Comprehensive analysis of the program: Salud Escolar

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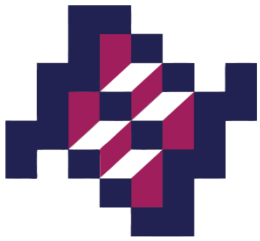

Instituto Nacional de Salud Pública

Comprehensive analysis of the program: Salud Escolar

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1. Introduction

Excess of weight in children and adolescents has been recognized as a major challenge in public health in Mexico and worldwide due to its magnitude, speed of growth, and the negative effect on the health of the affected population (Bray, Kim and Wilding, 2017). Overweight and obesity in childhood predispose to the development of chronic-degenerative diseases considered a risk factors of death and premature disability in Mexico (Rtveladze *et al.*, 2014; Soto-Estrada *et al.*, 2016). Overweight and obesity are conditions that can be prevented. The environment is critical promoting individual's food choices, and to promote regular physical activity(World Health Organization., 2016). The school is an ideal venue for health promotion and obesity prevention since girls and boys spend a considerable amount of time in school (Budd and Volpe, 2006; Brown and Summerbell, 2009)

Several strategies have been implemented in Mexico to promote the adoption of healthy habits in the school environment (Safdie, Jennings-Aburto and Lévesque, 2013; Barriguete Melendez *et al.*, 2014). However, gaps remain in policies and programs focused on the prevention and reduction of the high prevalence of overweight and obesity in Mexican children. As a result, in August 2019 was launched the School Health program in Mexico with the aim to promote correct nutrition, adequate hydration, and regular practice of physical activity in children attending to primary schools. In its first phase, this will be implemented in 58 schools in Mexico City from October 2019.

The comprehensive analysis of public policies facilitates programs success (Guti rrez, 2017). This study aim is to comprehensively analyse the design, implementation, results, and impact of the School Health program during the first phase of implementation using mixed methods. Based on the results derived from this analysis, a set of recommendations will be provided to improve the feasibility of scaling up the program at the national level.

2. Background

2.1. Epidemiological Overview of Overweight and Obesity in children and adolescents

Obesity is a global public health problem and it is not exclusive to high income countries and involves all age groups, ethnic groups, and socio-economic status (Alvear-Galindo *et al.*, 2013). Childhood obesity can track to adulthood, facilitating the development of diabetes and other chronic non-communicable diseases (CNCDs) and other comorbidities (Hesketh and Campbell, 2010).

The prevalence of obesity and overweight in children has reached levels without precedents in recent years. In 2016, it was estimated that 340 million of children and adolescents aged between 5 and 19 years were overweight and obese worldwide(World Health Organization., 2016). In America, the combined prevalence of overweight and obesity (OW/O) among children has been estimated

around 30%, percentage that exceeds the world prevalence (10%), and in other regions of the world such as Europe (20%) (Lobstein, Baur and Uauy, 2004). In Mexico, according to the 2016 National Health and Nutrition Survey (ENSANUT, by its Spanish initials), OB/O in girls was 32.8% and boys 33.7% (aged between 5 and 11 years); and in female adolescents of 39.2% and male adolescents of 33.5% (between 12 and 19 years old) (Instituto Nacional de Salud Pública, 2016). While, in Mexico City this prevalence rises as high as 25.7% among girls and 39.7% among boys whereas among female is 40.1% and male adolescents 43% (Shamah-Levy *et al.*, 2018).

2.2. Obesogenic Environment

Individual´s behaviours are influenced from obesogenic environments considered those that promote high-energy food consumption and limit the opportunities for spending that energy (Powell, Spears and Rebori, 2010). The high prevalence of overweight and obesity in early ages is can be partially explained by changes in eating and physical activity behaviours associated with an obesogenic environment (Swinburn, Egger and Raza, 1999; Safron *et al.*, 2011). Multiple conditions in the children´s environment could positively or negatively influence the risk of being overweight or obese (Hesketh and Campbell, 2010). There is a consensus that also genes, biology, and individual behaviour cannot fully explain the rapid increase in childhood obesity (Sallis and Glanz, 2009).

Obesogenic environments promote a high-caloric intake in different forms including the widespread advertising of foods high in fat, sugar, and salt targeting children and adolescents; inadequate nutritional guidance for the population as well as the limited availability and accessibility of healthy food and beverages in school settings (Sallis and Glanz, 2009; Powell, Spears and Rebori, 2010). In addition, these environments limit the access to adequate physical activity facilities including road insecurity and high-rate of crime, which contribute to a significant decrease in the percentage of children who are physically active and with healthy body composition (Sallis and Glanz, 2009).

School is an ideal place for health promotion and obesity prevention since is where schoolchildren spend a large proportion of their time. The school provides curricular (e.g. physical education course, PE), and extracurricular (e.g. recess, tournaments, active transport) opportunities to learn and practice healthy habits (De Bourdeaudhuij *et al.*, 2011). Although interventions focused on the adoption of healthy lifestyles in schools have shown inconsistent results, they seem to be promising options to contribute to the prevention of obesity among schoolchildren (Brown and Summerbell, 2009).

In Mexico there is evidence that schoolchildren do not receive sufficient support in their school environment to sustain a healthy lifestyle and to prevent overweight and obesity (Bonvecchio-Arenas *et al.*, 2010). At school and outside obesogenic environments might contribute to the small proportion of children and adolescents meeting guidelines recommendations for health (Barquera *et al.*, 2018). The World Health Organization (WHO) recommends that diet do not exceed 10% of the total

energy from added sugar and maintain a high intake of fruits, vegetables, and fiber (World Health Organization, 2015a). However, it has been documented that the exposure to high-energy food in Mexican schools and outside contributes to small proportion of children consuming fruits (39.2%), and vegetables (26.9%) frequently (Instituto Nacional de Salud Pública, 2016).

