

Original Article

Using programme theory to assess the feasibility of delivering micronutrient Sprinkles through a food-assisted maternal and child health and nutrition programme in rural Haiti

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Abstract

This paper uses programme theory to assess, in the context of an effectiveness evaluation, the feasibility and acceptability of distributing micronutrient Sprinkles through a food-assisted maternal and child health and nutrition programme in rural Haiti. We laid out the steps related to programme delivery and household utilization of Sprinkles and used qualitative and quantitative methods to gather data on these steps. Methods included structured observations, checks of beneficiary ration cards, exit interviews, focus group discussions (FGD), individual interviews and survey data from the effectiveness evaluation. Results are as follows: (1) information on use of Sprinkles was provided before mothers first received them, as planned; (2) Sprinkles were re-packaged and distributed as planned and in the appropriate amount; (3) almost all mothers (96%) received two monthly rations of Sprinkles and received timely information on their use; (4) mothers understood instructions about use of Sprinkles and acceptance was high, and no selling of the product was reported or observed; and (5) mothers reported using Sprinkles as instructed, every day (63% in survey; 86% at exit interviews), and for the child only (99%). FGD with staff highlighted the acceptance of the intervention, with a reported 'modest' increase in workload. Within this well-established programme, it proved feasible to distribute Sprinkles and to ensure appropriate use by beneficiary mothers. Existing programme venues were suitable for distributing Sprinkles and educating mothers about their use. Use of programme theory helped to assess feasibility and acceptability of the Sprinkles intervention and provided useful information for programme replication or scale-up.

Keywords: micronutrient Sprinkles, supplementation, anaemia, feasibility evaluation, programme evaluation, delivery strategies.

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Introduction

Micronutrient Sprinkles, an innovative product consisting of an encapsulated micronutrient mix that is sprinkled on food just before ingestion, have been shown to reduce anaemia among infants and young children up to the age of 24 months in controlled efficacy trials in Ghana and Cambodia (Zlotkin *et al.* 2001, 2003; Giovannini *et al.* 2006). Their effectiveness at reducing anaemia among 6–23-month-old children in programmatic settings has also been demonstrated in Mongolia (World Vision Mongolia 2005), Bangladesh (Ip *et al.* 2007) and Haiti (Menon *et al.* 2007).

Current options for delivering micronutrient Sprinkles include free or subsidized distribution through public sector health programmes, subsidized private sector distribution through social marketing programmes or free distribution by non-governmental organizations and United Nations agencies in development or emergency contexts. Few studies, however, have documented experiences with specific delivery systems for distributing Sprinkles in different contexts. In this paper, we describe our experience with adding a Sprinkles distribution intervention to an ongoing USAID (United States Agency for International Development) Title II food-assisted maternal and child health and nutrition (MCHN) programme implemented by World Vision (WV) in rural Haiti. We have previously documented the effectiveness of this intervention, which delivered a 2-month supply of Sprinkles,¹ in reducing anaemia for up to 7 months post intervention among children of 9–24 months of age (Menon *et al.* 2007). Here, we focus on the delivery of the intervention using a programme theory framework (impact pathway analysis) in order to document programme processes, feasibility, acceptability and utilization by beneficiary families.

This paper was motivated by the growing recognition of the need for increased attention to the study of programme delivery and utilization in the context of

¹The micronutrient Sprinkles contained 12.5 mg of iron, 5 mg of zinc, 400 µg of vitamin A, 160 µg of folic acid and 30 mg of vitamin C. The Sprinkles intervention was randomly allocated at the level of the food distribution points. Further details about the allocation and the effectiveness study may be found in Menon *et al.* (2007).

evaluations of nutrition programme effectiveness (Habicht *et al.* 2008). Through careful enunciation of programme processes, called programme theory (Rossi *et al.* 2004), and of their measurement and analysis, it is possible to identify pathways to success (Bryce *et al.* 2005). Alternately, when programmes do not deliver expected results, information on these processes can illuminate constraints and suggest avenues for programme improvement (Victora *et al.* 2004; Habicht *et al.* 2008).

In international public health programmes more broadly, there has been a long tradition of process evaluation and operations research. In particular, a large number of studies have documented process issues in the area of family-planning programmes, post-abortion care and prevention of maternal mortality (Wawer *et al.* 1991; Haaga & Maru 1996; McGinn 1997; Billings & Benson 2005). In addition, the USAID-funded Quality Assurance Project sponsored studies examining programme processes by managers of over 100 child survival interventions (Nicholas *et al.* 1991). Until recently, however, there were few published examples of process evaluations or operations research related to nutrition programmes. A few recent studies have begun to illustrate the value of process evaluations for illuminating pathways towards impact (Santos *et al.* 2001; Dickey *et al.* 2002; Marsh *et al.* 2002; Pelto *et al.* 2004; Penny *et al.* 2005; Roberts *et al.* 2006; Ruel *et al.* 2006; Roberfroid *et al.* 2007) and for programme improvement (Loechl *et al.* 2005).

Objectives and programme theory framework

Recognizing the value of attention to process, we designed this study with the following objectives: (1) to assess the feasibility and acceptability of incorporating Sprinkles distribution as a new element in an ongoing programme; and (2) to assess whether the programme activities in fact resulted in correct use of Sprinkles in the household and for the targeted child. Specifically, we asked:

1. Feasibility:

(1) Is it operationally feasible to incorporate a micronutrient Sprinkles distribution intervention into an

