only 8 CDOs participated in the in-depth interviews. The investigators past experience that health staff is more comfortable in expressing their views individually than in a group setting led to the decision on selecting in-depth interviews as the research tool. Average time for an in-depth interview was one hour and fifteen minutes. We conducted FGDs and in-depth interviews either in health centers (dispensary) or in the crèche at a time convenient to them. This provided adequate time, privacy, minimal disturbances and a relaxed environment for respondents to express their views and for the interviewer to probe important issues. It also provided an opportunity for the investigators to observe the facilities and function of the health centers and crèches that enhanced their understanding of the context. The structure of the interview format was flexible to accommodate a variety of experiences and opinions. We aimed to elicit participants' perception of issues related to IYCF, use of mobile phones and current sources of nutritional information through a voluntary and a natural manner than direct or indirect questioning. This helped to minimize influence of the research question and presence of the

investigator on the participant's responses. Two investigators not known to the participants previously conducted the FGDs and in-depth interviews in the local Sinhala and Tamil languages.

We audio recorded the FGDs and in-depth interviews and transcribed in local language in verbatim. Then two investigators translated all 42 transcripts independently to English language and typed in text format. We compared the English translations and the original transcript in local language for any differences, and agreed on a common English transcript taking all efforts to retain the original meaning of the narratives. We analyzed inductively grounded in the data through an iterative process to identify emerging themes to unearth core issues related to mobile phone use in IYCF counseling. The two investigators who conducted the FGDs and in-depth interviews did the preliminary coding independently from each other taking the interview format as a flexible guide. We developed a common set of codes for both FGDs and in-depth interviews as the inquiry on both methods was on similar issues. We did not attempt separate analysis for two locations considering the similarity of the context in the two estates. The structure and the flow of codes reflected the FGDs and interviews. Then we compared the codes and made adjustments based on the research objectives for a final set of codes. Then the two investigators recoded the transcripts using the agreed set of codes. Coded narratives in the transcripts in text format were pooled together for identification of patterns and comparison across interviews. We compared across different coding sorts to identify emerging themes.

We obtained clearance for the study from the ethics review committee of the faculty of medicine at the University of Colombo. District health and administrative authorities and the management of tea estates provided their fullest support to conduct the study. We explained the intention of the study, the process of data collection, and the right to decline participation. Participants received a printed information sheet, including contact information of the researchers, prior to obtaining verbal consent. In Sri Lankan rural settings, obtaining written consent for interview-based studies is not required and informed verbal consent is sufficient for non-invasive research methods. The participants did not receive any incentives for their participation in the study. We explained that the research findings would be the basis for establishing a potential mobile platform for IYCF counseling.

Results

The results section intends to provide an in-depth understanding of the context and the interactions the estate community has with the usage of mobile phone. Therefore, we have arranged the results section according to six emerging themes for clarity of presentation. The themes follow in sequence to illustrate mobile phone use in the family, cost and utility of mobile phones, perception of mobile phone by women, IYCF counseling activities in the study area, mother's perceptions on use of mobile phones to receive messages on IYCF and health workers' perceptions on mobile phone for counseling. Due to the nature of the topic, some of the content presented under those six themes are overlapping. Further, to make flow of the presentation smooth and the logical, we have revisited certain sub themes more than once across the results section.

Mobile Phone Use in the Family

There are more than six mobile phone service providers in Sri Lanka. Depending on the geographical location of households, the extent of coverage differs. Apart from mobile phones, there are providers of fixed telephone services using code division multiple access (CDMA) technology. In both estates, the majority of the residences have fixed telephones. Two

providers had initiated easy payment terms for the estate population by collaborating with the estate management several years ago. This resulted in a majority of households having access to fixed telephones. Apart from the fixed phones, most of the households in the two estates also own a mobile phone. Men, particularly the young and middle aged, use the mobile phones; elderly men rarely own or use mobile phones. The mobile phone is generally kept in the custody of husbands who take it wherever they go. Only a very small proportion of women own a mobile phone; they generally use the fixed phone at home. Younger women have limited access to their husband's mobile phone when the husband is at home. Because a fixed phone is available at home, there has not been a serious need for use of mobile phones by women. When the husband is working in a distant place, particularly in another city, women are likely to own a mobile phone. This is to communicate with the husband in emergencies. One health worker in the estate observed:

Most of the time men go out. So they tend to have mobile phones. Women can use fixed phone when they are at home. They don't take phones to estate work. So they don't need cell phones. But few women have cell phones.