Recommendations on adequate hydration indicate the sporadic consumption of sugar-sweetened beverages (SSBs) and an intake of pure water between 6 to 8 glasses per day (Salud, 2015). Environmental factors such as the scarce or no availability of drinking water in schools and the presence of incentives from SSBs manufacturers to sell their products in schools are factors related to the high consumption of these drinks (Carriedo *et al.*, 2013). According to ENSANUT 2016, 83.9% of adolescents and 81.5% of girls and boys consume SSBs frequently (Instituto Nacional de Salud Pública, 2016).

Regarding physical activity, opportunities in the school environment in Mexico have been exposed as insufficient in various studies. Evidence-based guidelines recommend that children and adolescents ages 5 to 17 accumulate a minimum of 60 minutes a day of moderate to vigorous physical activity (MVPA) (World Health Organization, 2010). In addition, it is recommended to not exceed two hours a day of screen time (e.g. playing video games, watching TV) (Tremblay *et al.*, 2017). In Mexico, only 17.2% of children aged between 10-14 years, and 61% of adolescents aged between 15 and 19 years meet the physical activity recommendations whereas approximately 80% exceed screen time (>2h/day) (Medina *et al.*, 2018).

In terms of academic curricular, there is limited coverage of PE teachers in Mexican schools, which leads to frequent cancellations or to the class being taught by the generalist teacher (Medina, Barquera, Peter T Katzmarzyk, *et al.*, 2015), who in most cases does not have physical activity literacy or training to teach that subject. The equipment and facilities necessary for adequate PE have been reported as insufficient .[21] The frequency and duration of the class have been documented to be only once a week, and generally last 33.6 minutes, which is below the established in the curriculum (Gharib *et al.*, 2015). Furthermore, the time dedicated to the practice of AFMV corresponds to only 16-24% of the total minutes allocated for the EF class (Gharib *et al.*, 2015). Regarding extracurricular opportunities, it has been identified that only 10% of the break time is dedicated to MVPA (Medina, Barquera, Peter T. Katzmarzyk, *et al.*, 2015).

2.3. Policies and Programs for The Promotion of Healthy Lifestyles in The School Environment

Schools have been considered as an ideal space to develop strategies that help improve lifestyle and prevent obesity problems among schoolchildren worldwide (Brown and Summerbell, 2009; Gharib *et al.*, 2015). The WHO recognizes the importance of schools in promoting health and physical activity and has developed global (World Health Organization (WHO), 2007) and regional strategies to strengthen this role (Ippolito-Shepherd, Cerqueira and Ortega, 2005).

The Political Declaration of the High-Level Meeting of the General Assembly of the United Nations (UN) on the Prevention and Control of Noncommunicable Diseases recognized the crucial importance of reducing unhealthy diet and physical inactivity.[25] In September 2015, the Assembly adopted the 2030 Agenda for Sustainable Development, an action plan for people, the planet and prosperity. Among its objectives, "Health and Wellbeing" stands out (Organización de las Naciones Unidas, 2015). In addition, the WHO created the Global Action Plan for the Prevention and Control of Noncommunicable Diseases 2013-2020 (World Health Organization, 2013). This plan includes a reduction of the prevalence of the main risk factors for CNCDs and the strengthening of protective factors, emphasizing children, and vulnerable groups among its main lines of action (OPS/OMS, 2014). Specifically for the Americas´ region, the WHO and the Pan American Health Organization (PAHO) formulated in 2014 the Action Plan for the Prevention of Obesity in Childhood and Adolescence (OPS/OMS, 2015). The general objective of this plan is to stop the accelerated increase in the obesity epidemic in childhood and adolescence by considering a multisectoral approach based on the socio-ecological model (OPS/OMS, 2015).

In recent decades, it has been evident a rise of school interventions to promote healthy lifestyles mainly focused on diet and physical activity and obesity prevention. In the most recent systematic review of such strategies, Brown and Summerbell identified 1,553 interventions to prevent obesity through changes in diet and physical activity (Brown and Summerbell, 2009).National policies such as Healthy Schools in the United States of America have demonstrated the potential to promote health in parallel with the academic development of schoolchildren (Brown and Summerbell, 2009).

In Mexico, education and health are fundamental rights recognized by the nation and are administered primarily by the Political Constitution of the United Mexican States, the General Law of Education, the General Law of Health and the General Law of Rights. of Girls, Boys, and Adolescents (OPS/OMS, 2015). In recent years, a set of norms and guidelines related to the health of children and adolescents have been developed, including:

Mexican Official Standard NOM-009-SSA2-2013. This, aims to establish the criteria, strategies, and activities of the personnel in health promotion and disease prevention aimed at the school population of the National Education System. It is the normative instrument of the actions carried out by the Ministry of Health (Secretaría de Salud, SS for its abbreviation in Spanish) in collaboration with the Ministry of Public Education (Secretaría de Educación Pública, SEP for its abbreviation in Spanish) for the promotion of school health in the basic, middle-higher and higher education schools within the National Educational System. In addition, this standard establishes the recognition of Health Promoting School for those schools that develop and practice specific actions for the benefit schoolchildren´s health.(Diario Oficial de la Federación, 2013; Secretaria de Salud and Secretaría de Educacion Pública, 2019).

National Agreement for Food Safety. The agreement was launched in January 2010 by the SS with the aim to prevent overweight and obesity in different contexts, including schools. In this agreement, the 5 Steps Strategy for School Health was promoted, which provided food and healthy lifestyle guidance to students of all educational levels through five simple and practical actions (get active, drink water, eat vegetables and fruits, measure yourself, share) (Secretaria de Salud and Secretaría de Educacion Pública, 2019).

General guidelines for the sale and distribution of prepared and processed food and beverages in the schools of the National Educational System. The guidelines were published in the National Gazette in 2010 and updated in May 2014 (Diario Oficial de la Federación, 2015a). These guidelines include the nutritional criteria for the food and beverages preparation or sale of in all public and private schools of the National Educational System. They also establish the obligations of suppliers and the sanctions of those who fail to comply these guidelines (Diario Oficial de la Federación, 2015a; Secretaria de Salud and Secretaría de Educacion Pública, 2019).