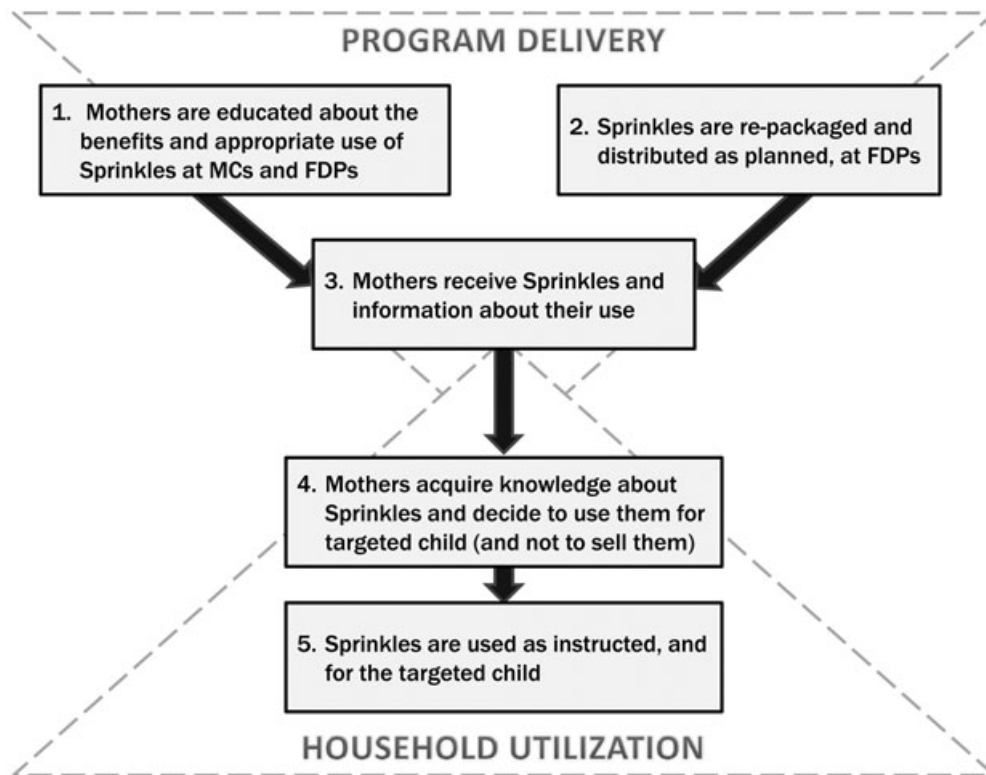


Fig. 1. Programme theory of process pathways for the Sprinkles intervention.

ongoing food-assisted MCHN programme, using existing venues (contact points between programme staff and beneficiaries)?

(2) Is it feasible to incorporate a behaviour change communication (BCC) intervention about the use of Sprinkles into an existing BCC strategy?

2. Acceptability:

(1) Is the intervention acceptable to *beneficiary mothers*? Is the product itself acceptable? Are they willing to use it as recommended for their child? Do they accept the idea of giving Sprinkles to the targeted child, or do they feel that the product must be shared with other children?

(2) Is the intervention acceptable to *health staff*? Do they understand the potential benefit of the intervention? Do they perceive that the intervention is an added burden to their workload? Overall, do they perceive that the intervention is acceptable and beneficial for children in the communities they serve?

3. Household utilization:

Do participant families receive and use the Sprinkles appropriately – i.e. in right amounts and for the right child?

In order to answer these questions, we used a programme theory framework, whereby the theory behind the intervention was articulated and made concrete using process pathways (Fig. 1). These pathways to impact show the sequence of expected actions that link the delivery of the intervention to the use of the intervention by participating families (Rossi *et al.* 2004; Victora *et al.* 2004; Habicht *et al.* 2008). The research methods used to assess each step in the programme theory pathway are described below, after the section describing the programme evaluation context.

Programme evaluation context and background

The evaluation was conducted in the Central Plateau of Haiti, about 100 km north of the capital city, Port

au Prince. WV Haiti had been active in this region for several years prior to this study; their activities included operation of a food-assisted MCHN programme which continues at present. The WV MCHN programme offers services at five contact points between programme staff and beneficiaries. These include:

1. *Rally posts (RP)*, where health education, growth monitoring and promotion, and preventive health care are provided for all community members, and programme beneficiaries are identified for food assistance and other services;
2. *Mothers' clubs (MC)*, in which small groups of beneficiaries gather to discuss health, hygiene and nutrition topics following the programme's BCC strategy;
3. *Pre- and post-natal consultations*, where pregnant and lactating women receive preventive health care and education;
4. *Food distribution points (FDP)*, where beneficiaries receive their monthly food rations; and
5. *Home visits*, where WV health staff visit beneficiary households with a newborn infant, a severely malnourished child or a child with growth faltering.

The Sprinkles intervention

The Sprinkles intervention included two components: (1) the distribution of a 2-month supply of Sprinkles to children enrolled in the programme and receiving food assistance; and (2) a BCC intervention, which conveyed information on the benefits to the child, on the appropriate use of the Sprinkles, and on potential side effects of use.

Distribution of sprinkles

Sprinkles were produced and packaged in individual single-serving sachets by the manufacturer, with each sachet constituting a daily dose for the child. In order to ensure efficient and accurate delivery of the intended number of sachets to beneficiaries at the FDP, the sachets were repackaged into re-sealable bags containing 15 individual sachets along with a set of instructions. In each of two consecutive months,

mothers received two re-sealable plastic packages for a total of 60 sachets (30 per month).

The Sprinkles were distributed at the FDP along with monthly take-home food rations. The distribution process consisted of storing on delivery, re-packaging, preparing the distribution, distributing at FDP and tracking. The tasks for this process were distributed among the WV health staff and commodities staff.² Commodities staff were responsible for ensuring Sprinkles storage and transport to the FDP, identifying beneficiaries at the FDP and obtaining beneficiary signatures to confirm receipt. The health staff was responsible for re-packaging of Sprinkles, preparing beneficiary lists, conducting reminder education sessions at FDP and handing the Sprinkles to beneficiaries at the FDP.

The BCC strategy

The BCC strategy for the Sprinkles intervention used the following three contact points:

1. The MCs, which are the main venue for the ongoing MCHN programme BCC, were selected as the primary contact point for the Sprinkles intervention. A 20-min learning session was developed,³ to be conducted at MCs the month before Sprinkles distribution started. The session covered why children need iron, the benefits of Sprinkles for reducing childhood anaemia, appropriate use of Sprinkles and the main potential observable side effect (dark stools); on side effects, mothers were assured that darker stools were normal and in fact indicated that the child was receiving the iron. Mothers learned how to use Sprinkles correctly through an interactive demonstration and tasting session. They were taught to mix the Sprinkles into a small quantity (2–3 spoonfuls) of the child's food and to feed the child this food first, before giving him/her the remaining unfortified portion or other foods;

²The WV commodities staff are responsible for the distribution of donated Title II food commodities. Health staff are responsible for activities at RP, MC, pre- and post-natal consultations and home visits.

³Session was based on materials designed by the Sprinkles Global Health Initiative (<http://www.sghi.org>).

