Original Article

Strengthening health services to deliver nutrition education to promote complementary feeding and healthy growth of infants and young children: formative research for a successful intervention in peri-urban Trujillo, Peru

Rebecca C. Robert^{*†}, Hilary M. Creed-Kanashiro^{*}, Ruben Villasante^{*}, M. Rocio Narro^{*} and Mary E. Penny^{*}

^{*}Instituto de Investigación Nutricional, Lima, Peru, and [†]School of Nursing, The Catholic University of America, Washington D.C., USA

Abstract

Formative research is critical for developing effective nutrition-specific interventions to improve infant and young child (IYC) feeding practices and promote healthy growth. Health workers interact with caregivers during health facility visits, yet there is limited research about how to optimize delivery of such interventions during these visits. The extensive reach of IYC health services globally calls for research to address this gap. In Trujillo, Peru, formative research was conducted to explore complementary feeding practices with caregivers as well as health worker routines and interactions with caregivers related to feeding and healthy growth; results informed the development and delivery of an educational intervention. Multiple qualitative methods were used to collect data on a purposive sample of health workers and caregivers from three health facilities and communities: household trials followed. Complementary feeding messages with doable behaviours were developed, and three were selected as key to promote based on their nutritional impact and cultural acceptability. In the health facilities, medical consultation, well-child visits and nutrition consultation all dealt with aspects of IYC nutrition/growth during their interactions with caregivers but were independent and inconsistent in approach. A nutrition education strategy was developed based on consistency, quality and coverage in the IYC health services. We conclude that formative research undertaken in the community and IYC health services was critical to developing a successful and culturally relevant intervention to promote optimal complementary feeding practices and healthy growth during interactions between health workers and caregivers at routine health facility visits. © 2016 John Wiley & Sons Ltd

Keywords: formative research, infant and young child feeding, complementary feeding, Peru, health services, healthy growth.

Correspondence: Rebecca C. Robert, School of Nursing, The Catholic University of America, WA D.C., USA.
E-mail: Robert@cua.edu

Introduction

The promotion of healthy growth and prevention of childhood under nutrition are global health priorities. (Victora *et al.* 2010; Lutter *et al.* 2011; Black *et al.* 2013; de Onis *et al.* 2013). Targeting the first 1000 days, from conception to 2 years, with effective nutrition-specific interventions such as breastfeeding promotion

and optimal complementary feeding are recommended to promote healthy growth of infants and young children (IYC) (Lutter *et al.* 2011; Bhutta *et al.* 2013; Black *et al.* 2013; de Onis *et al.* 2013; Prendergast & Humphrey 2014). Benefits of healthy growth are well documented and extend over the life course – from decreased mortality and improved cognitive development in infants to improved school performance for children and increased adult work capacity (Victora *et al.* 2008; Dewey & Begum 2011; Black *et al.* 2013). The first 1000 days also coincide with regular visits to the health facility for preventive

(well-child) and/or sick care of IYC. During these visits, caregivers of IYC routinely interact with health workers – nurses, doctors, nutritionists and/or ancillary staff. To optimize the promotion of healthy growth through these interactions, a clear understanding of complementary feeding practices within the local cultural context is needed, as well as the health worker routines and practices within the IYC services offered.

Formative research, using qualitative methods to explore and understand feeding behaviours and challenges within a local context, is key for developing effective interventions aimed at improving complementary feeding practices and growth (Pelto *et al.* 2003; Menon *et al.* 2005; Dewey & Adu-Afaruwah 2008; Paul *et al.* 2011; Paul *et al.* 2012; Daelmans *et al.* 2013; Sanghvi *et al.* 2013a; Bentley *et al.* 2014; Fabrizio *et al.* 2014). To promote optimal delivery of these interventions by health workers, the barriers to coverage and quality interactions with caregivers of IYC also need to be explored and opportunities for change recognized (Lutter *et al.* 2011; Locks *et al.* 2013; Lutter *et al.* 2013). The published literature describing such formative research and its translation into actual interventions for improving IYC health services is limited, yet the reach of IYC health services globally is extensive (Tchibindat *et al.* 2004; Lutter *et al.* 2013; Sanghvi *et al.* 2013b; Fabrizio *et al.* 2014). In this paper, we describe the formative research undertaken in the community and health facilities of Trujillo, Peru, and its translation into an effective nutrition education intervention that was delivered through the IYC health

services. The intervention strengthened and integrated nutrition education into all IYC services and resulted in health workers interacting with caregivers of IYC during routine well child visits and sick visits to promote key complementary feeding behaviours and healthy growth (Penny *et al.* 2005; Robert *et al.* 2007).