General guidelines for the installation and maintenance of drinking fountains in the schools of the National Educational System. They were published in December 2015 in the National Gazette (Diario Oficial de la Federación, 2015b). They resulted from an agreement between the SEP and the SS in order to define the needs for water supply and quality. The guidelines were developed considering the school population, educational level, time and geographic location, as well as the design, installation, and maintenance of drinking fountains in schools of the National Educational System (Diario Oficial de la Federación, 2015b; Secretaria de Salud and Secretaría de Educacion Pública, 2019) More recently, various inter-institutional efforts have been focused on programs to improve indicators of education and health in children and adolescents (Figure 1).

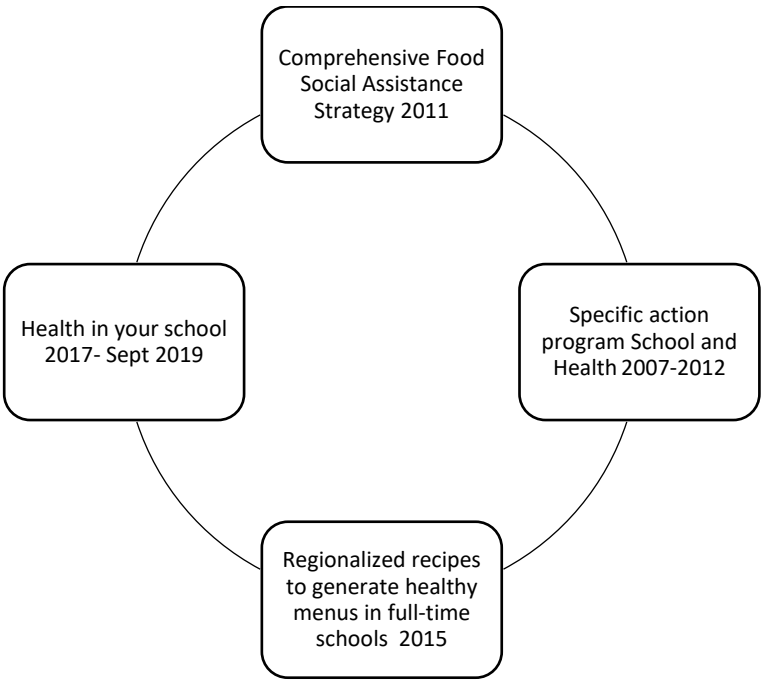

Figure 1. Programs to improve education and health indicators in Mexico.
From Programa Salud Escolar (Secretaria de Salud and Secretaría de Educacion Pública, 2019)

The Health in your School Program (Programa Salud en tu escuela, in Spanish) was launched in 2017 and continued during two academic periods. This program sought to strengthen the prevention, promotion, and health care in children and adolescents through the acquisition of health behaviors. The main lines of action of the program are direct diagnostic, monitoring, training, communication interventions in schools, and referral to medical services (Secretaria de Salud and Secretaría de Educacion Pública, 2019) (Figure 2).

Figure 2. Lines of action Health in your School program. From: Programa Salud en tu Escuela (Secretaría de Educación Pública, 2017).

In response to the alarming prevalence of obesity and inadequate compliance with international health recommendations, in 2019 the SEP in coordination with the SS, the Mexican Institute of Social Security (IMSS, for its abbreviation in Spanish), the Institute of Security and Social Services of State Workers (ISSSTE, for its abbreviation in Spanish), the National System for the Integral Development of the Family (DIF, for its abbreviation in Spanish) and the National Institute of Public Health (INSP, for its abbreviation in Spanish) developed the School Health:

Healthy and Active Schools program (Salud Escolar: Escuelas Saludables y Activas, in Spanish*)* through a series of intersectoral workgroups (Secretaria de Salud and Secretaría de Educacion Pública, 2019).

This program aims to modify the school environment to promote healthy habits. It consists of a series of activities grouped into three components: Correct diet, which consists of updating and monitoring compliance with the general guidelines for the sale and distribution of prepared and processed foods and beverages, the delivery of hot breakfasts, and the strengthening of curricular contents on food and health. Adequate hydration refers to ensure the availability and accessibility of fresh water and promote its consumption during the school day. Physical activity consists of increasing the quantity and quality of physical activity among the school community before, during, and after the school day (Secretaria de Salud and Secretaría de Educacion Pública, 2019).

The first phase of implementation will be in 58 schools in Mexico City during the 2019-2020 school year among approximately 20,000 schoolchildren. The following strategies will be carried out in these schools using an intersectoral form:

- Measurement of weight and height in schoolchildren by DIF staff.
- Supervision of food and beverages availability by SS supervisors, and supervision of drinking fountains availability by the Federal Commission for the Prevention of Health Risks (COFEPRIS for its abbreviation in Spanish).
- Behavior change campaign by SEP.
- Application of a food and health questionnaire by SS supervisors.
- Training for the community delivered by SEP.
- Promotion of physical activity by conducting quality physical education sessions, implementing active recreation strategies and active breaks. The SEP will be responsible of these strategies by general teachers (active breaks) and physical education teachers (physical education classes).
- Promote healthy hydration by SEP.
- Validation of a health-promoting school by SS supervisors.
- Delivery of hot breakfasts by DIF.

During the second phase (August 2020-July 2021) the program will be scaled to 14 states in the country where there are regions among the highest levels of marginalization including: Chiapas, Veracruz, Guerrero, Oaxaca, Yucatán, Hidalgo, San Luis Potosí, Puebla, Quintana Roo, Nayarit, Durango, Chihuahua, Campeche and Michoacán (Secretaria de Salud and Secretaría de Educacion Pública, 2019). [29] Finally, in a third phase (August 2021 - July 2022) the program will be scaled nationwide. The implementation of the program will be carried out through SEP teaching staff (Secretaria de Salud and Secretaría de Educacion Pública, 2019).

