Contribution of formative research to design an environmental program for obesity prevention in schools in Mexico City

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Abstract

Objective. This paper describes the methods and key findings of formative research conducted to design a school-based program for obesity prevention. **Materials and methods**. Formative research was based on the ecological model and the principles of social marketing. A mixed method approach was used. Qualitative (direct observation, indepth interviews, focus group discussions and photo-voice) and quantitative (closed ended surveys, checklists, anthropometry) methods were employed. **Results.** Formative research key findings, including barriers by levels of the ecological model, were used for designing a program including environmental strategies to discourage the consumption of energy dense foods and sugar beverages. **Conclusion.** Formative research was fundamental to developing a context specific obesity prevention program in schools that seeks environment modification and behavior change.

Key words: interdisciplinary research; obesity; school feeding; environment; Mexico

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Resumen

Objetivo. Describir los aspectos metodológicos y principales resultados de una investigación formativa realizada para diseñar un programa ambiental para la prevención de obesidad en escuelas. **Material y métodos**. La investigación formativa se basó en el modelo ecológico y los principios del mercadeo social. Se utilizó un enfoque de métodos mixtos: cualitativos (observación directa, entrevistas en profundidad, grupos de discusión y foto-voz) y cuantitativos (cuestionarios cerrados, inventarios de alimentos y bebidas, antropometría). **Resultados.** Los principales resultados de la investigación formativa, incluyendo las barreras identificadas en los niveles del modelo ecológico, fueron contemplados para el diseño del programa, que incluyó estrategias ambientales para desincentivar el consumo de alimentos de alta densidad energética y bebidas azucaradas. **Conclusión.** La investigación formativa fue fundamental para diseñar un programa de prevención de obesidad para la modificación del ambiente y cambios de comportamientos, factible y adaptado al contexto de las escuelas públicas de la Ciudad de México.

Palabras clave: investigación interdisciplinaria; obesidad; alimentación escolar; ambiente; México

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Mexico has experienced one of the fastest increases of overweight and obesity in the world. Currently 34% of Mexican school age children are either overweight or obese.[1]

There is growing evidence that the rapid increase in childhood obesity is mainly a result of the changes in the environment rather than a biological issue. However, many obesity prevention programs to date have focused on individual behavior change, generally leading to only short-term obesity improvements, versus environmental change.[2-5] According to available evidence, school environments that support healthy food choices and physical activity for children likely decrease the risk of obesity.[6] Despite the apparent advantages of addressing obesity at schools, there is a relative lack of evidence of effectiveness of school-based programs.[5,7] According to Baranowski´s Model of Mediation and Moderation of Intervention Outcomes,[8] inappropriate program design, selection of interventions that do not impact mediators of behaviors, and selection of targeted behaviors not related to health outcomes, could explain this lack of effectiveness and impact. All of the above can result from an unclear understanding of the target population and the environmental context, possibly a result of absence of or inappropriate formative research. Formative research is a key component of behavior change interventions, and its utility in developing intervention trials has been documented by various authors.[7,9] Appropriately designed prevention programs, based on formative research and using multi-level interventions, including environmental modification, may be most effective at influencing health outcomes.[10] This article describes the methods and key findings of formative research conducted to design a school-based program for obesity prevention. Formative research was the first step and a key component of a larger cluster randomized trial to prevent obesity in public primary schools of Mexico City.[11] The trial had two components: healthy eating and physical activity. The physical activity results have been published elsewhere.[12-13] This article focuses on the healthy eating component.

Materials and methods

Rationale for the formative research and theoretical frame

Formative research is conducted before an intervention is developed or implemented to obtain detailed information about the people for whom, and the context in which, interventions will be designed.[14] Our formative research was based on simplified ecological model based on McLeroys schema[15] and the principles of social marketing,[16] using a mixed-methods approach.

Formative research was conducted in order to: a) assess school environment; b) understand school actors' beliefs and attitudes towards obesity and healthy eating during schools hours; c) understand barriers which limit healthy eating at schools; and d) identify appropriate program intervention strategies.