The results of the randomized intervention trial in Trujillo, Peru, have been described elsewhere (Penny *et al.* 2005). In brief, a cohort of children was followed in six intervention and six control communities from birth to 18 months. Stunting was reduced by more than two-thirds, and improvements in dietary intake of iron, zinc and energy intake were found in the intervention cohort compared with the control. Formative research was fundamental to the success of this study but has not yet been described in detail.

Methods

Setting

The study took place in the socio-economically poor peri-urban areas surrounding Trujillo, a large coastal city in northern Peru. Low and insecure income, poor housing and general lack of one or more basic services (i.e. safe water, reliable electricity source and sewage disposal), characterized the area. Government health facilities were in walking distance for most households, and local markets were accessible and sold a variety of affordable foods (Villasante 1997). Mothers were

Key messages

- Linking the formative research conducted in the community with that conducted in the IYC health services was critical to design the educational intervention for the health services.
- Key messages were developed to be culturally relevant, appealing to mothers, promote a doable behaviour and address common feeding practices with potential nutritional impact; key messages were also easy for IYC health workers to remember and deliver.
- Household trials conducted with mothers in the community were vital to inform the feasibility and acceptability of potential messages to improve complementary feeding practices.
- Formative research results were translated into the overarching concepts of consistency, quality and coverage to guide intervention development and delivery within the health facilities. This united many personnel throughout the system in addressing complementary feeding and healthy growth.

Spanish speaking; many were second-generation migrants to the coast from the Andes.

The government health facilities ranged from smaller health posts to larger maternity centres – but all offered a basic set of health services for IYC including well-child visits and immunizations, and medical consultation for illness. Some facilities offered nutrition consultation. Results from a preliminary community survey showed that one-third of caregivers had taken their child to a government health facility in the last month, the majority for illness. Two-thirds named the facility as a main source of information on IYC feeding (Penny 1998). Stunting and iron deficiency anaemia were the priority problems; regional prevalence of stunting was 17.0% in children less than 5 years (stunting = below 2sd height-for-age z-scores). Anaemia prevalence was 56.8% for all Peruvian children less than 5 years, similar across regions and level of urbanization, and higher in the younger age groups, 78.6% in children 6–11 months, 75.6% in children 12–23 months (Instituto Nacional de Estadística e Informática 1997). This context together with the research team's own experience of working on IYC research in Peru and specifically in Trujillo led to an informed and focused formative research study. Preliminary ideas for the intervention included a focus on prevention, compatibility with existing nutrition education in the government health facilities, low cost and sustainability.

Study design

An ethnographic approach was used, and a variety of qualitative methods employed (Table 1).

Three successive phases were completed as follows:

Phase I

In-depth exploration with mothers of IYC, health workers and health facilities; food market surveys (Creed Kanashiro *et al.* 1999; Creed-Kanashiro *et al.* 2000).

Phase II

Development of messages for recommended feeding practices and household trials to test the recommended practices (Dickin *et al.* 1997; PAHO 2004).

Phase III

Development of the intervention strategy, intervention components and delivery channels for health workers in the health facilities.

The three phases of field work and analysis were completed over 3 months. Approval to conduct the formative research was given by the Research Ethics Committee of the Instituto de Investigación Nutricional, Lima, Peru. Oral and/or written informed consent was obtained from each informant.

Data collection methods and sampling

Data were collected in three of the six randomly selected intervention group health facilities and respective catchment areas; purposive sampling of informants ensured representation of the different health worker roles and caregivers of different aged infants. Data collection occurred over two to three weeks for each health facility/community. Table 1 provides a brief description of the various data collection methods and samples.

