

REGULAR ARTICLE

A realistic evaluation approach highlighted the success factors and difficulties of an innovative and comprehensive malnutrition programme in Madagascar

Margot Magnin (margotmagnin@gmail.com)¹, Emilien Jeannot^{1,2}, Rajaobelina Voahangy³, Beat Stoll¹

1.Institute of Global Health, Faculty of Medicine, University of Geneva, Geneva, Switzerland

2.School of Health Sciences, University of Applied Sciences and Arts, Western Switzerland, Geneva, Switzerland

3.Medical Dispensary, Maternity Ward and CRENAM (Outpatient nutritional recovery and education centres which deal with moderate acute cases of malnutrition) of Anosizato and Miray Association, Antananarivo, Madagascar

Keywords

Healthy eating, Malnutrition, Maternal education, Nutricartes, Realistic evaluation

Correspondence

M Magnin, Institute of Global Health, Faculty of Medicine, University of Geneva, Chemin Praz Maigroz 18, 1805 Jongny, Switzerland.
Tel: 0041 79 399 27 93 |
Email: margotmagnin@gmail.com

Received

17 July 2017; revised 21 October 2017;
accepted 2 February 2018.

DOI:10.1111/apa.14267

INTRODUCTION

In Madagascar, acute malnutrition affects 13% of children under five years of age, is an important cause of morbidity and mortality in this population and causes about 44 800 child deaths per year (1). The Malagasy Ministry of Public Health has recommended that the work of nutritional recovery and education centres, and the associated community involvement, should be strengthened (2). The Ministry's protocol for managing moderate acute malnutrition recommends that children receive a supplement that provides them with 1000–1500 kcal per day, together with vitamin A, deworming and any vaccinations that are due (3). It also says that nutritional education programmes should be provided for children's carers, but does not provide details on what these should comprise. Despite this, the few programmes evaluated by the Ministry of Public

ABSTRACT

Aim: Malnutrition has multiple causes, not just a lack of calories. We explored the successes and barriers of an innovative, comprehensive programme in Madagascar that educated mothers in particular about nutrition.

Methods: The outpatient programme in Antananarivo treats 2400 malnourished children from 6 to 59 months each year. The 35-day programme comprises health checks, cooking demonstrations, the distribution of enriched flour supplements and two food-related games that are called Nutricartes and are based on boards and picture cards. In 2014, we involved 74 of the children's mothers in a realistic evaluation process, which investigates the mechanisms that produce a particular outcome in a given context.

Results: The mechanisms of success were the community-based aspects of the programme, the kindness and equality displayed by the nutritional assistants and improved household budgeting and hygiene. Children ate better and improved their health, which reduced medical visits and costs. Finally, the mothers became proud of their achievements and told other mothers what they had learnt. Adherence was greatest when the women were on a minimum wage and strongly motivated.

Conclusion: The effect of this multifaceted programme was that the mothers received sustainable education about healthy eating and improved childhood health and nutrition.

Health revealed low recovery rates and very high dropout rates (1).

The causes of malnutrition are always multiple and intertwined (2). A number of factors contribute to child malnutrition in Madagascar, such as fluctuations in the supply of food and people's access to it, political instability, poverty, poor sanitation among vulnerable groups, ignorance of the nutritional needs of children, family practices

Abbreviations

CIMO, Context, intervention context, mechanism, outcome configuration; CMO, Context, mechanism, outcome configuration; WHO, World Health Organization; WHZ, Weight-for-height z-score.

Key notes

- We explored the successes and barriers of an innovative, comprehensive programme in Madagascar's capital that educated mothers and children about nutrition.
- The 35-day outpatient programme treats 2400 malnourished children from 6 to 59 months each year and comprises health checks, cooking demonstrations, enriched flour supplements and food-related games.
- Focus groups held in 2014 showed how this multifaceted programme provided sustainable maternal education about healthy eating and improved childhood health and nutrition.

with regard to breastfeeding and nutrition and the lack of access to clean drinking water. Therefore, the situation is complex, because so many constantly changing factors are involved. By complex, we mean that it is made up of multiple intertwined elements and includes nonlinear relationships of cause and effect (4).

Consequently, the outcome of any intervention is susceptible to the state of the other factors at the time it is implemented and closely linked to the context where it is being provided (5). The complexity of the struggle against malnutrition does not just mean providing children with the calories they are lacking. We need to understand the overall complexity of the situation and empower the children and families who receive help from these programmes in a sustainable way.

Despite these considerations and the strong recommendations by experts to include nutritional and educational advice in protocols (6), most studies have focused on determining the most effective dietary supplement protocol (7), but neglected the educational role (8) and the community-based approach of programmes. In addition, while the real challenge is to maintain acceptable long-term recovery rates in malnourished children, there are a lack of long-term follow-up studies on the children who benefit from such programmes (9). A World Health Organization (WHO) report noted that there was a knowledge gap in the literature on the effectiveness of nonfood approaches to malnutrition, especially when the causes of malnutrition were not food-related (10), as in the case of Madagascar. Studies that explore why certain interventions do and do not work are therefore necessary.

Our study focused on a comprehensive treatment programme for infant malnutrition. As reported in a previous paper (11), this programme showed good quantitative results: 82.2% of children had recovered at the end of the programme and 79.1% were still in recovery one year after the programme finished. The aim of this study was to examine these results from a qualitative point of view, to understand the underlying mechanisms that brought this programme to success and to clarify who it worked best for and in what circumstances. Realistic evaluation, a social science method that investigates relationships between contexts, mechanisms and outcomes (CMO), was the best way to address the complexity of this particular situation (4).

Realistic evaluation is a theory-based evaluation (12) and its epistemological foundations can be found in critical realism (12,13). In critical realism, the reality exists but can only be apprehended in an imperfect way and objectivity becomes an ideal that the researchers look for (12). According to its authors, Pawson and Tilley (14), a realistic evaluation seeks not only to determine whether a programme works or not, but especially particularly focuses on to understand what works, who it works for and in what circumstances (15). In this way, a realistic evaluation also aims to understand which interventions produce which effects in which contexts; how certain mechanisms work, why they work and how they produce which specific

outcomes; as well as understanding the conditions that are necessary to set in motion such mechanisms (5,16). This understanding is essential to sustaining a programme, reinforcing its success factors and determining if it could be implemented elsewhere.

The main tool of the realistic evaluation is called the CMO configuration which is explained above (14) (Fig. 1). It explores how a particular context can lead to a mechanism that will generate a given outcome (17). In every intervention, the interaction of these two elements is what triggers, or does not trigger, the mechanism (12). Thus, an intervention does not function by itself, but triggers one or several mechanisms that enable the production of effects (12). For this study, we added an intervention context, according to the Lacouture et al. model (13), and obtained the context, intervention, mechanism, outcome (CIMO) configurations explained below. The context is the environment in which a particular intervention triggers mechanisms that will generate specific outcomes (18). The context refers to the general prevailing context before the intervention and includes setting dimensions, such as institutional, spatial, relational, historical, cultural and community aspects.