Study settings

Public primary schools in the south of Mexico City were included in the study and randomly chosen from a list of all schools that met the following criteria: 1) morning schedule (8:00am to 12:30pm), 2) located in the south of Mexico City, 3) classified by the Ministry of Education (MOE) as low socioeconomic status, 4) received the national school breakfast program (SBP) 5) at least one school yard facility for PA and the standard sport equipment provided by Secretary of Public Education, and 6) Over 300 students and two or more classrooms per grade. In the southern area of the city there were four districts with a total of 274 schools, of which, 83 met all inclusion criteria. From these 83 schools, 12 were randomly selected.

Students from 4th and 5th grades (9 to 11 years of age) were included in the study due to their cognitive development allowing for answering questions and reporting eating pattern information. This group could also be followed-up after the intervention trial the following year in 5th and 6th grades.

Project staff held informational meetings with the parents of all eligible students. Parents of participating students signed an informed consent and children gave their oral assent. The study protocol was reviewed and approved by the Research, Ethics and Biosecurity Commissions of the National Institute of Public Health (INSP, for its abbreviation in Spanish).

Data collection

The information collected by different levels of the ecological model: Individual (children), interpersonal (parents and teachers), organizational (school, principals, food vendors and minister of education authorities) community, environment and policy level is presented in table I.

Sample

A purposive sample was used to select participants for qualitative instruments. For the quantitative instruments, a random-number generation program was used to select the sample of students from each participating classroom.

Table I
Information collected by Ecological level and key informants

Ecological Level	*Actor*	*Information collected*	*Source of Information*
Individual	Children	- Overweight and obesity prevalence. - Knowledge, beliefs, attitudes and behaviors related to feeding patterns especially within school hours. - Food and beverage patterns during entrances, recess and the end of the school day. Includes the School Breakfast Program (SBP), Lunch brought from home and food bought at school and surroundings.	Anthropometric measurements: Height (cm) and weight (cm) Discussion groups Direct observations Survey school lunch and money
Interpersonal	Parents	- Beliefs and attitudes related to healthy eating.	In-depth interviews
	School teachers	- Beliefs and attitudes related to eating patterns. - Perceived barriers and opportunities to healthy eating at schools. - Previous schools initiatives related to the prevention of overweight and obesity.	In-depth interviews Photo-voice Appreciative inquiry workshops
Organizational	Food vendors	- Perception of their role within the school. - Beliefs, attitudes and school practices related to healthy eating. - Barriers and opportunities to improve and change food offered within the school. - Suggestions from their perspective.	In-depth Interviews Observation Food and beverage inventories
	School principals	- Beliefs and attitudes related to childhood obesity, healthy eating and the role of the school. - Perceived barriers and opportunities for healthy eating inside school. - Schools initiatives related to the prevention of overweight and obesity.	In-depth interviews
	School environment	- Food and beverages availability and demand at schools and surroundings. - SBP. - Food and beverage advertisement at school and surroundings. - Food industry interests and marketing practices that permeate school boundaries.	Direct observation Adapted School Health Index. Food and beverage inventories
Community and policy		Revision of official schools norms, agreements and programs	

Data collection techniques

An overview of the instruments used and sample sizes are presented in table II. Figure 1 illustrates the photo voice technique.

Data analysis

Descriptive statistics, mainly percentages and measures of central tendency and dispersion were calculated for quantitative information to characterize the schools and the study population. Overweight and obesity were classified according to International Obesity Task Force criteria, with cutoff points for body mass index (BMI) based on an international reference population, specific for age and sex. Said cutoff points are a projection of the criteria proposed by WHO for diagnosing overweight (BMI of 25-29.9) and obesity (BMI of 30 or more) in adults.[19] All the quantitative analyses were performed using Stata version 9.0.*

All In-depth interviews and discussion groups were taped and transcribed. The information was categorized and analyzed using the grounded theory.[20] The phenomenology theory,[21] which places emphasis on the social construction of the reality, was used for interpretation.