Analysis

To help select foods from the market survey, 'Best Buy' software of the IIN was used – which was later adapted for use by ProPAN (PAHO, 2004).

Interviews and focus groups were recorded and transcribed. The lead anthropologist held debriefing sessions with the research team after each day of field work and transcribed detailed summaries based on these sessions and the recordings. Notes taken during observations were later expanded in written summaries. Data from exit interviews were summarized. All members of the formative research team read and discussed the various data summaries. Triangulation of all data followed a process led by the lead anthropologist with input from the team. Matrices were created to focus and reduce data into relevant categories. Additional analysis included extraction of major content/themes from the interviews, for example, the motivations of health workers, and mothers' aspirations for their children.

Table 1. Data collection methods, description and sample

Method	Description	Sample
Phase 1		
Semi-structured interviews:		
• Mothers	Explore infant feeding practices, feeding difficulties, aspirations for their child and infant/young child development.	13
• Health promoters/ community leaders	Explore infant/young child feeding and nutritional concerns in the community.	10
• Health workers: physicians, nurses, nutritionists and medical assistants	Explore health worker/service role in infant/young child nutrition and work motivations.	10
• Health authorities	Explore health care system and quality control of programmes.	
Focus groups:	Explore infant/young child feeding.	3
• Mothers of infants 6–18 months	Food attributes exercise using food cards to explore positive and negative characteristics of foods for infants/young children. (Blum <i>et al.</i> 1997).	3 groups/27 mothers
Semi-structured observations in the health facilities:	Photo-projective exercise using selected photos to elicit narratives of healthy and unhealthy infants/young children (Gittelsohn <i>et al.</i> 1998). Observe nutrition content of visits, including anthropometry.	Health worker-caregiver interactions in the health facilities: 14
• Medical consultation		
• Well child care visits		
• Nutrition consultation		
• Anthropometry		
Exit interviews:	Determine reason for visit and nutrition content of health facility visits.	8
• Mothers of infants	Identify 'best buy' local foods based on availability, price, nutritional value and potential acceptability to infants/young children.	6 markets
Market surveys:		
• Local Trujillo markets		
Phase 2		
Household trials:		
• Caregivers of infants 6–18 months	Determine ability to put into practice various recommended feeding practices for IYC.	Nine families visited from three to four times during a 10 day period
Phase 3		
Pilot of message delivery in health centre and subsequent structured interview:	Determine ability to incorporate messages and give fliers during consultation.	Various health workers from one health centre
• Health personnel to mother		

A behavioural analysis was completed with data from the household trials; the feasibility and nutritional impact of each message was scored from 1 to 5 point scale by the research team (AED 1995; PAHO 2004).

Results

Phase I: in-depth exploration

Market survey and food attributes exercise

From the market survey, 17 foods were selected to explore with caregivers in the food attributes exercise. Foods were selected by the investigators to include examples of each of the nutrient categories of protein, iron and zinc, retinol, and vitamin C and based on price, local availability and potential acceptability to ICY.

Of these, chicken's liver, egg and fish were the micro-nutrient rich foods identified by mothers as most acceptable for infant feeding. Table 2 shows a summary of the mothers' comments on these foods. Among the unacceptable foods were blood pudding, as this was felt to be an adult food (although rich in vitamins), and mango, which was thought could cause diarrhea in younger children and harm them due to the 'hairy' texture around the stone, and was seasonal in terms of availability.

Photo-projective exercise

To elicit narratives of healthy versus unhealthy IYC, mothers selected from various photos. After selecting a photo of a well-nourished child, mothers identified a 'gordito' or plump appearance as the principle deciding characteristic. Other descriptors included having rosy

cheeks, smiling, is happy, one who is intelligent and lively. Narratives included that the child was healthy and experienced infrequent illness, and if ill, had the ability to recover quickly. The child's mother was imagined to have carried out good feeding practices including the following: (i) eating the correct foods (e.g. quinoa, chicken liver, fish broth), or eating a variety of foods; (ii) feeding particular preparations such as soups, broth, and soft purees; (iii) eating three meals/day at regular times; and (iv) using good hygiene practices. The mother also took the child to the health facility to receive immunizations and well-child checks.