2. The FDPs, which are the venue for Sprinkles distribution, were selected as a secondary contact point for the Sprinkles BCC. Health staff were instructed to conduct brief reminder sessions on the use of the Sprinkles at the time of the monthly distribution;

3. The third 'contact point' was the product itself: each bag of 15 sachets included an instruction card on the correct use and dosage of Sprinkles. Instructions were written in Creole (the local language) and illustrated with a 4-step set of simple drawings (taken with permission from the Sprinkles group at Hospital for Sick Children: <http://www.supplefer.com>).

The research team (IFPRI/Cornell University) provided basic technical assistance to WV to help

develop the Sprinkles intervention and to integrate it in their existing programme. The assistance included: (1) training commodities and health staff in the rationale for and use of Sprinkles; (2) developing the BCC materials and training the WV staff trainer on the Sprinkles learning session; and (3) developing the Sprinkles distribution system, and facilitating discussions among the WV commodities and health staff to allocate responsibilities in the distribution process.

Research methods

The programme theory framework guided data collection approaches, tools and sequencing. A combination of quantitative and qualitative methods (Table 1) was

Table 1. Methods and sample used to assess the intervention process

Step in process pathway	Methods used	Specific topic investigated
PROGRAMME DELIVERY		
(1) Mothers are educated about the benefits and appropriate use of Sprinkles at MCs and FDPs	Observations at FDPs ($n = 5$ FDPs)	Whether Sprinkles education information was given at FDPs
	Group interviews with programme staff: health promoters, assistant health promoters, health supervisors ($n = 5$ groups)	Whether Sprinkles education sessions were conducted at MCs; perceptions regarding additional burden of educating about Sprinkles use
(2) Sprinkles are re-packaged and distributed as planned at FDPs	Observations at FDP ($n = 5$ FDPs)	Effective distribution of Sprinkles: re-packaging and number of Sprinkles sachets in monthly ration (random check of 10 per FDP)
	Check of beneficiary ration cards at FDPs ($n = 101$ mothers)	Adequate recording of Sprinkles receipt in ration cards
	Group interviews with programme staff: food monitors, food supervisors ($n = 2$ groups)	Perceptions regarding additional burden of adding the Sprinkles distribution to food distribution
(3) Mothers receive Sprinkles and information about their use	Group interviews with mothers ($n = 4$ groups)	Whether mothers received information before distribution
	Check of beneficiary ration cards in effectiveness study ($n = 244$; data from ration cards obtained from 202 beneficiaries)	Adequate distribution of Sprinkles rations to beneficiaries for 2 months
HOUSEHOLD UTILIZATION		
(4) Mothers acquire knowledge about Sprinkles and decide to use them for targeted child (and not to sell them)	Group interviews with mothers ($n = 4$ groups) Market visits	Knowledge about benefits and appropriate use of Sprinkles (qualitative); acceptability of Sprinkles and perceived benefits (qualitative); sales of Sprinkles
	Interviews with mothers of children in effectiveness study ($n = 244$)	Knowledge about Sprinkles' benefits and appropriate use (quantitative)
(5) Sprinkles are used as instructed, and for the targeted child	Group interviews with mothers ($n = 4$ groups)	Reported use of Sprinkles (qualitative)
	Exit interviews with mothers at FDPs ($n = 101$)	Reported use of Sprinkles for the targeted child (quantitative)
	Interviews with mothers of children in effectiveness study ($n = 244$)	Reported use of Sprinkles for the targeted child (quantitative)

used to assess feasibility, acceptability and utilization of Sprinkles using the process pathway illustrated in Fig. 1. Quantitative methods included structured observations at FDP, structured interviews with mothers of beneficiary children and checking ration cards (where information on food and Sprinkles distribution is recorded). Data were also collected on the timing of the MC sessions vis-à-vis the distribution of the Sprinkles by interviewing programme staff. Qualitative methods included semi-structured group interviews with mothers and programme staff, and focused mainly on discussing their perceptions about the addition of Sprinkles to programme duties (for staff), and use and acceptability of the Sprinkles intervention (for mothers). Assessment of beneficiary mothers' utilization of the Sprinkles was done through both group and individual interviews.

Sampling and sample

The Sprinkles distribution started in June 2005. We observed Sprinkles distribution at five out of eight FDPs, during the second month of Sprinkles distribution (July 2005). At each FDP, the enumerator observed the distribution using a structured form, and conducted 15–25 brief structured exit interviews with randomly selected respondents, for a total of 101 interviews. The exit interview also included a check of the beneficiary's ration card. As part of our study of the effectiveness of this intervention (Menon *et al.* 2007), we interviewed 254 caregivers at study's end (August–September 2005), either at the RPs or in their homes. These interviews occurred 1 to 5 weeks after the last sachet from the 2-month supply of Sprinkles should have been consumed by the child, and provided additional information on acceptance/use of Sprinkles from a representative sample of beneficiary mothers. Thus, there were two survey samples of respondent mothers which provided data for the feasibility study: the sample interviewed specifically for the feasibility study, as well as those that also provided data for the effectiveness study reported in Menon *et al.* (2007).

Four group interviews with mothers of beneficiary children (six to eight mothers per group) were conducted in July and August 2005. Seven group

interviews with WV programme staff (5–10 staff members per group) were conducted in August and September 2005: two with health promoters, two with assistant health promoters,⁴ one each with supervisors of health promoters and assistants (called health supervisors in the following), food monitors⁵ and their supervisors (called commodities supervisors in the following). The group interviews were conducted by a consultant (external to the WV programme) who had ample prior experience both with the use of qualitative research methods and with interviewing WV programme staff. This resulted in free-flowing discussions with the programme staff about their experiences with the Sprinkles intervention.

The five main local markets in the intervention area were also visited by the research team in August 2005 to ascertain whether mothers might have been selling the Sprinkles in the market.

Data analysis

Quantitative data

All data were entered in EpiInfo, version 6.04, and descriptive statistics were generated using SPSS, version 12.

Qualitative data

Interviews were conducted in Haitian Creole, then transcribed and translated into French for analysis. The transcripts from the group interviews with programme staff and with programme participants were analysed separately. These data were supplemented with interviewer's field notes, which provided information on the participants, the context of the interview and the interviewer's own reflections about the interview.