Results

Formative research was conducted in two phases. Phase 1: Information gathering: a) Assessment of the school environment, b) Information from school personnel (teachers, principals, vendors), students and parents and c) Identification of barriers and opportunities to potential strategies and Phase 2: Consultation process with school stakeholders (teacher and Secretary of Public Education [SEP, for its abbreviation in Spanish] SEP authorities) for the selection of final trial´s strategies to maximize feasibility.

The information allowed the identification of main factors that affect healthy eating at schools. Preliminary strategies were selected based on the available evidence and results from Phase 1 of the formative research. In Phase 2, a consultative process with main school stakeholders was conducted to aid in the final program strategies selection.

The resultant key barriers that have implications in intervention planning were organized and summarized in a conceptual diagram by different levels of the ecological model (figure 2).

* Stata version 9.0. Statacorp. Stata Statistical Software.Texas: Stata Corporation, 2003.

Table II

Data collection techniques and sample size for Phases

Methods and instrument	*Number (N)*	*Description*
Phase 1. Quantitative:		
Anthropometry (height and weight): Children	1731	All the children from 4th and 5th grades in the 12 schools were measured weight (kg) and height (standing height in cm) by trained and standardized nutritionist field workers. Body mass index BMI was calculated and children were classified as overweight or obese following the international obesity task force (IOTF) cut off point.
Inventories	24	An instrument was designed to assess food and beverage available at school, and food and beverage advertisement at schools and surroundings. In a random school day, all independent food vendors present during the recess were surveyed by a trained nutritionist who recorded and weighed the food and beverages they have available before and after the recess, for each school.
Food and beverages availability	12	
Food and beverages advertisement	12	
Close ended surveys	551	Questionnaires were adapted from Center for Disease Control and Prevention (CDC) School Health Index (SHI).[17] Healthy eating sections were selected and customized to our context. Two versions of each section were developed, for teacher and for students. The teacher version of the healthy eating questionnaire (breakfast, lunch) was answered by a teacher member of the cooperative systems.
Adapted School Health Index teachers	60	
Adapted School Health Index students	60	
Breakfast, lunch and money	431	
Phase 1. Qualitative:		
Environment observations	104	Following a semi-structured guide to assess: a) food and beverage venues in and around schools (school canteen, street vendors or a combination, cooperative system); b) food and beverages consumption and purchases preferences at schools (in the classroom and recess) and surroundings (at the time of entry and exit) and c) state breakfast program that provides a subsided breakfast to children (organization, characteristics and acceptability). The observations were performed during the entrance, class time, recess and at the end of the school day.
School Breakfast Program	26	
Food & beverage consumption at entrance, during recess and the end of the school day	26	
Food & beverage purchases at entrance, during recess and the end of the school day	26	
Individual observations:		In a small subsample of children in each classroom, students were observed by a nutritionist before (in the classroom) and during the recess to assess the lunch brought from home (asking and observing content and portions), the money the child have available to buy food and beverages at school and how they spent this money. During the recess, the selected child was unobtrusively observed by the nutritionist who recorded what the children bought and consumed at school.
School lunch and money	20	
Groups discussion/ workshops about eating patterns:		Conducted with children separate by gender in order to understand their concepts and attitudes towards healthy life styles and feeding patterns. In each focus group a variable number from 6 to 10 children participated.
Children	5	
In depth interviews	20	The interviews were conducted following a semi-structured guide to direct the conversation and to explore perceptions, attitudes, beliefs and reported practices with respect to healthy eating patterns within the school environment. Also to collect information regarding decision's making process related to food availability within and around the school and identify strategies to promote healthy lifestyles.
Parents	4	
Teachers	4	
Vendors	4	
Principals	4	
Phase 2. Qualitative:		
Photovoice with teachers	18	A research methodology through a specific photographic technique photo voice was used. It uses the immediacy of the visual image and accompanying stories to furnish evidence and to promote an effective, participatory means of sharing expertise to create healthful public policy.[18] We used photo voice to: a) identify the problem and its solutions according to teacher perspectives, b) create awareness and promote the dialogue about the problem c) involve teachers in the process of problem identification and strategies selection. Cameras were delivered to teachers after reading and signing ethical consent to take pictures at schools. After a week, films were developed and pictures returned to each teacher. They were asked to select two pictures and answer three questions for each picture: What happens in the picture? Why is this happening? What can be done to correct it? (figure 1).
Appreciative inquiry workshops	4	The pictures taken by teachers were discussed in appreciative inquiry workshop to promote the dialogue among the participants.
Sensitization meetings	80	An extensive sensitization and deliberation process was held with the key actors involved.
Ministry of Education (MOE) authorities	20	
School supervisors from MOE	5	
Principals	52	
Project team	3	