3. Conceptual and theoretical framework

3.1. Risk factors associated with overweight and obesity

Overweight and obesity are defined as abnormal or excessive accumulation of fat that can be harmful to health (World Health Organization, 2000). In the case of children and adolescents from 5 to 17-year-old, overweight and obesity is determined based on certain considerations (Organización Mundial de la Salud, 2020): Overweight is the Body Mass Index (BMI) for age with more than one and less than two standard deviations above the median established in the WHO child growth patterns. Obesity is greater than two standard deviations above the median established in the WHO Child Growth Standards. In adolescents aged 18 and 19 years, overweight and obesity are defined according to the WHO cut-off points, which indicate that overweight is a BMI equal to or greater than 25 and obesity is a BMI equal to or greater than 30 (Organización Mundial de la Salud, 2020).

Obesity is a multifactorial health problem (Department of Health & Human Services, 2018), therefore, attention to this condition requires the analysis of the different risk factors. These factors can be from the individual (e.g. lifestyle behaviors) to the environmental sphere (e.g. exposure to foods with high energy value), social (e.g. social norms), among others (Pate *et al.*, 2013). Certain modifiable lifestyle behaviors have been consistently associated with the development of obesity in children and adolescents (Katzmarzyk *et al.*, 2015).These behaviors are mainly physical inactivity (Martinez-Gomez *et al.*, 2010), insufficient sleep time (Garaulet *et al.*, 2011), sedentary behaviors (e.g. watching TV) (Prentice-Dunn and Prentice-Dunn, 2012) and some aspects of the diet such as SSBs consumption (Malik, Schulze and Hu, 2006).

Diet is made up of foods, which in turn are made up of nutrients and other elements (Tapsell *et al.*, 2016). In this sense, a correct diet is based on recommendations for maintaining a healthy diet. These key factors include consuming at least 400g of fruits and vegetables per day (World Health Organization, 2003), reducing total lipids to less than 30% of the total energy of the diet,(FAO, 2010) consuming less than 5 grams of salt per day (Mozaffarian *et al.*, 2014), limit the consumption of added sugars to a maximum of 10% of the total energy of the diet (Tapsell *et al.*, 2016).

Physical activity (PA) can be defined as the body movement produced by the contraction of the skeletal muscle that increases the energy expenditure above the basal level, that is, the level at rest (World Health Organization., 2019). Regularly practiced physical activity has been shown to be a determining factor in energy consumption, making it essential for achieving energy balance and weight control, with the aim of reversing risk factors for the development of CNCD (Press, 2005). The term physical inactivity is associated with the lack of compliance in time and intensity that should be allocated to the practice of PA according to the recommendations by age group (Tremblay *et al.*, 2010).

Sedentary lifestyle includes any activity that does not increase energy expenditure substantially, such as sleeping, sitting, lying down, watching television and other types of entertainment in front of the screen (Tremblay *et al.*, 2010).

SSBs are all those that contain added sugars (sucrose, high-fructose corn syrup) (World Health Organization, 2015b). A frequent consumption of SSBs has been observed to be associated with an increased risk of weight gain and, therefore, to other comorbidities including cardiovascular diseases, diabetes, metabolic syndrome, and hypertension (Juan Ángel Rivera Dommarco, Anabel Velasco Bernal and Angela Carriedo Lutzenkirchen, 2015).

3.2. Socio-ecological model for the promotion of healthy school environments

Socio-ecological models propose that in the development of overweight and obesity there is an influence of various environmental factors on behavior and on the choices of individuals that lead to an unhealthy lifestyle (Sallis and Glanz, 2009). The socio-ecological model proposed by the Center for Disease Control and Prevention (CDC) contemplates five levels to understand and address the different factors interrelated with the development of overweight and obesity (Centers for Disease Control and Prevention, 2020). Effective programs for the prevention and reduction of these problems should consider each of these levels (Figure 3). Therefore, this proposal for political analysis considers the different levels proposed in this model as a reference (Centers for Disease Control and Prevention, 2020).

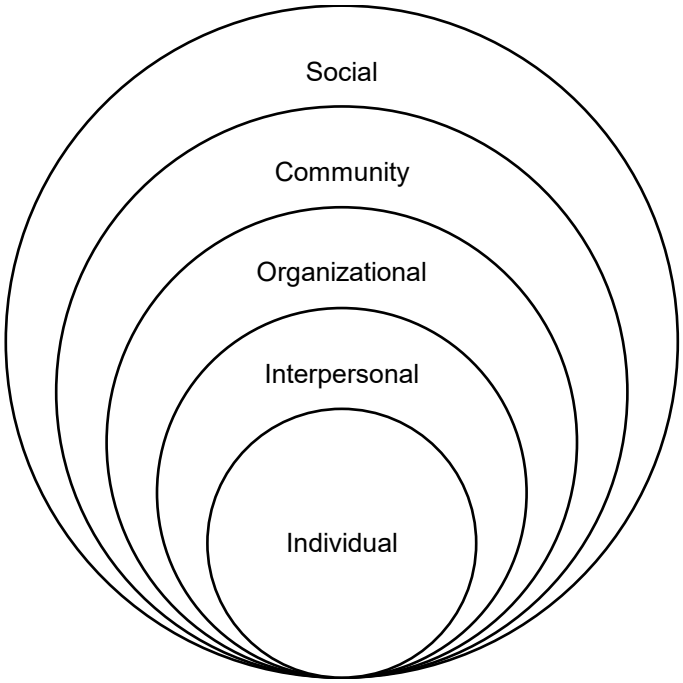

Figure 3 Socio-ecological Model. From Center for Disease Control and Prevention (CDC). From: The five-level social-ecological model. Atlanta, GA: Centers for Disease Control and Prevention, Division of Nutrition, Physical Activity and Obesity, 2020.

The individual level of the model focuses on changing knowledge, attitudes, and practices, whereas, the interpersonal level focuses mainly on interpersonal processes and groups that provide identity and support, such as the family. The organizational level is linked to environments outside the home such as schools, workplaces, and community centers. These settings determine the food and beverages offered and the opportunities for physical activity provided (Centers for Disease Control and Prevention, 2020). The community is defined as a large organization capable of making changes in politics and the environment to provide the best possible options related to food and physical activity. Interventions at the social level are those that operate on a larger scale, and are linked to the mandatory national and state legislation and school welfare policies (U. S. Centers for Disease Control and Prevention, 2020).