They use predominantly voice facility for communication. Short message service (SMS) is used very rarely even by the males. Most are not conversant with using SMS. They want the phone to convey a quick message to their home or to the place of work. They believe voice message is a more convenient and effective to convey a message. The males do not use the phones for social media. A father explained preference for voice utility:

We use phone to talk to someone and receive a call. We hardly use SMS. Most do not know how to send SMS. Text is in English and most of us cannot read it either. It is convenient to call and give a voice message. We are used to it.

A healthcare worker in the estate also supported this claim:

Most of them don't know to read those messages. Maybe, because of language problem. Only those who left school recently use those messaging facilities. Still is a small number compared to the population in the estate.

The husbands do not oppose usage of mobile phones by their wives. They do not see any cultural, ethical barrier for them to use it. However, they do not see a strong need for women to have a mobile phone because a fixed phone is available at home. Furthermore, women do not leave the estate frequently. If they go out, it is with the husband or with an elderly woman, so they do not see the purpose of having a mobile phone for women. However, some husbands were concerned about the additional expenses that have to incur if the wife too uses a mobile phone, particularly when they take unnecessary and lengthy calls:

We don't have a problem of wives using mobile phone. It is not an issue for us. If we give phone to them they will make lengthy calls and finish the credit. Then we can't use the phone for urgent needs. That's the only concern I have.

Elderly women and mothers in law were mainly neutral on the use of mobile phones by women in general. They have never used a mobile phone in their lifetimes. They are less aware of the use of such equipment and do not see a pressing need for women to have mobile phones, though they were not opposed to having them. One mother in law expressed her views:

[A] telephone is a good thing. If necessary, they have to use phones. We are not used to it. If someone makes calls and gives the receiver to us, then we can talk. I don't want to meddle with it.

Cost and Utility of Mobile Phones

Almost all who own a mobile phone in the estate use prepaid plans that accommodate their budgets. They reload the credit according to their needs. A majority spends around 400-600 rupees per month (1\$=130SLR) for the service. However, a few spent higher amounts, occurring when they are working away from home and earns a better salary. On average, the daily income of an estate worker is around 500 rupees. Phone recharge cards are available even in small boutiques inside the estate; hence, they can recharge the credit as required. Generally, they recharge the phone in minimal amounts to add a few calls. One mother of an infant noted that:

There is a shop close to our house where we can buy all kinds of mobile recharge cards. The shopkeeper keeps a small commission from each card they sell. But to reload the phone directly, we have to go to town.

Selection of the provider depends on the extent of the signal strength they receive in the area of residence, the convenience of obtaining a SIM (Subscriber Identity Module) card and the call rates the provider offers. However, the main factor is the signal strength they receive at their residence. This community resides in housing provided by the estate situated in difficult terrain. Most of the houses are located on slopes of hills where signal strength is minimal. Different parts of an estate receive variable signal strength so they choose a service provider based on which offers the strongest signal to their locality. Many have obtained more than one mobile connection. Certain households have very low signal strength inside their homes. In such instances, they search for the best location around the house to receive adequate signals to make a call. This minimizes the utility of mobile phones, as some cannot receive calls inside the house. One father expressed his difficulty:

Signal strength is different in different parts of the estate. Signals of certain providers do not reach some locations at all. So we have to choose the provider with the best coverage to our residence. Sometimes we have to come out of the house to a suitable place to make a call. We don't receive calls inside the house. So it becomes of less use. However, the fixed phone has better reception. So we rely on that when at home.

Therefore, some inhabitants rely more on fixed telephones for their communication needs when at their homes than on the weak or unavailable signals of mobile phones.

Perception of Mobile Phones by Women

Use of mobile phones by mothers in the two estates is extremely low. Although they do not use mobile phones in a regular basis, most young mothers know how to make or receive a call. Mothers over age 35 have rarely used a mobile phone and those who own or have used a mobile phone use the voice facility only. Very few know how to use the SMS facility, and most would ask their husbands to dial a call for them. Even when the local language is available for SMS facility, mothers prefer voice messages. One shared her experience of using a mobile phone:

I use the phone to call my parents living in another estate. I came to this estate after marriage. Sometimes I also call my husband to remind him to bring groceries when he returns from work. I know how to make a call. I don't send SMS. I talk long calls only to my parents.