What?
The girl is purchasing five *gorditas* (fried pastries) of pork rinds and still have money to buy a hot dog and a taco rice that the lady was preparing.

Why?
No other nutritious meal is available at school. Because she does not bring her own lunch. Because she is hungry and that's what she has on hand.

Solution:
1. Give to vendors a menu of nutritious food.
2. That mothers take responsibility for the "nutritious" food that their children should eat.



FIGURE 1. PHOTO VOICE EXAMPLE

Individual level (children)

Children recognized that they should consume more vegetables, fruits and water, although they could not resist "tasty" (junk) food and sweetened beverages. They preferred bringing money to school versus a lunch.

Interpersonal level (parents and teachers)

Most of the participant children had either one or two working parents who indicated lack of time to pack lunches and ease of sending money instead. Parents also indicated children's preference for money. Parents lacked awareness of obesity and healthy eating, and some viewed overweight as healthy or a sign of being well fed. Parents believed they have little control over what children eat during school hours, and a child's preference is the main argument in parents' decisions about food.

Regarding teachers, interviews showed that they believed that nutrition is the responsibility of parents, and they did not specifically relate obesity to the school environment. Teachers ate during class and allowed students to do so, even rewarding students with candies. In addition, they contend that parents give money to children to buy lunch at school because they do not have time to prepare lunch.

Organizational

School environment: From direct observation we identified that children have up to five opportunities to eat during school hours (8am - 12.30pm). This may increase the probability of excess energy consumption because most of the food available is energy dense. Canteens are uncommon in Mexican public schools and there are no vending machines. Foods and beverages are sold by concession stands managed by individual vendors who pay a fee to the schools cooperative committee; this represents important profit for both vendors and schools. Vendor selection is mostly based on food safety and low prices.

School breakfast program (SBP): the subsidized Federal SBP covered up to 33; 35, and 39% of children's daily recommendations of calories, fat and carbohydrates, respectively. Fruits are provided twice weekly and sugar beverages are offered daily. Surveys indicate that 72% of student eat the breakfast provided by the SBP, and 77% of those students do so every day.

Lunch during recess: During recess, schools yards were taken over by food vendors, selling mostly low cost sugared, fatty, energy dense food, leaving little space for activities. The majority of food items available were pizza, corn dogs and Mexican deep fried foods such as tacos and quesadillas, laden with cream. Most children did not bring lunch from home; instead they were given enough money to buy food that represents as much as 520 to 1 120 kcal at lunch/day. Drinking water was not available, and there was a widespread availability of non-carbonated sugar beverages. Fruit and vegetables represented only 6.7% of products sold during recess and are sold with chili powder, cream, yogurt, honey and/or sugar to make them more attractive to children.

Awareness of the problem: None of the principals was able to recognize an obesity problem among their students; they were more concerned with undernutrition, despite results revealing that 41% of children in 4th and 5th grades (n=1731) were overweight or obese.