The interventional context is defined as the circumstances in which an intervention is conducted and the manner in which it is implemented. These elements are necessary in order for a mechanism to produce a given outcome (18). The mechanism is generally hidden and not easily measured, but is nonetheless real. It is an underlying process that is sensitive to the contextual variations and that produces an outcome. It answers the question about how intervention A produces outcome B (18). The outcome is the intended or unintended consequence of an intervention and a change that can take place in the short, medium or long term. It can be positive or negative.

In addition to the CIMO configurations, the realistic evaluation approach follows a cyclical methodology with an exploratory nature. This methodology comprises a succession of different theories: first researchers build various initial theories, and then they test and revise them to refine the original hypotheses and increase the levels of proof (15). Researchers start with a literature review on the subject and

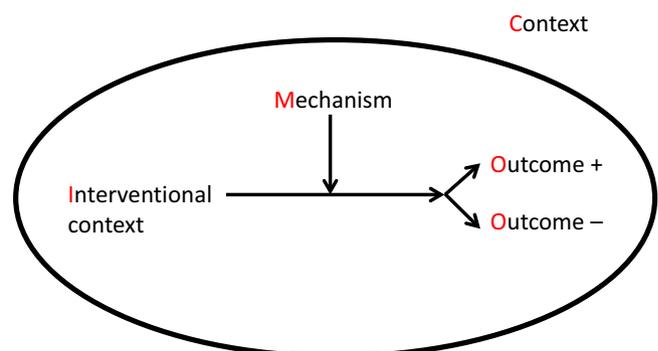


Figure 1 The Context, intervention context, mechanism, outcome configuration (schematic version).

try to understand the global context of the programme on the ground, so that they can make assumptions. This is called the initial theory. It comprises three hypotheses. To test these hypotheses, they conduct qualitative research on the ground, in different contexts if possible. With the new knowledge this delivers, they are then able to refine the theory and to provide the reviewed programme theory. This helps them to develop a better understanding of the programme, which is more precise and scientific and helps them to improve the programme if necessary.

METHODS AND PARTICIPANTS

Location and programme design

Details of this comprehensive outpatient programme, which has run since 2006 and combines food supplements with nutritional education, have previously been published (11). Each year, around 2400 malnourished children are admitted from the lower socio-economic class districts of Antananarivo, the capital of Madagascar. It is a poor urban environment that could be described as a slum. The definition of malnutrition used by the programme was based on the 2006 version of the WHO's weight-for-height z-score (WHZ) (19), as recommended by the Malagasy Ministry of Public Health (3). The children's nutritional status was graded as recovery if the WHZ was at least -1 , mild acute malnutrition if it was between less than -1 and at least -2 , moderate acute malnutrition if it was less than -2 and at least -3 and severe acute malnutrition if it was less than -3 .

Nutritional screening was carried out weekly by local community workers, who informed the families that all children under five years of age in the district could be screened. The children's mid-upper arm circumference was measured by local community workers, and then children who screened positive were given a more detailed examination by the nutritional assistants using the WHZ indicator and an evaluation of whether oedema was present. The children with oedema or a marked lack of appetite were referred to hospitals. All the local community workers and nutritional assistants were trained by the French Association L'APPEL, which is an international solidarity association that has supported local childhood initiatives since 1968 (20). The admission criteria were children from 6 to 59 months with a WHZ between -2 and -3 . The children meeting the programme criteria, and an accompanying person who was usually the mother, joined a group of about 20 children for a 35-day programme. They took part in weekly sessions organised by the nutritional assistants and the local community workers in their districts, for example in a classroom, a room provided for free by the district or by a richer citizen or in the square in front of a church. The sessions lasted around two hours and included anthropometric measurements such as weight, height, WHZ and control for oedema; information, education and counselling for the accompanying person; a cooking demonstration; the on-site consumption of one portion of cooked Koba Aina, an enriched flour (Taf Company, Antananarivo,

Madagascar) and the distribution of enough Koba Aina for the week ahead, corresponding to 720 kcal per day. For ease of reference, we will refer to the accompanying person as the mother from this point on, because most of time they are the mothers.

The education component of the programme was based on the Nutricartes (20) participatory pedagogical method, which was developed by L'APPEL. The pedagogical support comprised two interlinked games, each comprising a game board and picture cards. The first focused on education with regard to a balanced diet and represented the three essential food groups that a healthy meal needs: energy, proteins and vitamins. These were called energy, construction and protection, respectively, in the games, and the picture cards represented local market foods. The other game board concentrated on good practice with regard to hygiene, drinking water and prevention, and the picture cards showed behaviours that were and were not recommended, such as washing hands and defecating outside proper toilets. The pedagogical games were played in small groups of 5–10 mothers, and active participation was encouraged. Each group was given a game board and picture cards to play with. One nutritional assistant, who received regular training from L'APPEL, led each game, explaining the game, the rules, the food groups, their roles, etc. Then he distributed the cards, asked all the mothers to place their cards one after the other and interacted with them until they provided the correct answers. The information, education and counselling focused on the fact that giving the child diverse healthy meals that provided sufficient protein was possible and affordable. The themes addressed the plans supervised by the programme doctor and L'APPEL. In addition to the weekly sessions, the programme also provided an update on the children's vaccination status, free health care from the programme doctor, parental support and information on family planning. Breastfeeding was also encouraged.

The children finished the programme once they had reached the recovery threshold of a WHZ of more than -1 and the mothers had completed a minimum of four weeks of education. The children who did not reach the recovery threshold in three months were categorised as not having responded to the treatment.

Data collection and participants

A programme theory made up of three hypotheses was formulated by the evaluator for this study after his first journey to Madagascar in late 2013, based on observations, interviews with key stakeholders and a review of the literature. The three hypotheses were as follows: (i) playing games encourage participants to come back and result in a low dropout rate; (ii) the dropout rate is also lowered because the nutritional assistants connect with the mothers, so that the women feel they can trust them and feel valued and (iii) the information provided at the right level for the mothers make that they gain self-confidence and do their best to put the advice they received into practice at home.

To refine these three initial hypotheses, six focus groups were conducted in May 2014 in Antananarivo with the people who had accompanied children that had previously benefited from the programme. The study design remained a one-case study because the context of the intervention was identical. The recruitment for the focus groups was carried out by local community workers as they were the only people who had access to the relevant populations. The instruction was that each local community worker should vary the type of participant they recruited according to socio-economic level, motivation, follow-up date, level of satisfaction, etc. This was a limitation of this of this study that is discussed later. Of the 12 neighbourhoods covered by the programmes, four were chosen according to their representativeness in terms of socio-economic level, geographic localisation or mean participation and the availability of the local community worker. The convenience sampling recruitment was stopped when enough people had agreed to participate and the saturation level of information had been largely achieved. We enrolled 74 people: 42 had completed the programme more than two years before this study, 11 had completed it more than a year ago, 10 had finished it a few months earlier and 11 were still completing the programme. The participation rate was 100% because of the confidence the people had in the local community worker who personally invited them to take part.