Mothers felt mobile phones are a useful mode of communication particularly in times of need such as emergencies. The majority of women are more observers of mobile phones than true users; their experiences are based on how their husbands use them. Most of the women have limited movement out of the estate and if they do so, someone accompanies them, hence, they do not see a real need for a phone. Mothers have rarely contacted the PHM or other health care workers using a mobile phone; nor did the husbands. They contact the CDO in person. A PHM explained the method of conveying messages to the mothers:

I give details to CDOs through phone. I only call mothers if there is an urgent need such as the MOH wants to meet the mother because a medical test is positive. But usually the information to mothers is conveyed through CDOs.

According to mothers' own perceptions and the observation by the estate health staff, the social network of mothers is very limited. Most of the support they need is within the neighborhood from relatives and friends. Their experiences of communication and need for alternative options of communication is restricted by a limited social nexus. However, they were confident that nobody would object if they used mobile phones for useful purposes such as contacting the husband in emergencies, contacting the PHM or receiving information on health matters. A mother expressed the reasons for not owning mobile phone:

Our husbands are not opposed for us to use mobile phones. Thing is that we don't have our own mobile phone. As we use the fixed phone at home, there is no need for us to buy a mobile phone. When we go to work, we do not need a phone. We have fixed hours of work and if a message is to be given, it is given through the *kankani* (the person in charge in the field). Many women whose husband is working in a distant town have a mobile phone. They need to contact the husband when necessary.

IYCF Counseling Activities in the Study Area

The Sri Lankan public health system has been actively involved in IYCF for decades. There are special programs designed for training of trainers each year. Public health midwives are trained on IYCF and updates are provided periodically during in-service training. Child development officers also have training on basic aspects of IYCF. Most mothers in estates have regular contact with the CDO and interact with the PHM once or twice a month. At each weighing day, the PHM will explain the growth status of the child to the mothers and instruct on appropriate feeding. As most mothers are at work during daytime, the CDO will convey the message to the mother at the end of the day. They also demonstrate food preparation in the crèche with the help of the mothers. This provides them practical experience. Due to limited resources, such demonstration sessions are limited to once in three to four months. CDOs advocate healthy food habits for children in day care by imposing restrictions on food items that can be brought to the crèche. A health care worker explains their program:

There is a clinic for pregnant mothers and immunization clinics for children every month. In addition, during weight measuring days we spot out the low weight children. We talk to the mothers regarding nutrition. We instruct them to cook nutritious meals and bring it to crèche. If the children don't feed well, we even show them how to feed. We spot out 4-5 children like this per division.

PHMs in both estates have worked in this setting for over 15 years. The majority of CDOs have worked in the estate crèche for over 20 years. Both PHMs and CDOs noted that feeding practices have changed drastically during the last decade. They feel their advice and programs over the years have influenced the feeding behavior of mothers. With increasing educational attainment during the last decade, the mothers accept advice on feeding positively. According to health care staff the mothers over the age of 35 years are mostly illiterate and had not attended school beyond few grades. Most of the younger mothers attended school to a higher level and are receptive to health advice. They understand the importance of proper nutrition from infancy. Throughout, IYCF counseling has been face to face with mother groups or individual mothers. However, they also admit there are mothers who still use ancestral practices of feeding children such as delaying the introduction of solid foods, withholding meals during illness, and practicing food taboos on children. The health care workers feel such mothers need frequent counseling to change their behavior.

Mothers Perceptions on Use of Mobile Phones to Receive Messages on IYCF

Mothers clearly express their preference for face-to-face interaction for health related advice from the CDO and PHM. They have built a trusting relationship with them for their maternity and child health needs. Nearly all of the mothers lack access to newspapers or other reading material for information, so their main source of advice is from the estate health team apart from relatives. The opportunity to watch educational programming on television is rare, as they appear during the workday; television is mainly to watch dramas and Indian movies at night. In their limited environment, they have no access to written material so the clinic and crèche become the only educational opportunities. A mother of two children explained the limitations:

Although I can read and write, we don't get newspapers or magazines in the estate. We have to go to the town to buy those. That is not possible with our time and income. We work in the estate during the daytime. When we return from the work, we have to engage in household chores. We are very tired by then. So there is nothing else we can do than watching TV and going to sleep. There is no time to read.