Mother interviews

Results from the major topic areas explored with mothers follow. Aspirations for children. Mothers aspired to have their children grow healthy and achieve a better status in life than they themselves. They wished for them to be well fed and nourished, not to become ill, and develop physically and mentally. Happy, playful, affectionate, alert and active were the positive qualities mentioned.

Feeding messages and practices. Breastfeeding, introducing first foods at 6 months of age and the need to give a variety of foods for a 'balanced diet', were the practices mentioned by mothers. Most were also familiar with the MOH recommendation to feed young children five times daily, but in practice the food given to children was concentrated in the morning to avoid 'anticipated indigestion' that may come with feeding later in the day. With respect to feeding purees versus the culturally popular thin soups/broths, mothers mentioned both positive and negative comments (as below). As one mother cited as a positive reason to feed broth:

Table 2. Positive and negative attributes of key micronutrient rich foods by mothers

Food	Positive attributes	Negative attributes	Age acceptable to initiate food
Chicken's liver	Excellent food for babies contains vitamins, protein, iron and good for growth.	None.	6 months
Egg	Egg yolk is a good food with iron and vitamins, soft. Egg is a source of calcium.	Egg white is hard, difficult to eat before 12 months, has less vitamins than yolk, more fat.	5–6 months
Fish	'The best food' better than meat or chicken, has vitamins, phosphorus and iron. The best food for children beginning to eat, soft and rich.	Positive qualities often refer to the fish broth. Fear of choking on the bones exists, fish can make the child 'angry' and can cause wounds to infect.	7–9 months

Meat is nutritious food, but you cook it in a little water so that all the essence [nourishment] comes out of it and into the liquid.

Additional reasons by mothers not to feed purees included the following:

- fear of choking on the consistency of the preparation;
- may be 'heavy' or cause indigestion;
- thin soups are quicker to feed; and
- influence of other family members.

In contrast, positive comments in support of feeding purees included the following:

- includes the nutritious part of the food;
- helps the child learn to eat;
- contains certain nutrients good for children; and
- makes for a varied diet.

Family members were influential regarding feeding, especially in the case of a mother's first baby. While fathers took a minimal role with actual feeding, their support for the mother's decision regarding feeding was an important factor.

Difficulties with feeding. The majority of mothers expressed considerable concern and anxiety around feeding their child. 'He doesn't want to eat' was a common complaint yet mothers reported it was rarely addressed by health workers during visits to IYC services in the health facilities; instead they were told what to feed.

Four categories of actions emerged from caregivers including the use of the following:

- distractions such as games;
- aggressive behaviours such as forced feeding and threats;
- favourite food preparations; and
- skills, such as persistence in giving food with pauses and patience, eating with other family members.

Perceptions of well child check visits: infant development and connection to nutrition. In general, well child care visits were synonymous with immunization visits; this facilitated attendance from 0 to 4 months

when routine vaccines were given. Otherwise, mothers had little perception of prevention for health and nutrition; the health facility was perceived as more of a curative versus preventive system. As one mother stated,

If my child is healthy, why should I take him to the health facility?

Mothers also observed developmental changes in their infants more readily after 6 months of age than at earlier ages. These included changes in physical activity, the capacity of the child to understand and communicate, dentition and appealing gestures.

Health worker interviews and health service/facility observations

Data revealed that medical consultation, well-child care visits and nutrition consultation all dealt with some aspect of nutrition but functioned very independently. Nutrition messages were often given but varied in terms of content, focus, complexity and clarity, leading to inconsistent message delivery among health workers within the same health facility and across facilities. Education materials to support delivery of messages/nutrition education were generally lacking. Ancillary staff was involved in weighing and/or measuring children but did not provide mothers with feedback or messages. Anthropometry technique was variable as was the condition of anthropometric equipment. Little or no explanation of the child's growth was included during consultation.

Health services and facilities were structured and organized primarily by curative functions; less attention was given to prevention outside of vaccination.