3.3. Public policy analysis

Policies may include laws, programs, and projects. A public policy is understood as a government action that mobilizes human, financial, and institutional resources to solve public problems within a society (Tapia *et al.*, 2010). Public policies refer both to actions and inactions that affect the set of institutions, organizations, and services (Tapia *et al.*, 2010). Policy analysis refers to the retrospective evaluation of policies to learn what works and what does not for the development of future policies (Buse, Mays and Walt, 2005). Public policies can be designed to achieve results such as increasing income, learning, preventing, or reducing disease. For this reason, the analysis of public policies constitutes an essential tool for their success (Gertler *et al.*, 2017). Despite policy analysis is considered a fundamental piece of public health practice, it is not consistent or is not adequately integrated into the daily administration of many programs (Prevention, 1999).

According to the Organization for Economic Cooperation and Development (OECD), policy analysis allows to determine the value or meaning of an activity, intervention, program, or policy (Centers for Disease Control and Prevention, 2019). In Mexico, the National Council for the Evaluation of Social Development Policy (CONEVAL, by its Spanish initials) establishes that the analysis of public policies is a tool to constantly improve performance and knowledge about the effectiveness of the actions or strategies contemplated in these (Consejo Nacional de Evaluación de la Política de Desarrollo Social CONEVAL, 2019). The analysis of social programs and policies should systematically and objectively assess the design, implementation, results, and impacts of an intervention. In order to have a clear idea of the program performance, it is necessary to analyze the results of all the elements subject to the analysis. Each type of analysis has a specific objective, a general diagnosis of a program or public policy can be reached by the complementarity of all objectives (Gutiérrez, 2017).

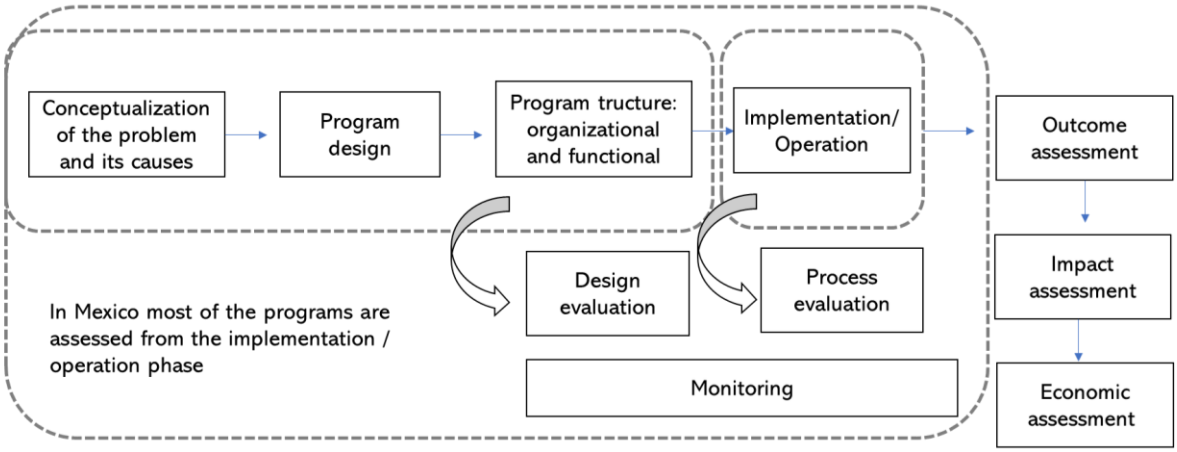

Figure 4 Types of analysis for social programs and policies

3.4. Design analysis

The analysis of program or policy design should be conducted during the first year of implementation to determine whether the design is adequate to respond to the target problem (Consejo Nacional de Evaluación de la Política de Desarrollo Social CONEVAL, 2017). This type of analysis provides elements to determine whether the actions or strategies proposed are likely to solve the problem, are adequate and fit with the platform for delivery and existing capabilities. It also enables the program's strengths, opportunities, weaknesses, and threats to be identified that minimize future risks (Suarez Bustamante, 2012).

In terms of planning, the design analysis provides information on the national and sectoral objectives to which each of the programs aligns and the relationship of complementarity that they have with other national programs that seek to solve related problems (Consejo Nacional de Evaluación de la Política de Desarrollo Social CONEVAL, 2017). In the design analysis, It is verified that there is a theory of the program and the matrix of indicators for results, in which the proposed activities and components are aligned with the purpose and purpose of the program or public policy (Consejo Nacional de Evaluación de la Política de Desarrollo Social CONEVAL, 2017). Having a matrix of indicators for results feedback the design and facilitates the implementation, monitoring, and evaluation of the program.

3.5. Implementation analysis

Implementation poses important challenges in the policy cycle and its analysis. Implementation research has been defined as a scientific method to identify how the process of implementing policies, programs, or interventions has been, and if it fits with what is planned (Suarez Bustamante, 2012; Peters DH, Tran NT, 2014). Implementation research purpose is to understand the execution of programs in real conditions and contexts, rather than controlling these conditions or removing their influence and possible effects (Peters DH, Tran NT, 2014). Since the central node is the users or beneficiaries of a program or intervention, and not only the

generation of evidence or knowledge working in the places where a program or strategy is implemented is imperative, rather than selecting users who do not necessarily represent the target population (Proctor *et al.*, 2011).Implementation research includes a wide range of methods and approaches to identify and address barriers in the program execution. Implementation methods includes identifying, evaluating and expanding implementation innovations, strategies to enhance the utilization of existing evolutionary science of implementation knowledge, tools and frameworks (Tumilowicz *et al.*, 2019).