To collect the data in the participants' native language, four Malagasy investigators were recruited. They followed a one-week intensive training on the organisation of the programme, focus group techniques and realistic evaluation. Continued daily training during the whole survey enabled the investigators to perfect their practices and to respecify the research axes when needed.

The Department of Maternal and Child Health and Reproduction of the Malagasy Ministry of Public Health authorised the study (number 266, dated May 27, 2014).

The 2014 focus groups took place in the neighbourhood settings where the information, education and counselling sessions were normally held. Each focus group lasted about an hour, and 10 to 11 people took part in each one. At the start of each focus group discussion, the four investigators told the participants that the date would be anonymous and they could withdraw from the focus group at any time without explanation. They also asked everyone to keep the information discussed in the focus groups confidential. The consent of the participants was obtained by asking them to raise their hands, as some were illiterate. Each group was then divided into two subgroups of five to six mothers to facilitate the transcription of the results with a double control. Investigators worked in pairs in each subgroup, with one investigator moderating the discussion while the other one took notes. The focus groups were not electronically recorded, because it would have discouraged the participants from feeling confident and talking honestly and because of the time and cost involved in translating the notes, which would have been ethically questionable in a resource-limited setting. The questions asked were taken

from a guide created by the investigators and the evaluator during the training and covered issues such as their reasons for participating in the programme, for following it until the end or not and their motivations and difficulties. The mothers' answers were then transcribed into a summary in French – the language spoken by the researchers – by the investigator who took notes, with the translation being double-checked by the second investigator.

Data analysis

The contents of the focus groups results were analysed item by item. Given the limited access to information technology, particularly computers in the lower districts, the data were processed manually and not using software. The French summaries were repeatedly read by the evaluator and the investigators so that they could become familiar with the data. Significant passages and themes were identified, as well as similarities and differences between the discourses. These elements were inserted schematically into a mind map each day, which is a graphic that provides a visual representation of a train of thought. Emerging themes were grouped together in the mind map under generic titles. The evaluator and investigators met daily to pool their responses, to limit any misinterpretations of the data, particularly with regard to the translations. This enabled us to pull together the information that had been gathered and to enable the evaluator and investigators to refine the understanding of the responses and to highlight the links between the information. Therefore, the collection and analysis of the data occurred simultaneously. A thematic coding of the data was then carried out, according to a system of points, relating to the frequency of appearance and the importance given by the mothers to each theme. The mind map was also coded in this way and was validated by the four investigators. The results were then translated into CIMO (Figs 2–7), leading to a reviewed programme theory.

RESULTS

The CIMO – context, intervention context, mechanism and outcome – configurations were grouped into five main themes that the participants said contributed to the high recovery rates from malnutrition. These were as follows: the community-based nature of the programme, the pedagogical approach, the contribution of knowledge from various fields, the comprehensive nature of the programme and the rapidly changing state of the children's health.

Community-based nature of the programme

The community-based nature of the programme (Fig. 2) generated strong interest from the mothers. The local community workers who screened the children and participated in the weekly sessions were one of the main reasons they decided to participate in the programme, as the workers were welcoming, friendly, always smiling and raised awareness by going from door to door. The mothers said they felt they received affection from the local

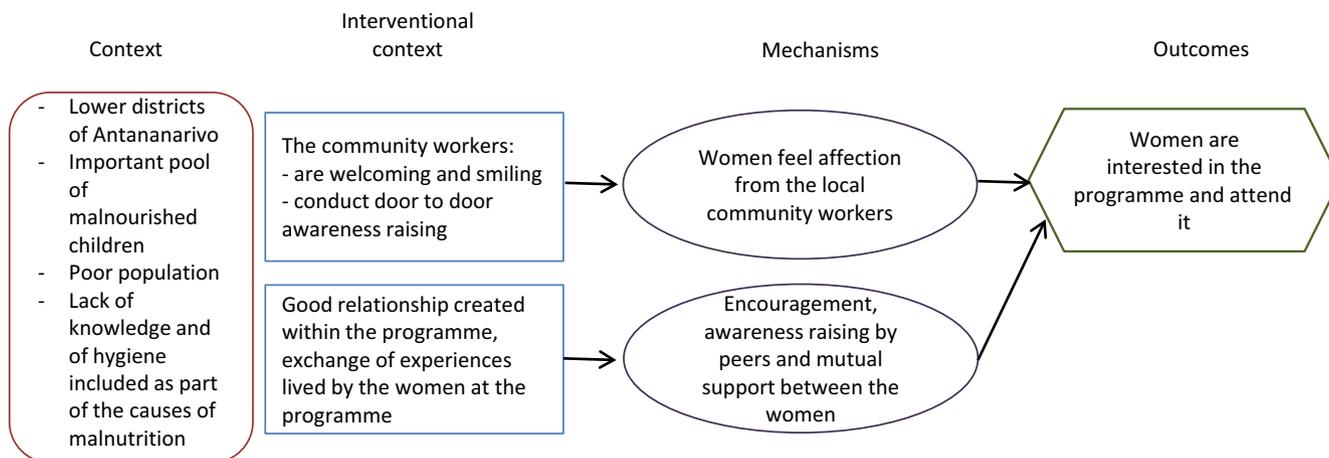


Figure 2 Impact of the community-based nature of the programme. Arrows represent only the results issued from the focus groups. Some other arrows could maybe be added but we did not do it not to misinterpret the participants' answers