⁴Health promoters and assistant health promoters are the front-line workers of the pre-existing/ongoing MCHN programme. They deliver the different health services to the beneficiaries. Assistant health promoters spend less time on programme activities and are only paid 50% of a health promoter salary.

⁵Food monitors distribute commodity foods to programme beneficiaries at FDPs.

The first step in data analysis was to identify specific themes for each of the topics that were presented by the facilitator in the group interviews. For example, one of the topics for the interviews with programme staff was whether and how Sprinkles affected their workload. One theme that emerged in the discussion of this topic was the sentiment that it increased the amount of work. Another theme was an explicit expression of the opposite sentiment, namely that it did not increase the workload. A third elicited theme was the idea that Sprinkles raised the workers' reputation with caregivers. The identification of specific themes was based on the statements that were made in the group interviews, not on an *a priori* basis.

The themes were used to create a set of matrices, which could then be analysed with the aid of Excel forms in which the topics were entered along one axis and responses/themes from the group interviews along the other axis. Evaluation of salience was based on the frequency with which a specific theme was reported in each transcript and by examining the nature of discussion about that topic in each interview. The identification of themes and the assessments of salience were developed by one member of the research team (CL) and reviewed by another team member (PM). Throughout the analytic process, we also made note of representative quotes. As the number of group interviews was manageably small, and the interviews were structured, we found this approach to the analysis to be more efficient than using a qualitative data analysis software package.

Ethical approval

Approval for the study was obtained from the Cornell University Committee on Human Subjects, from WV Haiti and from the regional health authorities in Haiti.

Results

The presentation of results follows the process pathway laid out in the programme theory (Fig. 1) and is divided into programme delivery and household use of Sprinkles. For each step in the pathway, we present quantitative and qualitative results.

Programme delivery

(1) Mothers are educated about the use and benefits of Sprinkles at MCs and FDPs

In the group interviews, both mothers and WV health staff reported that the Sprinkles learning sessions were conducted at the MCs before the Sprinkles distribution started, indicating that the initial learning sessions were implemented as intended. However, brief information sessions intended to reinforce MC learning were held in only three of the five observed FDPs. These MC Sessions were conducted by health staff as planned.

The perceptions of the health staff about the additional work burden of educating about Sprinkles use at the MC and the FDP are presented in Table 2. The results indicate a division of opinion about the effect on workload; some health staff felt that it did not increase their workload, while others thought it did. In three groups, a statement was made that the staff should be compensated for the increased workload. However, many of the same individuals who felt that the programme added work also suggested that Sprinkles was beneficial for children. In three groups, the discussants suggested that the introduction of Sprinkles into the programme raised their own reputation because mothers realized the benefits of Sprinkles for their children and associated it with the health staff.

The following quotes illustrate these views:

- This is an enormous work increase; if one has 5 clubs [referring to the MC]; one is obliged to talk about the Sprinkles use in the 5 clubs. And in some clubs one is obliged to repeat the education several times so that everybody understands it. I think that this is an additional task. (*Health promoter*)
- But we have to say as well that we accept this increased workload because it is something related to health and it makes our work more interesting because if the people come and take away something this raises our reputation in their eyes. (*Health promoter*)

The discussants in all groups expressed that they did not have any problems with educating mothers about the use of Sprinkles.

Table 2. Themes discussed regarding changes in workload due to Sprinkles education (health staff)*

Themes: Staff in each group:	No additional workload perceived	Increased workload perceived	Recognition of importance of added work	Raised reputation of health staff	Request compensation for added workload
Health promoters	X (medium)	X (medium)	X (medium)		X (medium)
Health promoters		X (high)	X (medium)	X (low)	X (low)
Assistant health promoters	X (low)	X (medium)	X (medium)	X (medium)	
Assistant health promoters	X (high)	X (medium)	X (medium)		X (medium)
Health supervisors	X (medium)	X (medium)	X (high)	X (low)	

*An 'X' in any cell indicates that the theme was present in the group interview transcript. The salience of each theme is noted in parenthesis as low, medium or high, depending on the frequency of comments and on the nature of the discussion in each group interview.

(2) Sprinkles are re-packaged and distributed as planned at FDPs

Sprinkles were distributed exactly as planned at all five of the observed FDPs (Table 3). There were no errors in packaging, and staff roles followed programme protocols. Receipt of Sprinkles was also accurately recorded on ration cards (99%), as required by the Sprinkles tracking system.

In contrast to perceptions of added work in the MCs, health staff did not appear to perceive the tasks related to Sprinkles distribution as at all burdensome. Therefore, only the perceptions of the commodities team (food monitors and their supervisors) are described here. Four major themes that emerged from the interviews are presented in Table 4.

As with the health staff, the interviews with commodities staff revealed mixed perceptions about the added workload. Also similar to the health staff, many of the commodities staff who made references to increased workload also recognized the benefits of Sprinkles for children. Only a few discussants in the food monitor group expressed that they would like to be compensated for the increased workload. Below are some examples of the ways in which these themes were expressed by the commodities staff:

- Personally, I don't think it is more work, because even at the level of the storage, it doesn't present a problem. (*Supervisor*)
- The addition of Sprinkles increases our workload that we have already, but given that WV's objective is to improve the health of families, we feel obliged to get involved at 100% in the Sprinkles distribution. (*Food monitor*)

The discussants of the two groups expressed that they did not have any problems with distributing the Sprinkles.

(3) Mothers receive Sprinkles and information about their use

The group interviews with beneficiary mothers revealed that information on Sprinkles use was communicated before the distribution started, as illustrated by these quotes:

Table 3. Distribution of Sprinkles along with food rations

Distribution	Source	n*	%
Sprinkles were distributed in re-packaged bags of 15 sachets at FDPs	FDP observations	5	100
Correct number of Sprinkles sachets (15) in each bag		50	100
Person who distributed bags		5	
Assistant health promoter			80
Mother health assistant†			20
Sprinkles ration received is recorded on mother's ration card on observation day	Ration card check at FDPs	98	99

*Sample for this table includes the observations at the FDPs and the exit interviews with mothers ($n = 101$). Incomplete data restricted the observations for the sample to 98. †Mother health assistants are beneficiary mothers who assist programme staff with some basic programme activities.