Food vendors: Emphasis was placed on providing hygienic foods and satisfying child preferences rather than nutritionally healthy items. Fruit and vegetable vendors believed it is time demanding peeling, cutting and maintaining these perishable foods. Vendors believed that their food was healthy because it was "homemade" regardless of the nutritional content.

Community level (community and policy)

Community: In Mexico City, working families often consume meals away from home from street vendors that provide "homemade" items such as *tacos, tamales, tortas*, etc., most of which are high in calories and fat.

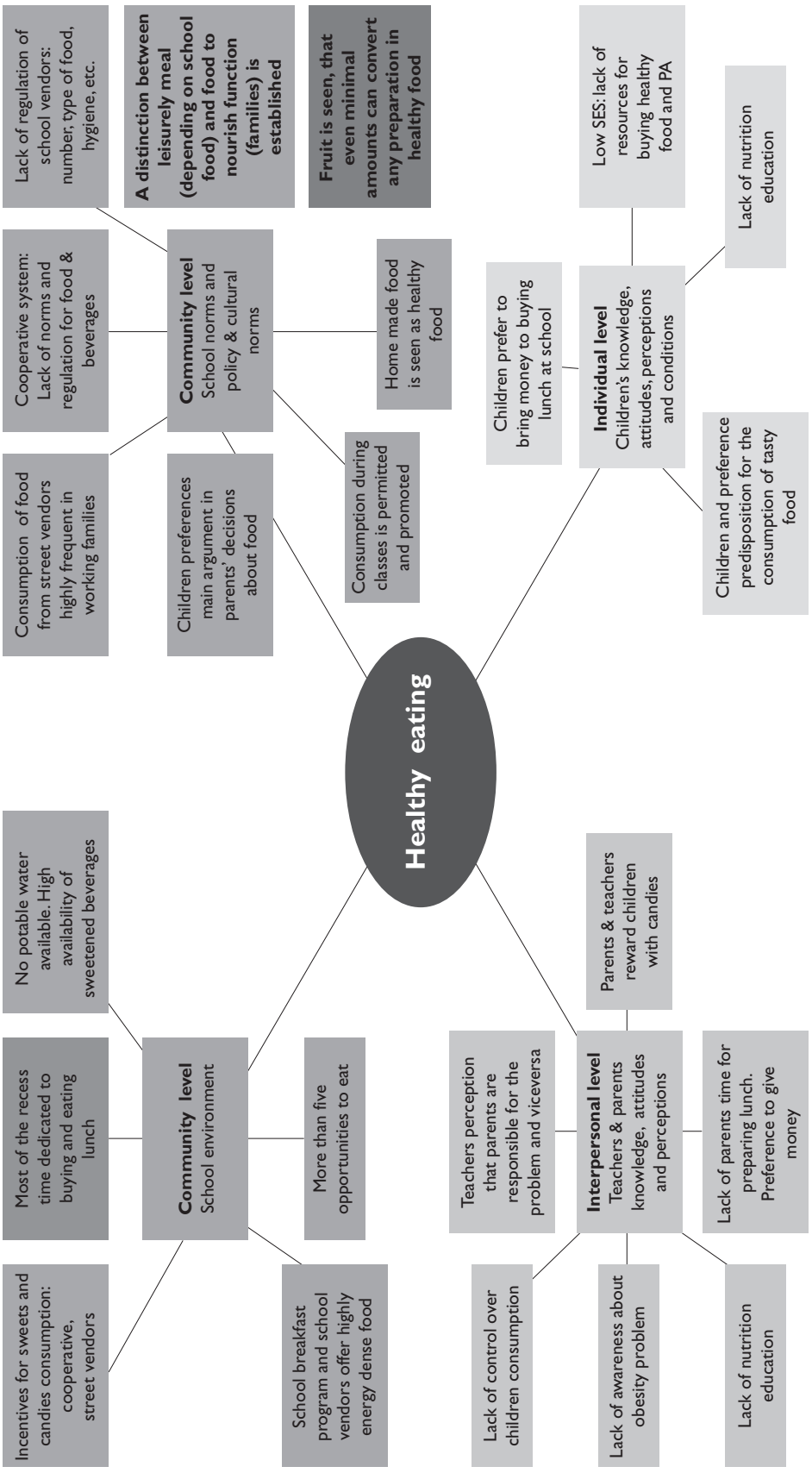


Figure 2. Barriers for healthy eating at school by ecological level

Analyzing the symbolic dimension of school food practices, two main representations that structure the relationship of key actors with school feeding were: (1) idealization of the homemade food regardless of the ingredients and cooking techniques, (2) ideation that the use of vegetables and fruit, even in very small amounts, transforms any food or drink into a healthy product. These representations represent a barrier for the availability and consumption of healthy food and beverages at school. Social representation linked to school feeding has been published elsewhere.[22]

School norms: At the time of the study, no national regulations existed on type or content of food sold on school grounds. An interim regulation was placed restricting eating in classrooms to SBP only and prohibiting the sales of soda, though this regulation was never enforced.

The intervention was designed according to these results to target different levels of the ecological model to provide a supportive environment for healthy eating at schools (table III).

A communication strategy based on social marketing,[23] social cognitive theory,[24] and theory of planned behavior[25] was developed for students, parents, teachers and vendors (individual, interpersonal and organizational levels).

At the organizational level, in addition to the physical activity intervention published elsewhere,[12,26] strategies to improve offerings of healthy food and water and to reduce opportunities to eat and availability of non-healthy food and beverages were selected.

Detailed information regarding the final strategies implemented in the trial has been published elsewhere.[11]

Discussion

Through this formative research process we collected information from ecological levels, as well from the social marketing perspective (channel identification, development of relevant messages, among others) with a mixed-methods approach, to guide the development

Table III
Recommended interventions by ecological level

Ecological level	*Main results from formative research*	*Recommendation for intervention*