The positive and negative aspects of each type of health service with respect to nutrition education are summarized in table 3.

Health worker motivations. Health workers voiced dedication to their health facilities, communities and work. Frustrations with the MOH authorities included a lack of positive recognition for their work, yet they received frequent complaints about small deficiencies. Low remuneration as well as the stress created from increased demands and expectations at work were mentioned.

Table 3. A summary of the three services with respect to nutrition is tabled below

Health service	Positive aspects	Negative aspects
Medical consultation with doctors	Influential with caregivers	Limited time with caregiver. Emphasis on illness.
Nutrition consultation with nutritionists	Well informed Education materials to support education Phasing out malnutrition food distribution programme	Idiosyncrasies with nutrition message content e.g. avoid giving some nutritious foods as they may cause allergy Use of technical language, terms and concepts. Isolated from other services. Manages other nutrition and feeding programmes.
Well-baby visits with nurses	Pleasant experience Well child Focus on prevention	Low coverage, especially after 6 month visit. Nutrition messages very general and without explaining why or how after breastfeeding recommendations. Less knowledgeable about nutrition. More emphasis on evaluation of child development.
All health services	Involved in some aspect of nutrition	Inconsistent nutrition education/message delivery among health workers and health services. Limited to no training in communication/counseling, very directive/vertical, focused on giving orders of what mother should do. Less emphasis on preventive nutrition, little attention on 'how' to feed. Variable use of child's anthropometry results, for example, weight only, no explanation of child's growth tendency

Interest in increasing their efficiency and a willingness to collaborate with others was expressed.

Phase II: message development and household trials

Message development

Messages were developed for health care workers to deliver during their routine interactions with caregivers. Message content was based on opportunities identified to improve complementary feeding behaviours at the household level; a brief example is shown from one of the matrices developed (table 4). Messages incorporated the comments/concerns of mothers in their vernacular, were based on prevention and consistent with the current MOH nutrition recommendations. Seventeen messages representing recommended feeding practices were created to be tested in the household trials; each contained a specific doable feeding behaviour and was simple, creative and appealing for the target audience as well as easy for health workers to remember/repeat.

Household trials

Results from the behavioural analysis conducted after completion of the household trials are displayed in Fig. 1; messages/feeding practices with top scores for nutritional impact and caregiver feasibility are shown in the upper left quadrant. Scores for the nutritional impact of each feeding practice were based on qualitative estimates by the investigators of its potential to improve nutritional status in the context of the target population. Feasibility scores represented qualitative estimates by the investigators of the feasibility/acceptability of feeding behaviours based on the qualitative data collected during household trials. Those circled became the three key messages to promote as follows:

1. 'A thick puree satisfies and nourishes your baby, equivalent to 3 portions of soup; at each meal give the thick puree (or main dish) first'.
2. 'Add a special food to your baby's meal: liver, egg or fish'.
3. 'Teach your child to eat, with love, patience and good humor'.

Each message contained a benefit/motivation either in the message itself or in the supporting script that was later developed for the health worker. Many of the remaining messages/feeding practices in Fig. 1 became the 'secondary' messages to promote in specific situations, for example, if the child did not want to eat.

Pilot of key message delivery

After piloting key message delivery for 2 weeks in the IYC health services, health workers voiced positive perceptions: key message delivery was feasible and acceptable, and it was simple to do and did not lengthen visits, and was understood and appreciated by mothers.

Phase III: development of the intervention strategy, components and delivery channels for health workers in the health facilities

Data led us to begin with the overarching concepts of consistency, quality and coverage to guide intervention development and delivery within the health facilities. This strategy aimed to strengthen and better integrate nutrition education into all routine interactions between health workers and caregivers during IYC visits; that is, all services were designated as responsible. Improvements were directed at the level of the health service (e.g. well child and sick child); in contrast to individual health workers, this emphasis recognized the high job

Table 4. Feeding practices and message development matrix

Current feeding practice	Reasons for feeding practice	Possible changes to improve household feeding behaviour intervention	Possible health centre intervention
Give thin soups or thin purees	<ul style="list-style-type: none"> • Perception of nutritive value of broth • Cultural practice • Would not choke • Easy to feed to child 	Give thick puree first at main meal, then any other preparations or foods	<ul style="list-style-type: none"> • Messages with pictures of thick puree • Food preparation demonstrations