Table 4. Themes discussed regarding changes in workload due to distribution of Sprinkles (commodities staff)*

Themes: Focus groups:	No additional workload perceived	Increased workload perceived	Recognition of importance of added work	Request compensation for added workload
Food monitors	X (medium)	X (low)	X (low)	X (low)
Food supervisors	X (medium)	X (medium)	X (medium)	

*An 'X' in any cell indicates that the theme was present in the group interview transcript. The salience of each theme is noted in parenthesis as low, medium or high.

- We have seen a demonstration of the use of Sprinkles at the [Mothers'] Club, the Sprinkles were added to a banana and we tasted it. I realized that the Sprinkles don't have any taste.
- I had no problems [with the Sprinkles], because before starting the Sprinkles distribution we were told how to use it, how to give it to the child.

Almost all beneficiary children (96%) received two monthly rations of Sprinkles according to the survey data. Ninety per cent received the rations in June and July as planned while 6% received the rations in July and August. Only 4% received a single month's ration, and less than 1% received 3 months'. Reasons for not receiving the Sprinkles ration as intended included that mothers did not attend the food distribution at all or that they did not receive the ration when they went. The latter was most likely due to the fact that they were not eligible, i.e. that they had not fulfilled the conditions⁶ for receiving rations.

⁶Mothers are required to attend the monthly RP meeting and the monthly MC in order to receive their monthly food ration for the child.

Household utilization of Sprinkles

(4) *Mothers acquire knowledge about Sprinkles and decide to use them for targeted child (and not to sell them)*

Knowledge

Data from the structured interviews with mothers at end line in the effectiveness study (Menon *et al.* 2007) indicate that maternal knowledge of the benefits and appropriate use of Sprinkles is excellent (see Table 5). These results are also well supported by the qualitative data from the group discussions with mothers of beneficiary children.

In response to an open-ended question, all mothers mentioned at least one benefit of using Sprinkles. They mentioned one or more of the following: that Sprinkles have vitamins and minerals, that they help children have strong blood, make children stronger, protect them from getting sick and help them grow and learn. These themes were also present in the transcripts of the group discussions with beneficiary mothers:

- It is good for the child's brain. When the child is malnourished, this has a direct influence on his/her

Table 5. Maternal knowledge about Sprinkles from effectiveness study

Knowledge	<i>n</i> *	% of correct responses
Mothers mentioned at least one benefit of using Sprinkles	237	100
One sachet of Sprinkles should be used per day	237	94
Sprinkles should be mixed into gruel or other food	237	96
Sprinkles should be mixed with food when food is ready to be eaten/just before feeding the child and when the food is a bit cool	223	99

*Sample for this table includes the survey sample from the effectiveness study (Menon *et al.*, 2007); (*n* = 244). Incomplete data for specific questions restricted the sample to the *N*'s shown in the table above.

brain, it can make it difficult for the child to learn, but the Sprinkles can help this child to learn.

- It is a vitamin that is very important for the child, it gives the child strength. It is very good for the child; it replaces his/her blood.

Nearly all of the mothers also knew the correct dosage for the Sprinkles (Table 5). This finding was also documented in the group discussions with mothers of beneficiary children, where references to the correct dosage of only one sachet of Sprinkles per day appeared with high salience. Similarly, 96% of mothers appropriately reported that the Sprinkles should be added to gruel or other food.⁷ The transcripts of the group discussions also confirm with high salience that mothers know that Sprinkles should be added to food, and not to drinks. In two groups, mothers specifically mentioned that the Sprinkles should *not* be mixed into bean puree, milk or coffee. Finally, mothers also knew that Sprinkles should be added to the food when the food is cool enough to be eaten by the child (99%). The results of the four group interviews confirmed that mothers were aware of the recommendation that Sprinkles should not be mixed into hot food.

⁷Mixing Sprinkles into drinks can lead to the lipid-coated micronutrients sticking to the side of the cup (<http://www.supplefer.com>, accessed 03/22/2006).

Acceptability

Data from the four group interviews with mothers of beneficiary children revealed that Sprinkles were very well accepted. None of the groups reported any problems with Sprinkles. Mothers liked the Sprinkles because they felt that the iron and vitamins helped children develop and gain weight. They also noted that their child did not have diarrhoea while taking the Sprinkles and that their stools were dark and hard (present in all four group transcripts). Less frequently, mothers expressed that they liked the Sprinkles because they increased the child's appetite (present in two transcripts) and protected the child's eyes (present in one group transcript). It also appeared from the transcripts that mothers were not worried about the side effects of Sprinkles consumption, such as dark stools and constipation (which were even mentioned as positive aspects), because they were told about it at the MCs. The following statements illustrate these perceptions:

- [The Sprinkles distribution] is a very good thing. My child was weighed last month and weighed 12 kg. This month, his weight increased, this is because of the Sprinkles. In addition, the child now eats very well.
- The Sprinkles help the child to develop. The child receives iron; this is why I think that [the Sprinkles distribution] is a good thing.
- When my child had dark stools, I was worried, but now I know that this is nothing because before starting to distribute [the Sprinkles] we were told that the child could have dark stools.

Mothers do not sell sprinkles

In order to assess whether sprinkles were being sold by programme beneficiaries, the research team visited five main markets in the project area in early August 2005, after 2 months of Sprinkles distribution by the programme. No Sprinkles were found for sale at market visits.

(5) Sprinkles are used as instructed, and for the targeted child

In order to evaluate the appropriate use of the Sprinkles for the intended child, we used quantitative

Table 6. Reported use of Sprinkles in the households

Use of Sprinkles	FDP exit interviews		Effectiveness study	
	<i>n</i> *	%	<i>n</i> *	%
Fed Sprinkles <i>once</i> to beneficiary child during last 24 h	101	17	154	33
Fed Sprinkles <i>twice</i> to beneficiary child during last 24 h	101	75	154	42
Usually fed food with Sprinkles only <i>once</i> per day to the child	101	80	153	92
Fed Sprinkles to child on all <i>7 days</i> in the past week	101	86	153	63
Fed Sprinkles to child on <i>4–6 days</i> in the past week	101	13	153	25
Usually mixed Sprinkles with appropriate foods	101	100	154	97
Usually mixed exactly <i>one sachet</i> of Sprinkles into child's food	101	99	154	95
Usually child consumed entire portion of food with Sprinkles mixed into it	101	98	154	96
Food with Sprinkles <i>never</i> eaten by other family members	101	99	241	97
Entire sachet of Sprinkles <i>never</i> given to another family member	101	98	241	99

*Sample for this table includes the survey sample from the effectiveness study (Menon *et al.* 2007); ($n = 244$). The sample size for use of Sprinkles in the past 24 h from the effectiveness study sample is smaller than the full sample size of 244 because some children had consumed the entire supply of sprinkles by the time the end line survey of the effectiveness study was conducted.

data on self-reported behaviours from the exit interviews done at the FDPs and from the effectiveness study end line interviews (Table 6). Compliance with programme recommendations was assessed primarily by asking mothers about the mode of use of Sprinkles, i.e. usual frequency of use, types of foods Sprinkles were mixed with, amount of food containing Sprinkles consumed by the child and sharing of Sprinkles with other family members. In addition, we report qualitative results from the group discussions with mothers of beneficiary children.