Mothers were therefore positive about receiving health related messages and reminders through phones. As they had no experience in mobile-technology based counseling or personal experience with mobile phone usage for regular communication, they were unable to visualize the concept fully. They prefer to listen to voice messages, as they are not familiar with reading text messages. They feel voice messages are more effective than reading and they can retain more information via repetition during encounters with PHM and CDO. Only a few mothers are accustomed to following directions from voice prompts and the complex task of navigating a menu. Still, they were willing to learn the new technology for betterment of children. One of the mothers working in the estate expressed her willingness to receive IYCF counseling over the phone:

Most of the time when the child is weighed in the crèche, I am at work. So it is difficult to come to the crèche when the PHM is still there. When I come to the crèche at lunchtime or after work, the PHM has already left. At that time I am also in a hurry to feed the child and get back to work. So it is difficult to retain all the things I am told. So I feel it is better if I get voice message over the phone so I can listen to them when I am free. I will comply with the instructions.

Both working and non-working mothers expressed that the best time to send messages is after 6:00 pm. Working mothers generally return home by this time. At night, all members of the family are more or less stay at home with less outside social activity. Therefore, mothers, whether working or not, have access to the mobile phone of their husbands at this time of the day. One mother stated:

Only my husband has a cell phone. So it should be sent only after he returns home. It is good if health messages are sent after six in the evening. At that time I have also finished cooking and husband is generally at home. So I can use his phone. I want to listen to the message. We need to listen to them several times. Therefore, I can remember them better.

Health Workers Perceptions on Mobile Phone for Counseling

PHMs and CDOs possess their own mobile phones. At present, they have simple phones with limited functions. They use the phone for both official and private needs. PHM regularly contact the estate health team, particularly the CDOs, to inform about her program, scheduling clinics, and other visits. PHMs and the CDO have not been part of a mobile-based counseling system. They reiterated the preference for face-to-face interaction. They insist that mobile messaging, voice or text, should be a supplementary method to face-to-face interaction. They support the idea of mobile counseling to mothers, but want content to be consistent with their own advice. None of the PHMs had used a smart phone, so they were not sure about their capability of using it for complex tasks such as entering data if, required in an m-health initiative; but they were willing to learn. At present PHM keep paper-based records and information system is through hard copies. They were willing to try electronic records system if it does not duplicate or increase their workload. A health worker expressed the importance of continuing face-to-face interaction with mothers while using mobile phones to strengthen communication:

Sending voice messages to mothers is good. It will help us to reinforce what we advise. However, face-to-face counseling should be there. Messages should help to strengthen the existing system. If not, mother will refrain from coming to clinics. It will cause many problems to us.

Discussion and Conclusions

Many studies in high income countries have shown encouraging results in using mobile platform in improving health outcomes (Free et al., 2013; Kaplan, 2006; Krishna et al., 2009). Those include disease specific interventions, preventive education, supporting health care workers, and monitoring follow up visits at health centers. Most of the available studies focus on interventions targeting health care workers. A systematic review reported that out of the 42 trials conducted during 1990 to 2010, only 10 targeted patients or consumers (Free et al., 2013). Most of them were directed to improve clinic attendance for specific diseases. Mobile

technology has been used for few maternal and child health related health education projects (Kaewkungwal et al., 2010; Medhi et al., 2012). However, it is rare to find dedicated use of mobile voice and text messages for IYFC counseling in low and middle income countries. This study explored the nature of mobile phone use and perceptions on m-health for IYFC counseling among the mothers, their family members, and service providers in the estate population of Sri Lanka for establishing a mobile platform for counseling.

Availability of mobile services providers, accessibility of such services by the target population, affordability, and support of the healthcare providers to implement the program are vital to sustain an m-health program. Availability of mobile phones in the community is a prerequisite to any m-health program. Almost all households in the population studied own a mobile phone. Still, coverage can pose a challenge as this community resides in a difficult terrain. Some households did not receive adequate signal strength to make a call inside the house. On average, ownership of SIMs by a mobile user was over 2 per subscriber at national level in Sri Lanka (GSMA intelligence, 2013). This could mean most subscribers have access to more than one service provider. The community in the estates also showed a similar subscription pattern for SIMs. Further, all providers in the country promote mobile connections for a nominal fee. Hence, the mobile user can choose the service provider depending on the connectivity of the service in the geographical location of the residence. Similarly, when establishing a mobile platform, the health care provider also has the flexibility to choose one or more mobile services to deliver the health message. Although few household could be missed out, majority can break the barriers of low connectivity to improve access to m-health using multiple service providers.