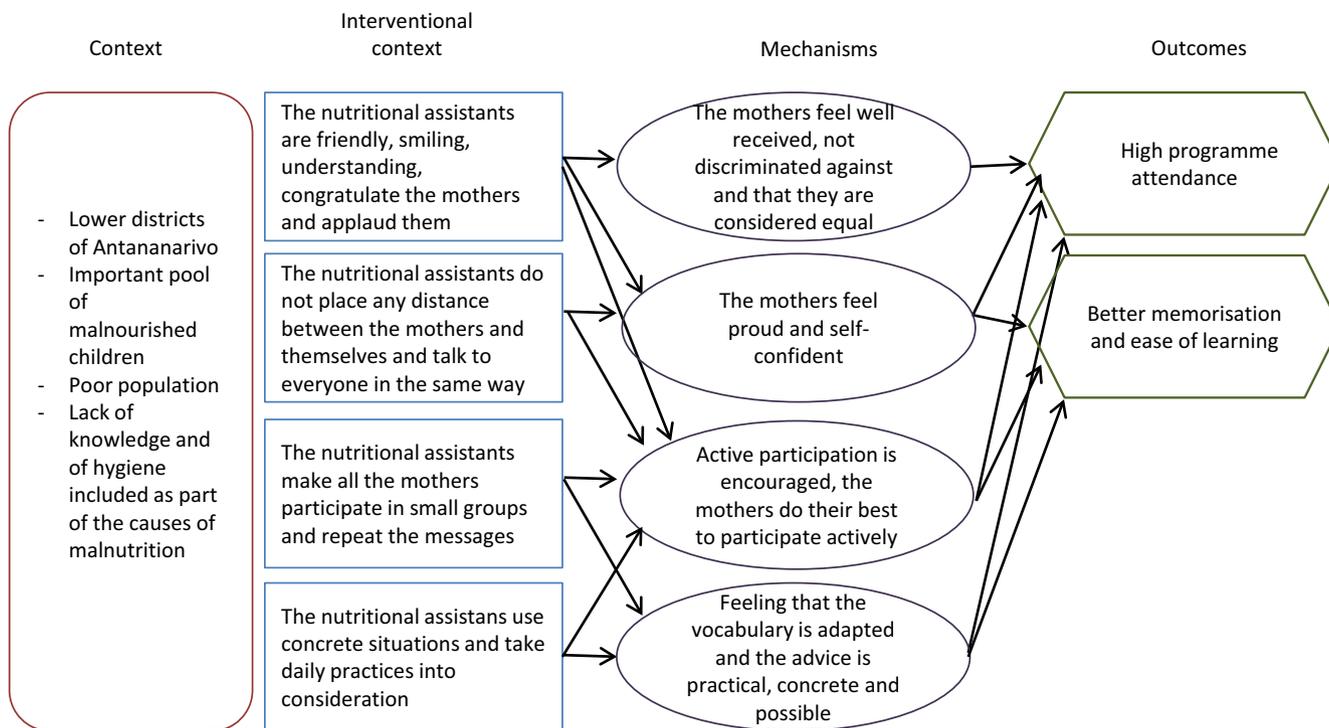


Figure 3 Impact of the pedagogical approach of the nutritional assistants. See Notes in the caption of Figure 2.

community workers. In addition, the links created between the women in the programme led to mutual aid and support outside of programme, with the mothers questioning themselves about their children's health status, sharing their knowledge and educating other mothers about what they had learnt.

The pedagogical approach of the nutritional assistants

The nutritional assistants played a key role in the success of the programme, both through their behaviour and through

their pedagogy (Fig. 3). The mothers described them as smiling, approachable, respectful and understanding. The women felt warmly welcomed, not discriminated against and equal, which made them feel proud, self-confident and happy. They said the nutritional assistants encouraged them by praising and applauding them, using simple words and repeating messages clearly. The nutritional assistants made sure that the women understood the programme well and made sure they all participated. Their advice was perceived as practical, concrete and realistic, which helped the

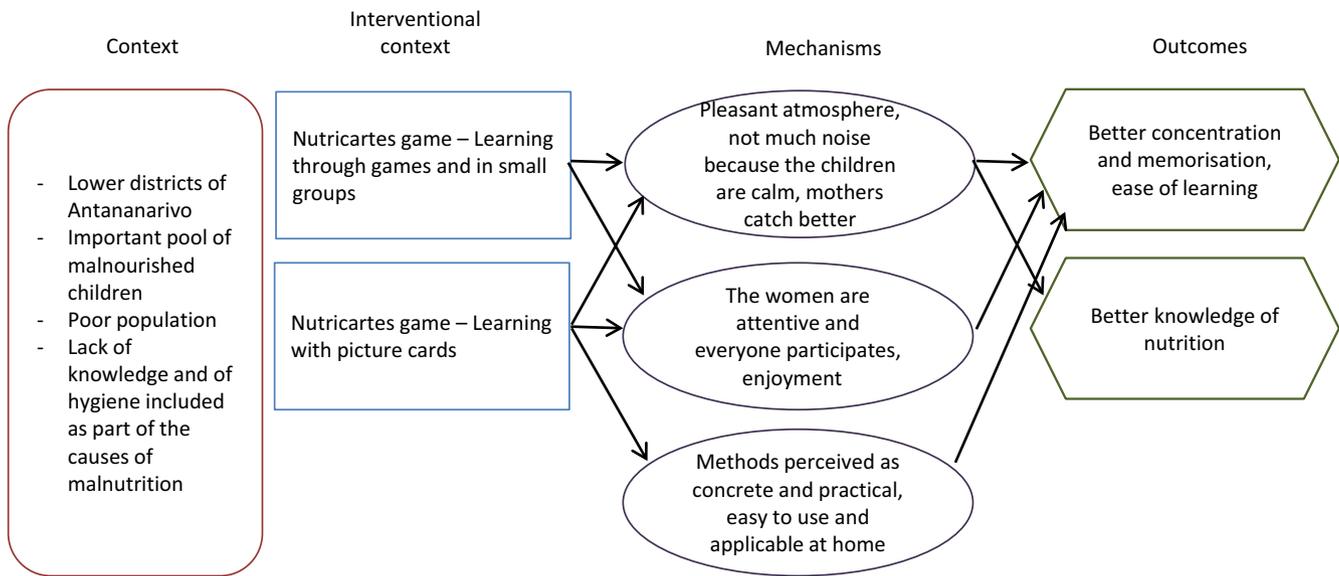


Figure 4 Effect of the contribution of knowledge from different fields (Nutricartes). See Notes in the caption of Figure 2.