3.6 Analysis of results and impact

The analysis of the results of a program or public policy consists of verifying the achievement of the established objectives (Nebot, Mª José López, *et al.*, 2011).In the public health arena, the direct results of a program may not be translated immediately into an improvement in health outcomes, such as reducing mortality or morbidity, thus there are usually expected results at immediate, intermediate and long-term (Nebot, M. José López, *et al.*, 2011). Short-term results include changes in knowledge, attitudes, and self-efficacy, changes in services demand and usage, and access to products. Intermediate refers to changes in practices or behaviours, and long-term results correspond to changes in health outcomes such as decreased diarrheal infections, improved nutritional status, and decreased anaemia (Nebot, M. José López, *et al.*, 2011).
The impact analysis of a program focuses on understanding what is the impact (or causal effect) of a program on an outcome of interest. The impact analysis analyzes the changes in the result directly attributable to the program. The causality and attribution approach are the hallmark of program impact analysis (Gertler *et al.*, 2017).

3.7 Gender perspective

Mainstreaming gender is a comprehensive approach that is aligned with Sustainable Development Goals (United Nations, 2019).The United Nations Children's Fund (UNICEF) recognizes that integrating perspective into the process of preparing, designing, implementing, monitoring, and evaluating programs is a strategy to achieve gender equality (UNICEF South Asia, 2018). Mainstreaming the gender perspective in the programmatic process seeks to apply the application of gender knowledge to implement programs more effectively and take advantage of opportunities to promote equality between women and men, and girls and boys (UNICEF South Asia, 2018).

Gender perspective permeates at the political, institutional and programmatic levels through seven principles. These are: 1) applying a gender lens to existing structures, processes and culture; 2) recognizing the needs and interests of women and men, girls and boys as different and equal; 3) promoting the joint work of women and men to rebalance access and control over resources and power; 4) political will to lead the process; 5) commitment of all the actors to incorporate the gender perspective, 6) gender advisor to support and promote skills; and 7) staff responsible for implementation aware of the gender perspective (UNICEF South

Asia, 2018). Figure 5 illustrates the key points for achieving the incorporation of the gender perspective in the programmatic phrases.

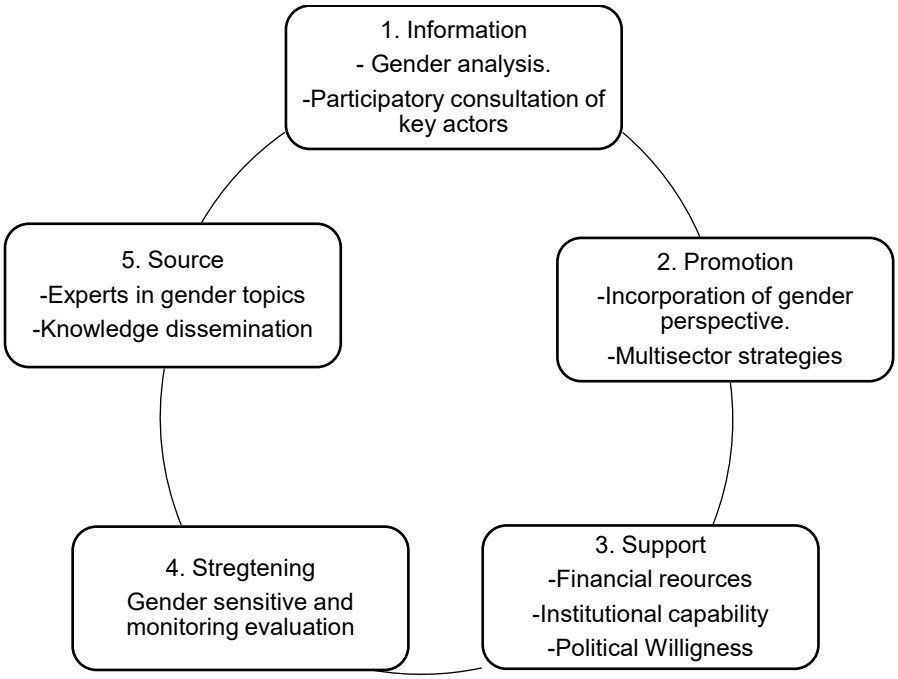

Figure 5 Key points to achieve gender mainstreaming during programming policies. From: Gender Toolkit. Integrating Gender in Programming for Every Child in South Asia, 2018.

Likewise, the incorporation of a gender perspective in the program cycle ranges from identifying how gender relations and differences in the roles of women, men, girls and boys impact the program's objective, as well as barriers and opportunities (U. S. Centers for Disease Control and Prevention, 2020). Table 1 details the steps at each stage of the program cycle to integrate the gender perspective.

Table 1 Integration of the gender perspective at each stage of the program cycle

Program stage	Incorporation of the gender perspective
Planning	Collection of information disaggregated by sex and age Overview of the situation and gender analysis Identification of gender problems Definition of interventions that address gender inequalities
Design	Program design considering gender issues, ensuring the participation of women and girls
Implementation	Implementation of actions to transform gender inequality
Monitoring	Gender-sensitive monitoring, using information disaggregated by sex and age
Evaluation	Evaluation results based on gender and human rights indicators
Results report	Sharing results Information for future programs

Note. Adapted from Gender toolkit. Integrating Gender in Programming for Every Child in South Asia, 2018.

4. Problem Statement

According to ENSANUT 2016, the prevalence of overweight and obesity is 32.8% for girls and 33.7% for boys (5-11 years old). A slight increase was observed in girls and a decrease of approximately 3 percentage points in boys compared to ENSANUT 2012 (Medina *et al.*, 2018). For adolescents between 12 and 19 years of age, the prevalence of overweight and obesity in women from rural areas from 27.7% in 2012 to 37.2% in 2016, and in urban areas from 38.6% in 2012 to 39.8% in 2016. ENSANUT 2016 shows heterogeneous results in Mexico related to overweight and obesity among schoolchildren (Medina *et al.*, 2018) contrastingly to other developed countries which have shown a tendency to stabilize with small reductions in the prevalence of overweight and obesity. This could be associated with the fact that in the last 30 years Mexico has faced several demographic, economic, environmental, and cultural changes that have negatively impacted the lifestyle of children (Aceves-Martins *et al.*, 2016; Shamah-Levy *et al.*, 2018).