Legend:

Nutritional Impact: 1=low, 5=high

Caregiver Feasibility: 1=low, 5=high

Fig. 1. Behavioural analysis of the feasibility and nutritional impact of the recommended feeding practices from household trial.

rotation and facilitated continuance of the intervention. A preventive approach was stressed – delivery of nutrition education to all IYC. Principles from social cognitive theory with an emphasis on self-efficacy and collective-efficacy provided the theoretical base for behaviour change at the health service and facility level as well as for individual health workers and caregivers.

The three key messages became the core of the intervention and were integrated with the rest of the components of the educational intervention as follows:

- message delivery and counselling for caregivers with aid of colour photo flip charts (Fig. 2);
- recipe flier handouts of thick purees and main dishes using local foods for caregivers;
- food preparation demonstrations involving caregivers in preparation and taste-testing for IYC;
- group well baby visits promoting healthy feeding, growth and development in a more interactive venue for caregivers; and
- improved anthropometry routines for IYC; consistent documentation and explanation of IYC growth for caregivers.

Central to the concept of consistency was the delivery of standardized messages across health services, and knowledge of the three key messages by all health workers in the health facility, regardless of their role.

Materials were coordinated across services and protocols for message delivery by health service provider – all to support and prompt consistent nutrition education delivery.

Quality was addressed through improving interactions between health workers and caregivers. For example, praise to engage caregivers, and the use of appropriate ‘checking questions’ to verify understanding and reinforce age appropriate feeding behaviours in key messages. Flip charts displayed coloured photos of Peruvian mothers engaging in the promoted behaviours, or of local foods, and a supporting script for health workers (e.g. with additional benefit or motivation for the mother). Novel components such as participatory food preparation demonstrations and group well-child care visits required caregiver participation/engagement. Food preparation demonstrations also provided an opportunity to bring the key messages to practice/action and were an excellent mechanism for promoting self-efficacy of the promoted feeding behaviours.

Expectations for coverage were that all IYC services and health workers engaged in nutrition education with caregivers, and that repeated exposure was ideal. The depth of nutrition education could vary by health service, but all health workers were responsible (doctors, nurses, nutritionists and ancillary staff) and expected to engage caregivers, albeit delivery of one key message. Non-IYC staff such as admissions, pharmacy and

Add a special food to your baby's meal: liver, egg or fish

Teach your child to eat, with love, patience and good humor

Fig. 2. Example of two key messages with accompanying flip-chart photos.

midwives were also expected to be familiar with the key messages lending further support to the 'nutrition environment' of each health facility. Group well baby visits were a successful intervention implemented by an organization in Lima 'Taller de Los Niños'; we adopted a similar approach to stimulate IYC attendance, increase efficiency for nurses and improve nutrition education coverage.

Training to implement the nutrition education intervention

Interdisciplinary teams of health workers were trained together to foster consistency and quality in intervention

delivery across the health services and promote self and collective self-efficacy for intervention delivery with each health centre. This replaced the usual model of separate trainings by professional role.

Health centre accreditation for infant and young child nutrition

Modelled after the MOH's quality improvement initiative in maternal child health (Lanata *et al.* 2002), a series of criteria outlining expectations for addressing IYC nutrition were established for health workers/health services. Involvement of the MOH authorities in this process encouraged compliance by the health centres.

A multidisciplinary team of health workers in each health facility was assembled to facilitate actual implementation. An accreditation process with supportive supervision was instituted to motivate health facilities to meet criteria (Penny *et al.* 2005; Robert *et al.* 2007). When evaluated by an independent team, health facilities were given immediate feedback – strengths were recognized and areas to improve were discussed. The rewards of accreditation were MOH accolades and official recognition as a ‘Pioneer Center of Excellence in Infant Nutrition’.