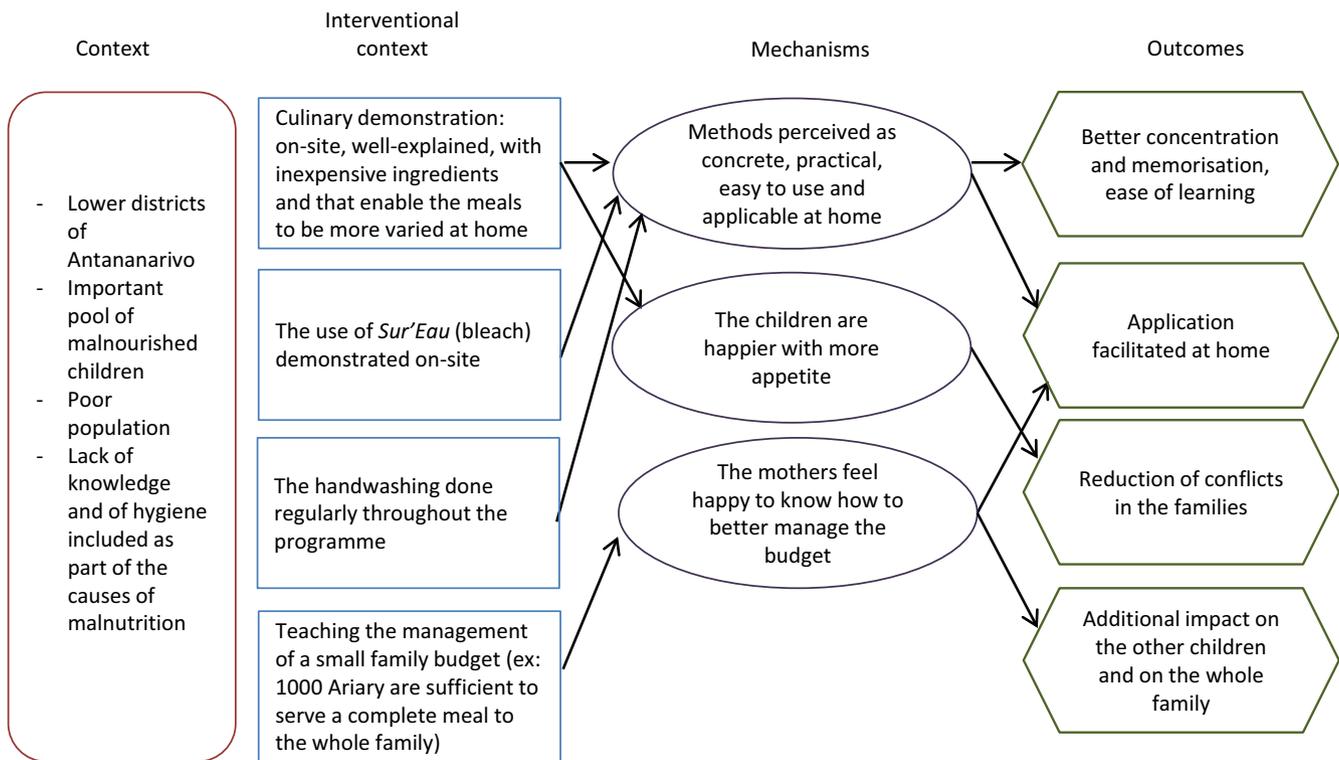


Figure 5 Effect of the contribution of knowledge from different fields (Other elements). See Notes in the caption of Figure 2.

women understand the programme content and reinforced their attendance.

The contribution of knowledge from different fields

The information, education and counselling that was provided was one of the main reasons why the beneficiaries

followed the programme until its end. The mothers said that the new knowledge they gained through the programme helped them to retain the benefits of the programme in the long term and to improve their quality of life. The Nutricartes pedagogy was very important, because the games and images made the mothers more attentive and the children

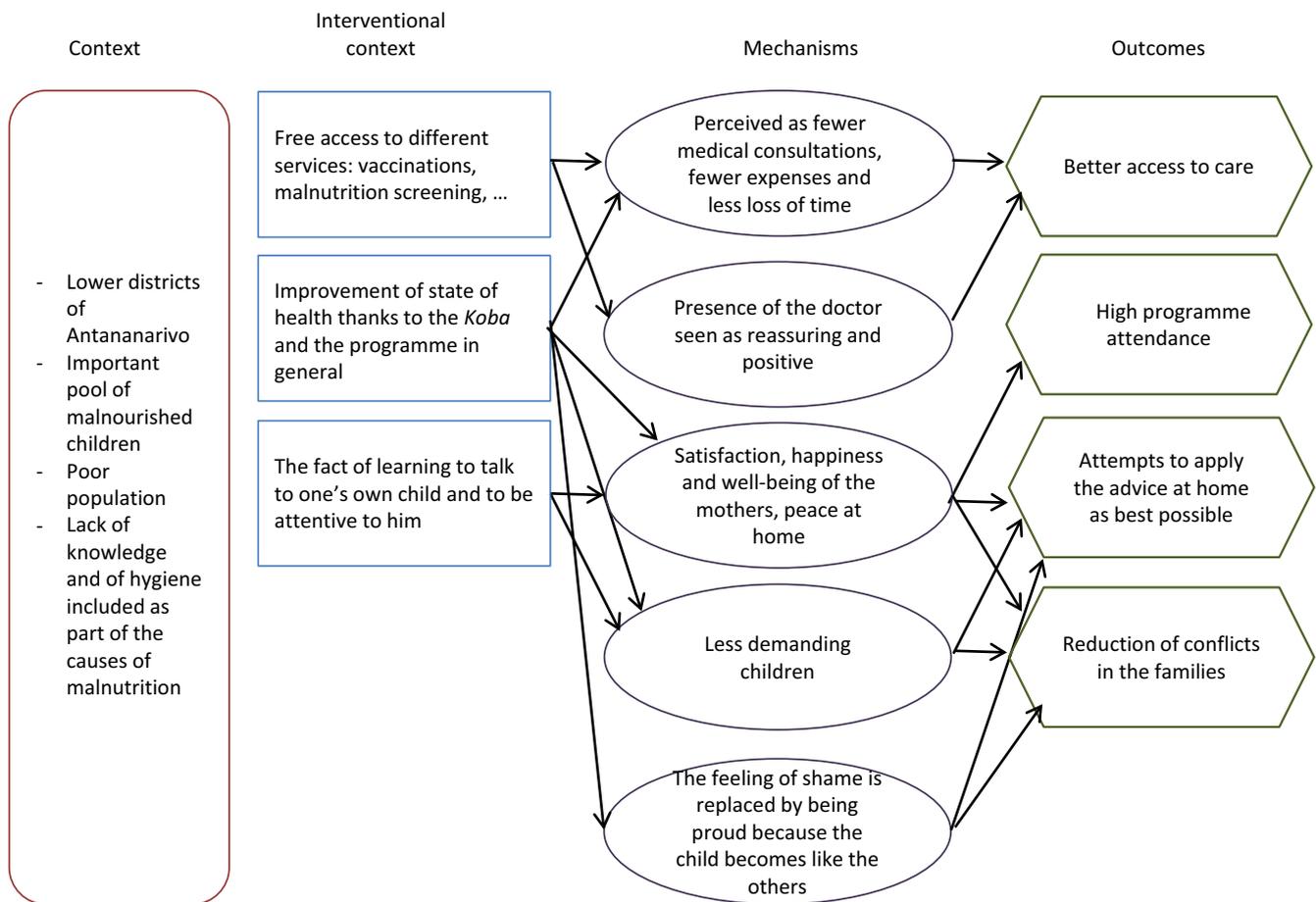


Figure 6 Impact of the comprehensive nature of the programme and of the rapid evolution of the children's state of health. See Notes in the caption of Figure 2.

calmer (Fig. 4). The small friendly groups meant that the mothers understood more and participated actively. The picture cards were easy to use and practical because they perfectly illustrated the food at the market. The women's concentration and ability to recall information were therefore encouraged.