In Mexico, national policies and programs have been established to reduce and contain overweight and obesity in children (Secretaría de Educación Pública, 2017). Even though various efforts have been made to reverse this trend, high rates of obesity are still observed. Policies with a common and concerted vision of strategies focused on changing eating patterns and increasing physical activity are required. In addition, a rigorous analysis of these is needed to guide the pertinent adjustments to maximize their effectiveness (Shamah-Levy *et al.*, 2018).

The monitoring and analysis are fundamental elements of health policies and programs provide a set of essential tools that allow them to verify and improve their quality, efficiency, and effectiveness (Shamah-Levy *et al.*, 2018). The analysis of programs should start from the clear identification of the problems that need to be addressed and the understanding of the factors that associated to its origin that are susceptible to intervention. In this continuum, each phase in the life of a program is subject to an evaluation. The analysis of the different stages of a program facilitates the understanding whether the process is actually working to reach success. Each phase of the analysis of a program is in turn conceived as a product and an input, that is, the evidence is generated on a relevant and pertinent aspect of a program and feeds the development of an additional stage of evaluation (Shamah-Levy *et al.*, 2018).

The comprehensive analysis of public policies seeks to contribute to decision-making and social equity, generating knowledge and evidence on the effectiveness of programs for the best allocation of resources (Guti rrez, 2017). It must be done at the beginning, during and after the program runs, starting from the idea of the program cycle through a staggered, interactive and interdependent sequence (Shamah-Levy *et al.*, 2018).[56] The implication of not having a comprehensive program analysis approach could lead to overestimating or underestimating the findings derived from the practice of a specific evaluation. An evaluation that does

not identify challenges, areas of opportunity or recommend improvements is a weak evaluation and its improving program performance is limited.

Research questions

1.- Does the current design of the School Health program contribute to improving the school environment through strategies aimed at promoting correct nutrition, adequate hydration, and increased MVPA?
2.- What are the barriers and facilitators for the implementation of the School Health program?
3.- What are the changes in the knowledge, attitudes, and practices that boys and girls from 3rd to 6th grade of primary have associated with the implementation of the School Health Program?
4.- What is the impact of the School Health program on physical activity levels, water, and fruit and vegetable consumption in girls and boys from 3rd to 6th grade of primary school?

5. Study Rationale

Low- and middle-income countries (LMIC) are currently undergoing a rapid epidemiological, demographic, and nutritional transition, which has led to a rapid increase in the prevalence of overweight and obesity in the child and adult population (Popkin, Lu and Zhai, 2002; Lobstein, Baur and Uauy, 2004; Popkin, 2004; Popkin, Adair and Ng, 2017). The rapid increase of overweight and obesity their prevalence and incidence, multifactorial origin and relationship with the development of CNCD make them a public health problems (Rivera *et al.*, 2002). In the last four decades, obesity in children between the ages of 5 and 19 has increased in most regions and countries. It is estimated that by 2016 there are around 340 million of children and adolescents living with overweight or obesity (WHO, 2020).In Mexico, 1 out 3 girls and boys from 5 to 11 years old have been classified with overweight or obesity, the prevalence even higher among girls and boys living in Mexico City (41.6%). These figures are even more worrying when the short and long-term consequences of childhood obesity are considered (Rivera *et al.*, 2002).

Overweight and obesity in children and adolescents have been associated with multiple health outcomes in adulthood such as sleep apnoea, hypertension, cardiovascular disease, type 2 diabetes, osteoarthritis, and certain types of cancer (Park *et al.*, 2012; Bentham *et al.*, 2017). Likewise, it leads to social and psychological problems including nonattendance to school (An *et al.*, 2017), bullying (Griffiths *et al.*, 2006; Bacchini *et al.*, 2015), stigmatization, depression and low self-esteem (Puhl and Heuer, 2009, 2010). In addition to the association with multiple chronic diseases, an increased risk of premature mortality in adulthood has been observed (Must *et al.*, 1992; Reilly and Kelly, 2011).

Childhood obesity has been translated into increased costs for the health system and society due to its multiple and serious consequences. Childhood obesity is associated with high direct and indirect costs,(Hamilton, Dee and Perry, 2018) non-attendance at school affecting educational and productive indicators and the

decrease in productivity and income in the future (Shamah-Levy *et al.*, 2018). By 2017, it was estimated that costs related to medical care for overweight and obesity in Mexico would reach 77,909 million pesos, while the costs associated with lost productivity would reach 72,951 million pesos (Hernández Ávila and Martínez Montañez, 2011).

In the context of the serious outcomes and high costs for the health system, preventing and reversing overweight and obesity in children and adolescents is a crucial investment in a country's public health. Interventions aiming to prevent and reduce the prevalence of obesity from an early age have great potential to lead substantial economic and health benefits (Hamilton, Dee and Perry, 2018). According to an OECD report, comprehensive prevention programs could annually prevent 55,000 deaths from chronic diseases in Mexico (Sassi, 2010), and among the most effective measures to prevent obesity are interventions in the school setting.

Multi-component Interventions in the school environment that promote healthy eating and physical activity and focused on prevention instead of treatment generally succeed (Gonzalez-Suarez *et al.*, 2009; Lobelo *et al.*, 2013; Safdie, Jennings-Aburto and Lévesque, 2013). Systematic reviews of interventions in multiple countries indicate that the key elements for the prevention of overweight in programs at the school level include: training of school personnel, curriculum integration, modification of environments and the design of materials and programs specific to the population objective (Kahn *et al.*, 2002; Hoehner *et al.*, 2008). The School Health program integrates key elements of effectiveness for the promotion of healthy lifestyles and the prevention of overweight and obesity. The activities designed by SEP and SS aimed at promoting correct nutrition, adequate hydration, and physical activity in Mexican children and adolescents providing a unique opportunity to improve the health and well-being of this population beyond short terms benefits. However, in order to reach their full potential, these types of interventions require a comprehensive analysis of their design, implementation, results, and impact to identify the effect and mechanisms by which they could be effective (Verstraeten *et al.*, 2012). Comprehensive analyses also contribute to building in evidence that facilitates decision-making processes towards scalability. Thus, the School Health program comprehensive and rigorous analysis is imperative.