Individual Children	Lack of nutrition knowledge. Preference to bring money to buy food at school.	Training and motivation sessions for children to understand in a practical manner, the concept of energy balance and healthy lifestyles and to learn how to prepare and package a healthy lunch. Massive communication campaign based on social marketing, target to children to promote healthy nutrition behaviors in attractive manner (e.g.: comics) to: a) increase the consumption of fruits & vegetables, c) water and d) package and bring healthy lunch to school. Include an attractive campaign launching.
Interpersonal Teachers, Parents	Lack of awareness about obesity problem and lack of knowledge related to healthy eating. Parents lack of time to prepare lunch. Rewards with candies and foods.	Motivation sessions for teachers and parents on the obesity problem, how to prevent it, healthy lifestyles and how to promote it. Present the formative research report from their school and introduce them to the project. Educational material handouts to parents teaching how to pack a healthy lunch and to involve kids in preparation.
Organizational Environment Food vendors School Breakfast Program (SBP) School policy	High availability of energy dense foods. School vendors offer low cost sugared, fatty, energy dense food including Mexican homemade deep fried food. Fruit and vegetables are available in very few amounts compared with the high availability of energy dense food. Too many opportunities to eat during school hours including the school breakfast program. Drinking water not available and there was a widespread availability of non-carbonated sweetened beverages. Kids rewarded with candies.	Reduction of opportunities to eat: set a fixed time to take the SBP, encourage teachers to comply with the regulations of not eating during classroom except for the SBP. Reduction of non-healthy food (sweets, pizzas and candies) and increase healthier choices daily at school (fruit, vegetables and low or non-sweetened fruit beverages). Modification of culinary techniques and ingredients of products sold. Provide material with information of recommended and not recommended food, and with culinary practices and suggestion of alternative ingredients to improve preparation of foods sold at school. Ensure potable water. Reduce or eliminate sweetened beverage. Training sessions for vendors to sensitize them about the obesity problem in school age children, to motivate them to modify the food offered and to learn healthy culinary practices. Educational material for school vendors, showing alternative food and improved culinary practices. Reinforce schools interim regulation of prohibiting the sales of sodas, comply with the list of recommended and not recommended food for school.
Policy and norms		Recommendations for improving SBP were communicated to the corresponding agency. Advocacy with Ministry of Health and other policy makers to make water for consumption available and ban sweetened beverage at schools.

of an intervention tailored to children in Mexico City public schools.