In addition, the cooking demonstration (Fig. 5) led to more varied meals at home, children had greater appetites and there were also fewer fights at the table. The recipes that were demonstrated were considered easy and suitable for use at home and adapted to the mothers' budgets.

The information on hygiene, handwashing and, in particular, drinking water (Fig. 5) was often cited as a successful element, because it improved the health of the children. Sur'Eau, which is a bleach-based product produced by a global nonprofit organisation to make water safe to drink (Population Services International, Antananarivo, Madagascar), was mainly easy and quick to prepare, not very cumbersome and an easy change in their lives. Some respondents reported that using Sur'Eau had reduced the frequency of diarrhoea.

Information on managing the family budget (Fig. 5), which was included in the information, education and counselling part of the programme, was perceived as being a

significant help. The economic arguments were appreciated, for example inexpensive proteins and ideas for family meals costing the equivalent of less than a third of a Euro. The mothers concluded that with a minimum budget, the implementation of the advice given was entirely possible and the improvement in the lives of the whole family made them happy. However, if they did not have the minimum financial resources required, putting the advice into practice remained nearly impossible.

The comprehensive programme

The mothers said that they benefited greatly from this comprehensive programme, which included nutrition, medical visits and vaccinations, because it was a significant time-saver. In addition, the free care, or at least competitively priced healthcare and the presence of a doctor during the weekly sessions, made it easier to access healthcare for their children. In addition, the support they received as parents was appreciated (Fig. 5).

The evolution of the children's state of health

The clear improvement in the children's health played an important motivational role for the mothers because it created a feeling of tranquillity at home (Fig. 6). According

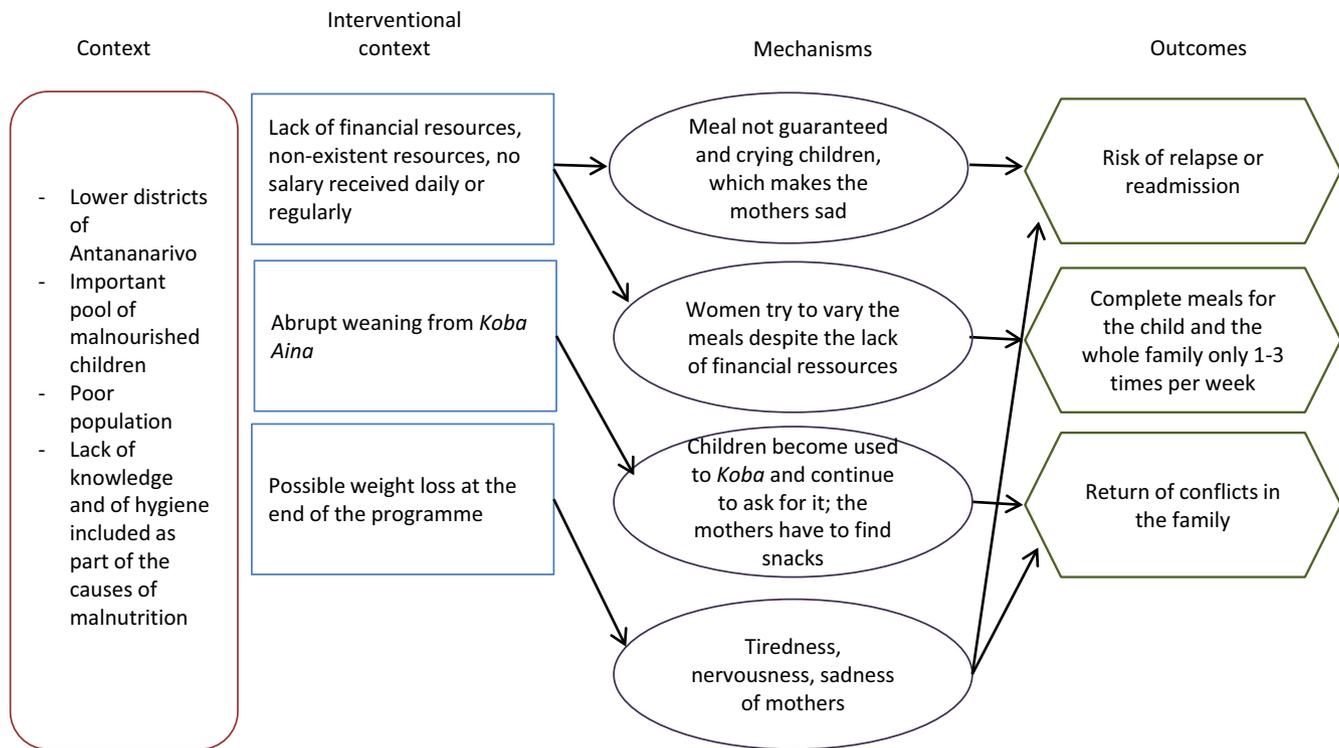


Figure 7 The difficulties encountered by beneficiaries. See Notes in the caption of Figure 2.

to the mothers, the children who followed the programme developed better reflexes, ran around and became more robust, were brighter and easier to educate, rather than being thin and tired as they were before the programme. They needed less medical visits, which reduced expenses. All of this meant that the shame the mothers felt with regard to their children was replaced by pride.

The mothers said the rapid improvement in their children's health was due to the *Koba Aina* food supplement as well as the programme in general. *Koba Aina* was associated with a child who gained weight, who was fit again quickly and resembled a child with good nutritional status. According to the mothers, this flour brought health and reduced medical expenses, which made them less anxious. *Koba Aina* was an important incentive: indeed, some mothers said the product was out of stock, but they still continued with the programme for its information, education and counselling content.

The difficulties encountered

The lack of financial resources and unemployment was the principal cause of relapse or readmission into the programme (Fig. 7). A lack of guaranteed meals in certain families led to children crying and mothers being sad. One difficulty, which was closely linked to finances, was the inability to provide food from three different groups on a daily basis. After the programme, the mothers tried their best to vary the meals, even if, on average, they only manage to serve a complete meal to the whole family between one

and three times a week. In addition, the difficulty children had when they had to give up *Koba Aina*, and some cases when they lost weight at the end of the programme were a source of worry. In most cases, the children lost a little weight without falling back into the malnutrition criteria, which corresponded to the quantitative results published independently (11).

DISCUSSION

One of the objectives of this study was to produce insights into the various elements of the intervention to find out what worked, who it worked for and in what circumstances. Our results revealed the conditions that needed to be fulfilled for such a programme to generate favourable results. The use of the *Nutricartes* games was an undeniable factor for the programme's success, but they were not sufficient on their own. Indeed, the community-based element, the pedagogical techniques used by the nutritional assistants and the way mothers were accompanied through the programme, in a nondiscriminatory manner that was marked by kindness and equality of treatment, were essential. For example, a warm welcome, friendly remarks, encouragement (21) or even praise (22), which were instinctively mentioned by the mothers, were indicators recognised in the literature that indicated good communication. Simple, uniform messages, repeated several times and adapted to the level of the learner, were also clearly associated with the success of the nutritional education (8).