In general, the quantitative data show that self-reported compliance was high and that the majority of respondents reported using the Sprinkles appropriately and in accordance with the BCC messages conveyed.

When mothers were asked how often they gave Sprinkles to their child, responses for 'number of times given yesterday' differed from responses on 'usual' practices. When asked about 'usual' practices, the majority of respondents reported giving the Sprinkles with food once per day. When asked about yesterday only 1/5 (exit interviews) to 1/3 (effectiveness study) reported that Sprinkles were given once. A higher percentage reported that Sprinkles were given twice. However, giving twice is appropriate, as long as the total amount of Sprinkles given in a day does not exceed one sachet. This difference in responses to 'usual' practice vs. recall of practice in

the past 24 h could reflect different interpretations of the question, such that for the former, respondents reported their knowledge on the most appropriate way to feed Sprinkles while for the latter, they were more likely to report actual practice.

Eighty six per cent of the exit interview respondents indicated giving the child Sprinkles every day in the previous week. This percentage was lower in the effectiveness study (63%), with 25% reporting that they gave sprinkles four to six times the previous week. This finding reflects the fact that the interviews were conducted late in the trial, and for some respondents, the 2-month supply would have already been consumed by the child.

The data on self-reported usual practices were very similar between the exit interviews and the effectiveness study survey. The majority of respondents reported mixing the Sprinkles into appropriate foods (solid or semi-solid foods, such as gruel, rice and beans, mashed plantain, bread soup, etc.). Close to 100% reported that they used an entire sachet of Sprinkles each time they fed them to the child, that the child usually consumed the entire portion of food containing Sprinkles and that they gave the Sprinkles exclusively to the beneficiary child.

The qualitative data support the findings of the quantitative data on compliance and appropriate use of Sprinkles. In all four group interviews, mothers reported with high frequency that they used one

sachet of Sprinkles per day, that the child consumed the entire portion of the food containing the Sprinkles and that Sprinkles were only given to the beneficiary child. The discussants in all groups listed appropriate foods in which they mixed the Sprinkles, but in three groups mothers also reported mixing Sprinkles into juice. The following are some examples of these themes:

- [We give] one sachet [per day]. We are given 30 sachets, one per day.
- [Child consumes] the whole amount. The child consumes the 2 spoons of food and then we feed the remaining amount because the 2 spoons are not going to be sufficient.
- One day, I tasted the food to have an idea of the taste, but I noticed that [the Sprinkles] are without taste. I have never given them to another person, only to the child. It is the child in the program who has low weight; we were told to only give [the Sprinkles] to this child.
- [The Sprinkles] should not be mixed into coffee with milk, in bean puree or hot food. We mix [the Sprinkles] into bananas, soup, rice with leaves, maize, bouillon.

The results of the group interviews also show that the step-by-step instructions conveyed at MCs were also understood:

- [We mix the Sprinkles into] 2 spoons [of food] so that the child eats the whole amount, so that the child is able to consume all. If [the Sprinkles] are mixed into the whole food portion, the child can leave some, which will be lost. In this case the child will not receive the entire vitamin.
- Every day we take a sachet, we tear open the top and we pour the content in 2 spoons of the food.
- After having prepared the food, one lets the food cool down, then one washes hands in order to take away the microbes, then one shakes the Sprinkles sachet a little bit and after that one opens the sachet and mixes the content into the food.

In the effectiveness study survey, mothers were asked whether they had interrupted or stopped

feeding Sprinkles to the child at any point in time. None of the mothers reported stopping completely, but about 30% interrupted it at least once in the 2-month period. Half of the mothers (49%) interrupted the daily regimen once and almost one-third (30%) twice. The total number of days of interruption (within the 2-month period) ranged from 1 to 28, with a median of 3 days. This was confirmed in the qualitative study in which mothers admitted that they sometimes did not give Sprinkles to the child for 1 or 2 days. The primary reason recorded was that the child did not want to eat the food the Sprinkles were mixed into, or did not like the Sprinkles at the beginning.

Discussion and conclusions

This paper uses a programme theory framework to assess the feasibility and acceptability of delivering Sprinkles in the context of an ongoing food-assisted MCHN programme implemented by WV in Haiti. The feasibility study, conducted in conjunction with an effectiveness evaluation, showed that including a Sprinkles intervention into the existing WV Haiti programme structure was highly feasible and occurred as intended. Results based on our programme theory framework show that: (1) information on use of Sprinkles was provided to mothers before they first received them as planned; (2) Sprinkles were also re-packaged and distributed as planned and in the appropriate amount; (3) almost all mothers (96%) received their two monthly rations of Sprinkles and reported having received timely information on their use; (4) interviews revealed that mothers had an excellent understanding of how to use Sprinkles and that acceptance was high; no selling of the product was reported and no sprinkles were found for sale in any of the markets from the study area; and (5) mothers reported using the Sprinkles as instructed (99% in exit interviews and 95% in effectiveness survey said they used one sachet into the child's food), every day in past week (86% in exit interviews and 63% in effectiveness survey; the latter percentage is lower because some children had finished receiving their 2-month dose at the time of the survey), and for the child only (98% and 99% in exit interviews and effectiveness survey, respectively).

Staff acceptance of the Sprinkles was generally high. However, there were some mixed feelings among front-line health staff with respect to whether or not the additional BCC requirement to support Sprinkles increased their workload. If it had been part of the programme initially, it is unlikely that this specific topic, with its single 20-min learning session, would have been seen as an additional burden, especially as a number of other learning sessions in the pre-existing MC sequence were longer. It could be that any new programme element will always be perceived as increasing workload by some workers, and it is encouraging that even those who felt it negatively affected their workload saw it as enhancing their stature, and supported the Sprinkles intervention.