The ecological model has been recognized as a theoretical and methodological framework able to support consistent and holistic approaches during the design, implementation and evaluation of health improvement interventions.[27] The importance of recognizing the influences of the different levels of the ecological model and their interactions in developing effective interventions to improving children's dietary intake in schools has been documented.[28]

In addition, the use of multiple data collection methods during formative research has been recommended in this type of study.[29-30] We carefully selected several methods appropriate to the information gaps and needs of the trial. The use of methodological instruments and stakeholders' triangulation was useful to a) understand the problem from different points of view, b) better understand the school environment, c) corroborate and explain information within methods, d) develop a comprehensive matrix of the situation, e) guide the intervention selection, and g) to assess the feasibility and acceptability of the intervention by different stakeholders. These and other advantages of using multiple methods in formative research, including the understanding of the cultural and ethnic diversity of the targeted audience, have been published elsewhere.[30-31]

Our formative research showed that the school environment restricts opportunities for healthy eating, and enhances opportunities to consume highly energy dense foods and sugary beverages, promoting a positive energy imbalance. The important role of the school environment in sustaining energy imbalance that leads to overweight and obesity in school children has been documented.[32] Therefore, an environment that promotes obesity is prevailing in the studied public schools of Mexico City.

The findings were used to formulate recommendations on the type of interventions needed to remove some of the barriers. For example, lack of parental time for lunch preparation was perceived as a main barrier by all stakeholders, thus teaching children how to prepare and pack a healthy lunch was a recommended strategy. However, this barrier is complex because inexpensive "homemade food" sold on school grounds is attractive and convenient for working parents and children. Thus in addition to teaching children how to pack a healthy lunch, it is necessary that the options offered to children are healthy options and do not compete with the potentially healthy food brought from home.

Developing an effective school based intervention to prevent obesity is a challenge.[10] This can be partially accomplished by formative research, as it can be used to identify barriers for change and to select interventions that are appropriate to the context and feasible to implement. Despite this important use of formative research, there are few publications on the formative research process and results.[29]

Limitations

There were some important barriers identified that were out of the scope of the project, for instance, the school breakfast program that was identified as a contributor of the energy dense foods available at schools, could not be modified in the short term. Recommendations for improving it were communicated to the corresponding agency.

The large amount of information produced by using quantitative and qualitative methods, although very valuable, was highly time and resource demanding. For this reason, qualitative and quantitative information from formative research is not often presented in the same article. Sampling sizes are not representative of the entire population, however for the qualitative methodology sample size is not a matter of concern[33] as well as for formative research, where sample sizes vary considerably among published studies.[29,30]

Conclusions

While the childhood obesity epidemic is very complex, it is difficult to reverse the problem without strong school-based policies and programs that support healthy eating and physical activity.[34] We are aware that it is not feasible to reach meaningful change by targeting only the environmental, individual and interpersonal factors associated with eating at schools. Interventions on the larger economic and social forces that affect healthy choices are needed.[2] However, these interventions are complex and occur over the long-term. Short-term interventions adequately designed and context specific should be implemented to foster healthy lifestyles and contribute to stopping or reversing the situation at public schools. This study followed a proven process of conducting research and using the findings to make strategic decisions about program interventions. Information was collected in a sequence designed to inform an intervention tailored to the specific needs and problems encountered in schools. Using formative research based on the ecological model is a promising way to develop appropriate obesity prevention interventions that seek environmental modification as well as behavior change.

The findings of the formative research provided evidence on the school environment that fostered policy change in Mexican elementary public schools.[35,36] This article will be helpful for other groups interested in

conducting formative research previous to the design and planning of any program (or policy) to increase its potential effectiveness.

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