It is important to highlight that the practices adopted by the nutritional assistants were the result of an enormous amount of work developed during years of close training with the French Association L'APPEL. This was only made possible because the team manager in Madagascar was proactive and open to change. In several studies, authors have confirmed that nutritional education could achieve good success as long as the staff were sufficiently well trained, particularly in communication skills (8,23). Other factors that were relevant to this particular context also played an essential role in our results. There needed to be a sufficiently large group of malnourished children, due in particular to a lack of knowledge about nutrition and hygiene in the area. The sample size meant it was possible to create mutual support between the mothers, but it also needed the families to have a minimum income and access to food that made it possible to implement the programme. The underlying mechanisms of the programme revealed by our study explained the programme's success, and these are the ones that need to be triggered when transposing the programme into a different context. However, it is also important to be conscious of the fact that the necessary interventions need to vary according to different contexts and cultures. The primary mechanisms are universal feelings, such as not feeling discriminated against, feeling welcomed by the programme staff, gaining self-confidence and receiving advice that can be translated into practical action. If someone has confidence in their own capacity, called a feeling of personal efficacy by Galand et al. (24), this will determine how a person will persevere in his or her learning and level of performance. This feeling of efficacy is said to be determined by encouragement and emotions (24), which validates the nutritional assistants' use of positive feedback and praise when the mothers performed well. Some authors have highlighted the requirement to provide feasible messages to motivate people to put the advice they received into practice (8), which also confirms the impressions of the mothers in our study.

The Nutricartes games have been associated with active participation, concentration, memorisation and mutual support between mothers. According to Battaglia et al. (25), when games are included in a complete pedagogical approach, it makes participants active and encourages mutual support as long as the teacher is prepared to supervise the games correctly. According to Sauvé et al. (26), games develop shared ideas and the capacity to establish links between the information received. Games also motivate the learning process, due to the pleasure and the notion of being challenged (26). These authors did not specifically target nutritional education for adults, but their results confirmed the effects of the game noted by the mothers in our study, especially as the games were conducted in small groups.

Finally, the Koba Aina supplement did not seem to be a determining factor in the children's long-term nutritional recovery. However, as Imdad et al. (27) noted, a well-adapted nutritional supplement leads to weight gain and this provides the mothers with a motivational role.

Strengths and limitations of the study

The realistic evaluation is particularly appropriate when it comes to evaluating a complex multicomponent programme, such as the one studied here. This approach allows to produce insights about how a given intervention generates results, why it works and who it works for. Understanding the necessary conditions for the success of a programme like this has helped L'APPEL to decide whether to expand the programme to other contexts, such as another region of Madagascar or another country, and has contributed material that can help with regard to reflecting on how it can be continuously improved and sustained. The other strength of this study is that we studied former beneficiaries of the programme and this kind of long-term follow-up remains rare when nutritional programmes are evaluated.

A limitation of this study could be a possible selection bias. The socio-demographic profiles of the participants were not noted, as the lack of literacy in some of the mothers would have increased the investment in terms of time and resources. In addition, sufficient participation was not clearly guaranteed because of the difficult access to the population, the security in the neighbourhoods or the language. Involving local community workers in recruiting the mothers was unavoidable, but it is possible that they subconsciously overrepresented the beneficiaries who had been satisfied by the programme, despite our instructions. However, this did not prevent us from identifying the success factors. Nonetheless, a nonbiased population would have enabled us to further explore certain difficulties experienced by the mothers.

The quality of the translation also remains a limitation. The bilingual investigators worked in pairs and teams in case they had any doubts about the translations. This was scrupulously followed, and they told us that this system was sufficient to ensure that the results were not skewed.

Finally, realistic evaluation presents several methodological challenges. For example, as Pawson (14) promoted working lines rather than a restrictive framework (28), the methodology has been applied slightly differently by various authors (12). We chose to formulate the CIMOs – context, intervention context, mechanisms and outcome configurations – with multiple components (Figs 2–7). This technique, which has been used by some other authors (15), is not the most common, but it reflects the reality of our fieldwork more accurately. Moreover, a methodological challenge is how to distinguish the elements belonging to the intervention context, mechanisms and outcomes to construct the CIMO. A number of authors have noted this difficulty (5,28,29), and Marchal et al. (30) even talked about the dilemma of the CMO, which is the same as the CIMO minus the intervention element. However, even if the drafting of the CIMO was not perfect, the research into its elements clearly improved the understanding of the programme. Finally, realistic evaluation was designed to be a continuous and cyclical process with regular re-evaluations of CMOs in different contexts, to refine the theories. It

is of great value to be able to compare a programme in different contexts with, for example, different outcomes according to the contexts. In our research, a single context was studied, because we were not able to identify any difference between the teaching, practices or results in the different neighbourhoods. Several authors have expressed the same difficulty (5,15,27). Nonetheless, our investigation began with an initial programme theory: the three hypotheses stated earlier in this paper. And it ended with a reviewed theory: our results. The CIMOs enunciated in the results could even serve as a basis for formulating a new programme theory with a view to conducting future studies.

CONCLUSION

The practices used in this programme, which continue to be used today, reinforced the attendance of mothers and how they put the advice they received into practice at home. At least, this was true for the beneficiaries on minimal wages and who were strongly motivated. Nutricartes is not a miraculous pedagogical tool, but an excellent work basis for motivated and well-managed teams. The next logical step would be to study the same programme in different contexts to determine which patterns occur and to further increase the level of evidence of the underlying mechanisms revealed by this study.

ACKNOWLEDGEMENTS

We would like to thank PhD Gaëlle Vareilles, International Federation of Red Cross and Red Crescent Societies, Geneva, Switzerland, for her support with the realistic evaluation, Mrs Jennifer Hasselgard-Rowe, University of Geneva, Switzerland, for translating the manuscript and Professor Heather Greenfield, University of New South Wales, Australia, for her initial assistance with the English.

FUNDING

This study was funded by the Dora Foundation, which played no role in conducting the study.

CONFLICT OF INTEREST

The authors have no conflict of interest to declare.