The main issue was the access to this mobile phone for the targeted participants of the program, the mothers. Although only a small number of mothers themselves owned a mobile phone, they at least had access to their husband's phones. Key reasons for not owning a mobile phone by mothers at present was absence of a compelling need and lack of financial capacity to purchase it. Mothers in this community recognizes the utility of mobile phone to receive health messages that will improve their practices on child health. Mothers preferred to receive voice messages on IYFC at night when they feel free and had access to the husband's mobile phone. In many studies where the target population consists of consumers or patients, m-health projects have provided them with a mobile phone and credit to receive the m-health services (Franklin et al., 2006; Puccio et al., 2006). When mothers had to rely solely on their spouse's mobile phone, the frequency of sending messages as well as possibility of introducing interactive two-way communication is restricted. Furthermore, available credit on the husband's phone could be a deciding factor of a mother receiving the messages on time. Puccio et al (2006) suggested that mobile phone packages with unlimited minutes and the capacity of adding existing family phone lines could be a possible strategy to address credit issues and cost. In developing countries, the cost of the device and service has to be kept at a lower level for maintaining sustainability. Building the record management system on platforms such as smart phones or tablet PCs would be unsustainable within current budgets (Medhi et al., 2012). The estate population in Sri Lanka is a low-income stratum; hence, cost implications need to be considered seriously. Mobile phones with basic functions are available for relatively low cost in the local market. As a simple IYFC mobile counselling platform does not expect recipients to undertake complex tasks, an inexpensive basic phone can fulfil delivery of both voice and text messages to the target recipients, which is affordable in a low income setting. Thus, an m-health project working on a low budget can still improve access, by providing basic inexpensive mobile phones, even if the ownership of the mobile phones in the target population is low at the beginning.

Staff time for running an m-health program is a crucial element for sustainability. Extra burden on staff to maintain m-health activities on top of their routine work would act as a

deterrent for effective cooperation. Previous studies have shown that health care workers' workload has not been increased significantly due to m-health programs (Franklin et al., 2006; Puccio et al., 2006). Health workers in this study expressed concern that duplicating their work would be an issue for sustaining cooperation; hence, m-health initiatives for IYCF in this population need to be tailor made to complement their ongoing work, rather than adding new tasks. Evidence from India (Medhi et al., 2012) suggests that health workers preferred the mobile phone system because of the social respect and social power it earned them in the local community. Public health midwives in Sri Lanka have indicated they would like to use new technology in their routine work and requested additional training (Health System Research Unit Faculty of Medicine University of Colombo and Family Health Bureau, 2008). Therefore, shifting current paper based recording and reporting system of PHMs to an e-record system along with the m-health counselling platform is a possibility.

Usage of text or voice messages in m-health programs depends on the preference of the target population as well as their literacy to use them effectively. Study participants clearly expressed their preference to use voice messages in their routine use of the mobile communication. The community barely uses text messages for their communication needs. Low literacy in technology as well as language barriers was seen as reasons for the preference of voice messages. Many studies have shown it is possible to train consumers on such applications with little effort (Medhi et al., 2012). This could be further strengthened by providing dedicated local points of contact for trouble-shooting via technical support (Medhi et al., 2012). Most trials targeting patients or consumers have used both text as well as voice messages and conversations over the mobile to deliver the information (Free et al., 2013). The most common documented use of m-health is text messages (Kahn et al., 2010). One study has compared the effectiveness of voice over text messages. They concluded that using voice messages had significantly increased attendance for clinic visits over the text messages alone (Nelson et al., 2011). Systematic reviews done by Free et al (2013) concluded that text communication between health workers and consumers had modest benefits in increasing clinic attendance. However, this increase was similar to other forms of reminders too. This could mean other factors, particularly the logistic support, staff time, consumer preference, and cost for all possible communication modes has to be evaluated before initiating m-health programs.

Effective messaging can connect people to needed and available services. Sharing service information can also encourage providers to improve services (Kahn et al., 2010). Health behavior interventions must reach the public in order to succeed in promoting and maintaining health behavior change at the population level. M-health behavioral interventions must therefore, be designed and deployed using existing technology development and adoption of trends rather than introducing new devices/technologies (Tufano & Karras, 2005). Both voice and text message technology has been available for a decade in Sri Lanka. Although text messages are not widely used by the estate community, voice messages are a key way of communication. Availability of technology, possibility of improving access to mobile services, willingness of both the recipient and healthcare providers to an alternative method of IYCF counselling, become positive indications to accommodate a new approach for nutrition intervention in the estate sector. Hence, in bridging the gap of nutritional inadequacies in the estate sector, particularly in IYCF, m-health counselling is likely to be a promising candidate that needs attention in parallel to the provision of the established face-to-face services.

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