Discussion

Formative research identified key complementary feeding behaviours in the community to impact healthy growth and brought to light the primary concerns of mothers regarding ‘how to feed’ vs. what to feed their infants. Culture, local context and desired feeding practices were built into messages that contained doable feeding behaviours and spoke to caregivers. Formative research in the health facilities revealed multiple opportunities to improve interactions around feeding and healthy growth between health workers and mothers. This led to an overarching strategy of consistency, quality and coverage for intervention delivery and integration among all IYC health services and workers. This strategy was easy for health workers to comprehend and could be translated directly into improving routine interactions with caregivers during visits to the IYC health services.

Development of effective complementary feeding interventions is contingent on knowledge of local foods and an understanding of the cultural practices and influences (barriers and facilitators) that shape feeding experiences at the household level (Fabrizio *et al.* 2014). This requires immersion into the emic or insider’s perspective on acceptable foods for infants, but also the expectations of the feeding experience, the expected results as they relate to growth and health and how these are framed by the caregivers. Listening and prioritizing this perspective, via methods such as the photo-projective exercise and interviews, keyed us into selecting important behaviours and key words/language that would resonate with mothers.

Identifying the novel ‘how to feed’ message of ‘Teach your child to eat with love, patience and good humor’ embodied and acknowledged caregivers’ challenges and struggles in everyday IYC feeding. This message was to touch the emotions of caregivers, stand in contrast to the typically delivered ‘what foods to feed’ messages and set a tone for improved interchange between health worker and caregiver. Similarly, formative research conducted in the Congo to improve communication between health workers and mothers about growth and development investigated their respective perspectives and recognized the importance of using mothers’ words and concerns to develop educational messages (Tchibindat *et al.* 2004).

Understanding the context of the health facilities through formative research allowed us to create a type of counselling through key message delivery that was flexible, feasible and acceptable to health workers. New ways to deliver nutrition education and key messages were also identified – for example via recipe flyers of thick purees, and food preparation demonstrations of thick purees where caregivers also practiced feeding their children with patience. The increased attention to complementary feeding and healthy growth called for more careful anthropometric assessment by health workers.

Although individually oriented and thorough complementary feeding counselling with caregivers is promoted as ideal, the demands on health workers time, other patient priorities, lack of training and the culturally influenced vertical nature of many health worker-caregiver interactions all stand as challenges to this ideal (WHO & Unicef 2006; Lutter *et al.* 2013). In addition, complementary feeding is complex, involving a number of different feeding behaviours that change as the child ages, especially from 6 to 12 months (Dewey 2003). Observations in the IYC health services led us to create a simplified approach whereby key messages were central, and the need for flexibility in their delivery was acknowledged. This flexibility meant nutrition education by health workers could continue despite busy days or short staffing, even if this meant delivery of just one key message. Three key messages were selected as a reasonable number for all health workers to easily recall and promote. The designation of ‘key’ indicated the message represented a behaviour that

had the most potential for nutritional impact given the local context and was acceptable and feasible during the household trials. Adding praise for the caregiver and checking questions to the key messages were important steps to engage mothers, improving the quality of interactions between health workers and caregivers, and motivate behaviour change.

Importantly, key messages address critical feeding behaviours on a community level with the expectation that such practices will lead to improved IYC nutrition and healthy growth (Penny *et al.* 2005). These messages work not only on individuals but also aim to change the community norm of acceptable feeding practices through repeated caregiver exposure and coverage.

Through the formative research, we learned that all health workers played a role in nutrition to some degree. We were able to capitalize on this and promote multidisciplinary training (i.e. doctors, nurses and auxiliaries training together in teams) and team work in the health facility towards common nutritional goals for the facility. Training has been cited as a critical component of strengthening IYC nutrition interventions in health services (Pelto *et al.* 2004; Zaman *et al.* 2008; Baker *et al.* 2013). Later, qualitative data for the process evaluation revealed that a 'culture of nutrition' had replaced the fragmented environment exposed in the formative research (Robert *et al.* 2007). While nutrition gained prominence, we did not hear comments about other services being displaced. Our emphasis on improving the IYC health services and strengthening the role of nutrition in each (e.g. well child, sick child) vs. improving individually selected health workers was deliberate. This approach proved to be vital as turnover of health workers was extremely high and included minimal overlap between outgoing and new staff (Robert *et al.* 2007); as others have also recognized (Bryce *et al.* 2008). Health worker frustration around lack of recognition was a prevalent theme. To address this frustration, an accreditation process was built into the intervention, which included clear publicized objectives for the health services to achieve, an independent evaluation with supportive supervision and recognition and accolades upon achieving successful accreditation. The Alive & Thrive project in Vietnam also report application of supportive supervision and accreditation of facilities in their model of social