References

- Office National de Nutrition (ONN) (National Nutrition Office). Evaluation du plan national d'actions pour la nutrition (PNAN 2005–2009) (Evaluation of the National Nutrition Action Plan 2005–2009). ONN, Antananarivo, 2010.
- République de Madagascar (Republic of Madagascar). Plan National d'action pour la nutrition 2012–2015 (National Nutrition Action Plan 2012–2015). Antananarivo: République de Madagascar, 2012.
- Ministère de la santé publique de Madagascar (Malagasy Ministry of Public Health). Dépistage et prise en charge de la malnutrition aigüe (Screening and follow up of acute malnutrition). Antananarivo, Impression NIAG, publié avec le support du gouvernement japonais, 2009.
- Blaise P. Culture qualité et organisation bureaucratique, le défi du changement dans les systèmes publics de santé. Une évaluation réaliste de projets qualité en Afrique (Quality culture and bureaucratic organisation, the change in public health system challenge. A realist evaluation of projects in Africa). Doctoral public health thesis, 2004.
- Rycroft-Malone J, Fontenla M, Bick D, Seers K. A realistic evaluation: the case of protocol-based care. *Implement Sci* 2010; 5: 38.
- Bhutta ZA, Das JK, Rizvi A, Gaffey MF, Walker N, Horton S, et al. Evidence-based interventions for improvement of maternal and child nutrition: what can be done and at what cost? *Lancet* 2013; 382: 452–77.
- Lazzerini M, Rubert L, Pani P. Specially formulated foods for treating children with moderate acute malnutrition in low- and middle-income countries. *Cochrane Database Syst Rev* 2013; 21: CD009584.
- Ashworth A, Ferguson E. Dietary counseling in the management of moderate malnourishment in children. *Food Nutr Bull* 2009; 30: 405–33.
- Kerac M, Bunn J, Chagaluka G, Bahwere P, Tomkins A, Collins S, et al. Follow-up of post-discharge growth and mortality after treatment for severe acute malnutrition (FuSAM study): a prospective cohort study. *PLoS One* 2014; 9: e96030.
- World Health Organization (WHO), World Food Programme (WFP) and UNHCR (United Nations High Commissioner for Refugees). Consultation on the Programmatic Aspects of the Management of Moderate Acute Malnutrition in Children under five years of age. Geneva: WHO, 2010.
- Magnin M, Stoll B, Voahangy R, Jeannot E. Most children who took part in a comprehensive malnutrition programme in Madagascar reached and maintained the recovery threshold. *Acta Paediatr* 2017; 106: 960–6.
- Ridde V, Robert E. Realist approach to evaluate programmes and the systematic review: from theory to practice (L'approche réaliste pour l'évaluation de programmes et la revue systématique: de la théorie à la pratique). *Meas Eval Educ J* (Journal Mesures et évaluation en éducation) 2013; 36: 79–108.
- Lacouture A, Ridde V, Breton E, Guichard A. Le concept de mécanisme et l'approche réaliste en évaluation: clarifier le concept pour en faciliter son opérationnalisation. (Mechanism concept and realist approach in evaluation: to clarify the concept to ease his implementation). Presentation for the 22nd annual congress of Société québécoise d'évaluation de programme (Quebec Society for programme evaluation). SQEP, Québec, 2013.
- Pawson R, Tilley N. *Realistic evaluation*. London: SAGE Publication, 1997 (then reprinted).
- Wand T, White K, Patching J. Realistic evaluation of an emergency department-based mental health nurse practitioner outpatient service in Australia. *Res Rev J Nurs Health Sci* 2011; 13: 199–206.
- Pommier J, Guevel MR, Jourdan D. Evaluation of health promotion in schools: a realistic evaluation approach using mixed methods. *BMC Public Health* 2010; 10: 43.
- Wong G, Greenhalgh T, Westhorp G, Pawson R. Development of methodological guidance, publication standards and training materials for realist and meta-narrative reviews: the RAMESES (Realist And Meta-narrative Evidence Syntheses - Evolving Standards) project. Southampton: National Institute for Health Research Health Services and Delivery Research programme - NIHR Journals Library, 2014.
- Tilley N. Realistic evaluation: An overview. Presentation at the Founding Conference of the Danish Evaluation Society. Danish Evaluation Society, unknown location, 2000.

19. World Health Organization (WHO). Child growth standards: weight-for-height, 2006. Available at: <http://www.who.int/childgrowth/standards/en/> (accessed on January 9, 2013).
20. L'APPEL (the NGO) and the Nutricartes, the pedagogical method. Available at: <http://www.lappel.org/Madagascar> and <http://www.lappel.org/Nutricartes> (accessed on January 12, 2016).
21. Zaman S, Ashraf RN, Martines J. Training in complementary feeding counselling of healthcare workers and its influence on maternal behaviours and child growth: a cluster-randomized controlled trial in Lahore. *Pakistan. J Health Popul Nutr* 2008; 26: 210–22.
22. Santos I, Victora CG, Martines J, Goncalves H, Gigante DP, Valle NJ, et al. Nutrition counseling increases weight gain among Brazilian children. *J Nutr* 2001; 131: 2866–73.
23. Roy SK, Fuchs GJ, Mahmud Z, Ara G, Islam S, Shafique S, et al. Intensive nutrition education with or without supplementary feeding improves the nutritional status of moderately-malnourished children in Bangladesh. *J Health Popul Nutr* 2005; 23: 320–30.
24. Galand B, Vanlede M. Le sentiment d'efficacité personnelle dans l'apprentissage et la formation: quel rôle joue-t-il? D'où vient-il? Comment intervenir? (The feeling of personal efficacy in learning and education: which role does it play? Where does it come from? How to intervene?). *Journal Savoirs (Knowledges journal)* 2004; Hors série: 178.
25. Battaglia M. Tout jeu peut devenir sérieux si on l'accompagne d'une démarche pédagogique (All games can become serious if we use it with a pedagogical approach). *Journal Le Monde (The World journal)* 2014. Available at: http://www.lemonde.fr/education/article/2014/03/26/tout-jeu-peut-devenir-serieux-si-on-l-accompagne-d-une-demarche-pedagogique_4390087_1473685.html (accessed on February 1, 2017).
26. Sauvé L, Renaud L, Gauvin M. Une analyse des écrits sur les impacts du jeu dans l'apprentissage. (An analysis of the writings concerning impacts of game in learning). *Journal Revue des sciences de l'éducation (Educational Sciences Review journal)* 2007; 33: 89–107.
27. Imdad A, Yakoob MY, Bhutta ZA. Impact of maternal education about complementary feeding and provision of complementary foods on child growth in developing countries. *BMC Public Health* 2011; 11(Suppl 3): 25.
28. Ridde V, Guichard A, Blaise P, Van Olmen J. L'approche réaliste à l'épreuve du réel de l'évaluation des programmes (The realist approach in reality check of programme evaluation). *Can J Program Eval* 2012; 26: 14–8.
29. Byng R, Norman I, Redfern S, Jones R. Exposing the key functions of a complex intervention for shared care in mental health: case study of a process evaluation. *BMC Health Serv Res* 2008; 8: 274.
30. Marchal B, Dedzo M, Kegels G. A realist evaluation of the management of a well-performing regional hospital in Ghana. *BMC Health Serv Res* 2010; 10: 24.