Staff comments also confirmed the effectiveness of training in conveying the rationale for the intervention and the benefits to children. These same benefits were well-understood by mothers exposed to the BCC messages, and are likely to have contributed to the appropriate utilization by programme beneficiaries. Our results suggest that a good BCC intervention – in this case embedded in a well-designed larger BCC strategy – can ensure appropriate use.

Our study measured mother and child acceptability only indirectly – i.e. through mother's compliance. The qualitative data did reveal some possible problems with child acceptance, but mothers reported creative strategies to cope with the problem when it existed. Moreover, the fact that the intervention was highly effective at reducing anaemia (Menon *et al.* 2007) suggests that child acceptance may not have been such a widespread constraint to utilization. More explicit attention to maternal and child acceptance of the Sprinkles and the collection of quantitative data on this issue would have elicited a more thorough understanding of whether or not acceptance needs to be addressed more directly in future use of the Sprinkles.

Two other unpublished studies have documented the feasibility of implementing Sprinkles distribution in a community setting. Schauer *et al.* (2003) reported that it was feasible to integrate Sprinkles distribution for infants 6–36 months old within a nutrition programme of a non-governmental organization (WV) in Mongolia; and Hyder *et al.* (2004) provided evidence of feasibility of distributing Sprinkles in Bangladesh,

through a network of health workers. In both these studies, the mechanism for ensuring appropriate use of the Sprinkles included home visits by health workers. Our study provides evidence that it is feasible to integrate the delivery of a micronutrient Sprinkles intervention into a food-assisted MCHN programme, a programme model widely used by USAID-funded private voluntary organizations in many countries. In addition, the programme theory-based approach to assessing feasibility in our study allows comparison with other programmatic contexts.

Existing capacity vs. technical assistance

This Sprinkles intervention was implemented in the context of a well-functioning programme. Both the pre-existing BCC intervention and an effective commodity distribution and tracking system were important to the success of the Sprinkles intervention in Haiti. Specifically, WV health staff was already well trained in technical issues related to infant feeding, in adult education techniques and in the facilitation of small group education sessions prior to the integration of the Sprinkles intervention into the programme. Furthermore, the mothers attending the MC were familiar with the format of the learning sessions held at the MCs on infant feeding and child health. It is not clear whether a similar approach and similar BCC materials would work as well in other settings. Designing and implementing small-group education sessions within delivery systems that are not well established for this mode of BCC would likely require more capacity-strengthening activities prior to implementation. Therefore, research is needed to determine what is required to implement a Sprinkles intervention such as this one where programme capacity is low or non-existent.

The integration of the Sprinkles distribution and related education intervention in WV's programme required some initial technical and financial input provided by the research team. WV continued the distribution of Sprinkles in the same fashion after the feasibility and effectiveness studies were completed, until the Sprinkles stocks were finished. In addition, in February 2006, WV started facilitating the sale of commercially available Sprinkles (called 'BabyFer' in

Haiti) at the programme's RPs for a lower rate than the local market rate (for 35 instead of 56 Haitian Gourds).⁸

Use of a programme theory framework for nutrition programmes

This study provides an example of a programme theory-based process evaluation embedded in an effectiveness study. The effectiveness study (Menon *et al.* 2007) necessarily included several data collection activities and adding the additional steps needed to explore and confirm the success of each step in the programme theory pathway (Fig. 1) was not burdensome. The data reported here strengthen the plausibility that observed impacts on prevalence of anaemia (Menon *et al.* 2007) were in fact due to the intervention activities. Had the intervention not been successful, the process evaluation could have identified breaks in the chain of effect, and informed programme modifications for the future (Habicht *et al.* 2008).

Conclusions

This study illustrates the value of attention to process within a programme theory framework incorporated into an effectiveness study. As this literature grows, so will the opportunity to examine conclusions across programmes and sites and identify key approaches, processes and programme elements that have led to positive impacts. This will provide critical information for urgently needed quality improvement and scaling-up efforts in nutrition programming.

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⁸Since October 2005, 'BabyFer' has been made available commercially in Haiti at a cost of 56 Haitian Gourds (equivalent to \$1.43) for 30 sachets, or 2 Gourds (\$0.05) for one sachet, based on the exchange rate on 30 July 2005).

Key messages

- It is feasible to deliver micronutrient Sprinkles and a BBC intervention about the use of the Sprinkles through an existing, well-established food-assisted MCHN programme.
- It is also possible to achieve appropriate utilization of the Sprinkles by beneficiary mothers – and for the targeted child – through a Sprinkles BBC intervention embedded within an overall BCC strategy that focuses on improving feeding and caregiving practices of infants and young children.
- We believe that in Haiti, the existing programme capacity in WV (the programme implementation agency) was essential to ensuring smooth delivery of the Sprinkles and that good BCC is important for effective intervention delivery.
- Using a programme theory framework to design a feasibility study allowed us to evaluate whether all critical steps in the intervention delivery and utilization pathway were achieved.
- It is important to incorporate process/feasibility studies based on programme theory within impact evaluations because such studies provide important information on the generalizability of evaluation findings, which is useful for replication or scaling-up.

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Conflicts of interest

None declared.

References

- Billings D.L. & Benson J. (2005) Post abortion care in Latin America: policy and service recommendations from a decade of operations research. *Health Policy and Planning* **20**, 158–166.
- Bryce J., Victora C.G., Habicht J.P., Black R.E., Scherpbier R.W. & MCE-IMCI Technical Advisors (2005) Program-