franchising of IYC services to improve the quality and consistency counselling (Sanghvi *et al.* 2013b). Furthermore, Baker *et al.* (2013) discussed a number of critical elements from the Alive & Thrive experience for strengthening IYC nutrition interventions in the countries of Bangladesh, Ethiopia and Vietnam among which include government buy-in, feasibility studies, training and job aides, monitoring and supervision. We also found these elements to be critical in moving our formative research into the actual intervention that was delivered through the IYC health services.

The frequent IYC visits to the health facilities and interactions with health workers during the first 2 years of life provide multiple opportunities to promote optimal feeding practices and healthy growth. A preventive framework that starts with promoting optimal IYC feeding behaviours instead of reacting to poor nutritional or anthropometric outcomes makes inherent sense; others have also taken this approach (Ruel *et al.* 2008). Nutrition-specific interventions rely on optimal delivery (e.g. by health workers) to promote IYC feeding behaviours. Taking advantage of all opportunities where interactions between mothers and health workers occur and optimizing these interactions are keys to promoting healthy growth.

The use of multiple qualitative methods and informants and triangulation of data leads credibility to our findings. Successive phases of formative research logically built our intervention and assured its feasibility and acceptability for the trial. We felt that each method contributed to, and complemented, the other methods and provided important insights in this research context. However, it is possible that not all methods would be needed to develop a similar intervention – depending on the context and available knowledge. The use of matrices to develop intervention messages – effectively reduced data into usable chunks and streamlined identification of potential feeding practices to improve; others have also discussed similar analysis matrices to identify potential IYC feeding practices to promote (Menon *et al.* 2005; Pan American Health Organization and United Nations Children's Fund 2013).

Limitations of this study are acknowledged. The sample size was small; however, it was purposively selected to represent different perspectives (e.g. different

types of health care workers, and mothers of different aged IYC), and provided for a range of responses. In addition, this work built on previous knowledge of the region and health services. Another limitation is the context in which the formative research took place – a peri-urban context with an accessible health system. Nonetheless, the principles of qualitative exploration, data collection and analysis apply to other settings, as does the translation of this type of research into context specific, culturally appropriate interventions.

In summary, stunting, micronutrient deficiencies and inadequate feeding practices in IYC remain as challenges to many low and middle income countries. To promote healthy growth and prevent malnutrition, effective nutrition-specific interventions (Bhutta *et al.* 2013) are needed that respond to the context and culture of the community/region and fit with the existing IYC health services and health facilities. As health services are extensive globally, they provide a large opportunity to reach IYC and promote healthy growth via health worker–caregiver interactions. Our study adds to the literature on formative research for IYC complementary feeding interventions. It importantly contributes by describing how the research was undertaken in the community and health services, but also in translating the results into an effective intervention for delivery through the IYC health services. Evidence demonstrates that formative research is critical for developing such interventions, yet the level of detail provided on methods, results and translation/application is often insufficient (Fabrizio *et al.* 2014). Formative research was vital to the success of the intervention in Trujillo and provides an example for future work to strengthen health services and health workers in their delivery of culturally informed, nutrition specific-interventions to promote healthy growth of IYC.

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Conflicts of interest

The authors declare that they have no conflicts of interest.

Contributions

RCR participated in data interpretation and wrote the manuscript. HMC-K conceived and designed the study, implementation, data interpretation and provided critical revisions of the manuscript. RV participated in the study design, implementation, data interpretation and manuscript review. MRN participated in the study implementation, data interpretation and manuscript review. MEP participated in the conception and design of the study, data interpretation and manuscript review.

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