- matic pathways to child survival: results of a multi-country evaluation of integrated management of childhood illness. *Health Policy and Planning* **20** (Suppl. 1), i5–i17.
- Dickey V.C., Pachon H., Marsh D.R., Lang T.T., Claussenius D.R., Dearden K.A. *et al.* (2002) Implementation of nutrition education and rehabilitation programs (NERPs) in Viet Nam. *Food and Nutrition Bulletin* **23** (Suppl. 4), 75–82.
- Giovannini M., Sala D., Usuelli M., Livio L., Francescato G., Braga M. *et al.* (2006) Double-blind, placebo-controlled trial comparing effects of supplementation with two different combinations of micronutrients delivered as sprinkles on growth, anemia, and iron deficiency in Cambodian infants. *Journal of Pediatrics Gastroenterology and Nutrition* **42**, 306–312.
- Haaga J.G. & Maru R.M. (1996) The effect of operations research on program changes in Bangladesh. *Studies in Family Planning* **27**, 76–87.
- Habicht J.P., Pelto G.H. & Lapp J. (2008) *Methodologies to Evaluate the Impact of Large Scale Nutrition Programs*. World Bank: Washington, DC. <http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/EXTPOVERTY/EXTISPA/0,,menuPK:384336~pagePK:149018~piPK:149093~theSitePK:384329,00.html#doingIE>
- Hyder S.M., Haseen F., Rahman M. & Zlotkin S. (2004) *Delivery of microencapsulated iron Sprinkles in rural poor through female health workers: lessons learnt at BRAC in Bangladesh*. [Abstract]. International Nutritional Anemia Consultative Group [INACG] symposium in Lima: Peru.
- Ip H., Hyder S.M., Haseen F., Rahman M. & Zlotkin S.H. (2007) Improved adherence and anemia cure rates with flexible administration of micronutrient sprinkles: a new public health approach to anemia control. *European Journal of Clinical Nutrition*. doi:10.1038/sj.ejcn.1602917
- Loechl C.U., Ruel M.T., Pelto G. & Menon P. (2005) *The Use of Operations Research as a Tool for Monitoring and Managing Food-Assisted Maternal/Child Health Nutrition (MCHN) Programs: an Example from Haiti*. Food Consumption and Nutrition Division Discussion Paper 187. International Food Policy Research Institute (IFPRI): Washington, DC.
- McGinn T. (1997) Monitoring and evaluation of prevention of PMM efforts: what have we learned? *International Journal of Gynecology and Obstetrics* **59** (Suppl. 2), S245–S251.
- Marsh D.R., Pachon H., Schroeder D.G., Ha T.T., Dearden K.A., Lang T.T. *et al.* (2002) Design of a prospective, randomized evaluation of an integrated nutrition program in rural Viet Nam. *Food and Nutrition Bulletin* **23** (Suppl. 4), 34–44.
- Menon P., Ruel M.T., Loechl C.U., Arimond M., Habicht J.P., Pelto G. *et al.* (2007) Micronutrient sprinkles reduce anemia among 9- to 24-month old children when delivered through an integrated health and nutrition program in rural Haiti. *The Journal of Nutrition* **137**, 1023–1030.
- Nicholas D.D., Heiby J.R. & Hatzell T.A. (1991) The quality assurance project: introducing quality improvement to primary health care in less developed countries. *Quality Assurance in Health Care* **3**, 147–165.
- Pelto G.H., Santos I., Goncalves H., Victora C., Martinez J. & Habicht J.P. (2004) Nutrition counseling training changes physician behavior and improves caregiver knowledge acquisition. *The Journal of Nutrition* **134**, 357–362.
- Penny M.E., Creed-Kanashiro H.M., Robert R.C., Narro M.R., Caulfield L.E. & Black R.E. (2005) Effectiveness of an educational intervention delivered through the health services to improve nutrition in young children: a cluster-randomized controlled trial. *The Lancet* **365**, 1863–1872.
- Robert R.C., Gittelsohn J., Creed-Kanashiro H.M., Penny M.E., Caulfield L.E., Narro M.R. *et al.* (2006) Process evaluation determines the pathway of success for a health center-delivered, nutrition education intervention for infants in Trujillo Peru. *The Journal of Nutrition* **136**, 634–641.
- Robertfroid D., Pelto G.H. & Kolsteren P. (2007) Plot and see! Maternal comprehension of growth charts worldwide. *Tropical Medicine & International Health* **12**, 1074–1086.
- Rossi P.H., Lipsey M.W. & Freeman H.E. (2004) *Evaluation: A Systematic Approach*, 7th edn, Sage: Thousand Oaks, CA.
- Ruel M.T., Quisumbing A.R., Hallman K., de la Briere B. & Coj de Salazar N. (2006) *The Guatemala Community Day Care Program: An Example of Effective Urban Programming*. Research Report 144. International Food Policy Research Institute (IFPRI): Washington, DC.
- Santos I., Victora C.G., Martinez J., Goncalves H., Gigante D.P., Valle N.J. *et al.* (2001) Nutrition counseling increases weight gain among Brazilian children. *The Journal of Nutrition* **131**, 2866–2873.
- Schauer C., Zlotkin S.H., Nyamsuren M., Hubbell C.R., Chan M., Purevsuren O. *et al.* (2003) *Process Evaluation of the Distribution of Micronutrient Sprinkles in over 10 000 Mongolian Infants Using a Non-Governmental Organization (NGO) Program Model* [Abstract]. International Nutritional Anemia Consultative Group [INACG] meeting in Marrakesh: Morocco.
- Sharieff W., Bhutta Z.A., Schauer C., Tomlinson G. & Zlotkin S. (2006) Micronutrients (including zinc) reduce diarrhoea in children: the Pakistan sprinkles diarrhoea study. *Archives of Disease Child* **91**, 573–579.

- Victora C.G., Habicht J-P & Bryce J. (2004) Evidence-based public health: moving beyond randomized trials. *American Journal of Public Health* **94**, 400–405.
- Wawer M.J., McNamara R., McGinn T. & Lauro D. (1991) Family planning operations research in Africa: reviewing a decade of experience. *Studies in Family Planning* **22**, 279–293.
- World Vision Mongolia (2005) *Report on the Effectiveness of Home-Based Fortification with Sprinkles in an Integrated Nutrition Program to Address Rickets and Anemia*. World Vision Mongolia: Ulaanbaatar.
- Zlotkin S., Arthur P., Antwi K.Y. & Yeung G. (2001) Treatment of anemia with microencapsulated ferrous fumarate plus ascorbic acid supplied as sprinkles to complementary (weaning) foods. *American Journal of Clinical Nutrition* **74**, 791–795.
- Zlotkin S., Arthur P., Schauer C., Antwi K.Y., Yeung G. & Piekarz A. (2003) Home-fortification with iron and zinc sprinkles or iron sprinkles alone successfully treats anemia in infants and young children. *The Journal of Nutrition* **133**, 1075–1080.