6. Objectives

General

To conduct a comprehensive analysis of the *Programa Salud Escolar* in public primary schools in Mexico City.

Specific

- To analyze whether the design of the School Health program contributes to improving the school environment through the promotion of correct nutrition, adequate hydration and the increase of MVPA

- To identify whether the School Health Program is being implemented according to its design and the regulations established for this purpose.
- To identify barriers and facilitators for the implementation of the strategies of the School Health Program associated with correct nutrition, adequate hydration, and quality physical activity among schoolchildren.
- To estimate changes in knowledge, attitudes, and practices related to correct nutrition, adequate hydration, and physical activity in schoolchildren from 3rd to 6th grade of primary school after one year of implementation of the School Health program.
- To analyze the impact of the School Health Program on schoolchildren physical activity levels, water consumption, and fruit and vegetable consumption.

7. Materials and methods

A comprehensive analysis of the design, implementation, results, and impact of the School Health Program will be carried out, which will be implemented in 58 schools in Mexico City during the first phase of implementation from October 2020. This study includes a design analysis of the Health School program*,* a quasi-experimental study to evaluate the impact of School Health on the individual outcomes of interest in the program (correct hydration, healthy eating, and physical activity), as well as an evaluation of the implementation. This analysis will be developed through three methodological stages which are presented in Figure 6. In this protocol is presented the first stage of implementation of this analysis only.

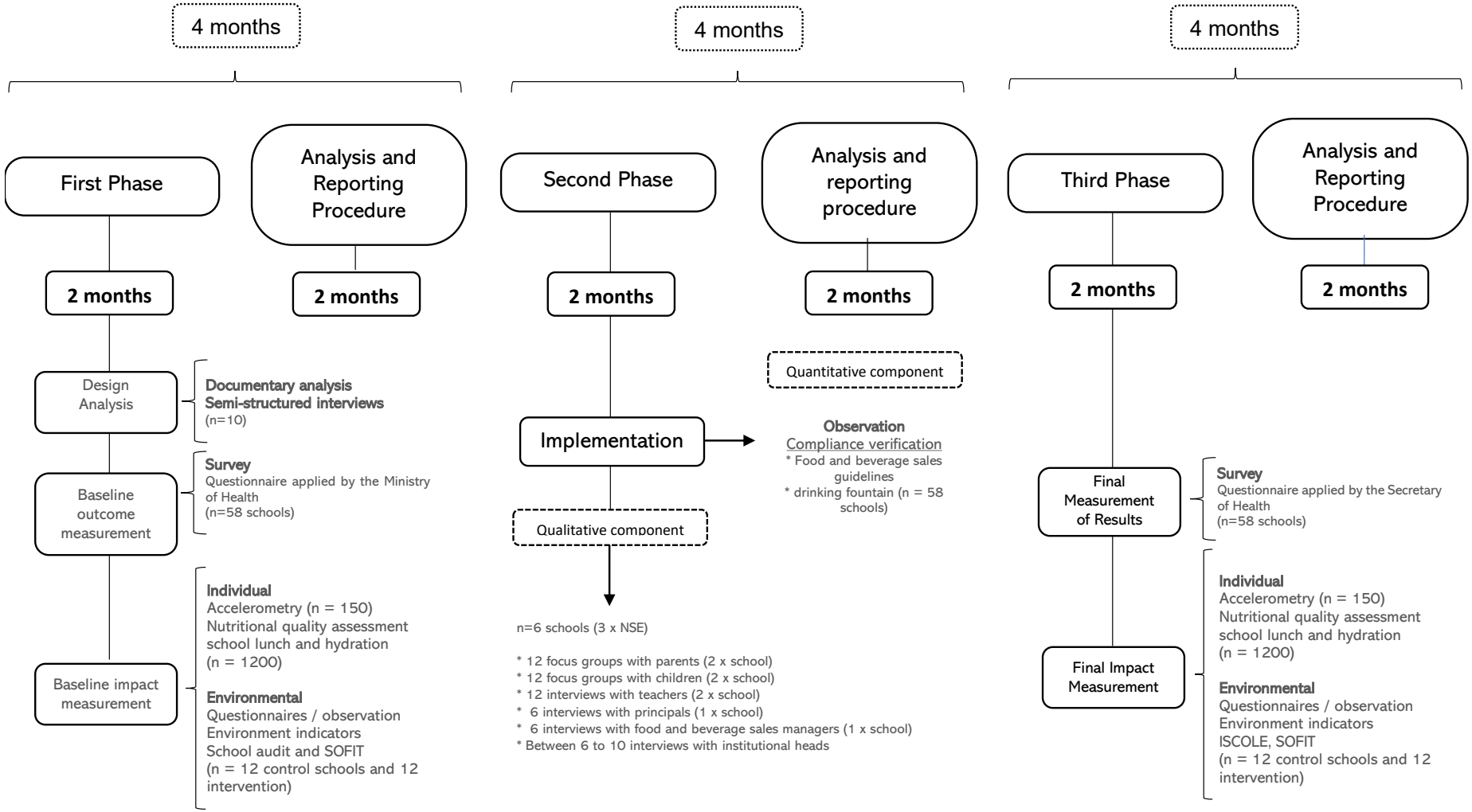

Figure 6. Stages, measurements and instruments of the Comprehensive analysis of Salud Escolar program

7.1. Design analysis

The design analysis of Salud Escolar will be conducted through a desk-review and semi-structured interviews (if necessary). The information derived from this analysis will (1) facilitate decision-making processes to improve the internal logistics of Salud Escolar, and (2) facilitate the understanding of how Salud Escolar may contribute to solve the target health problem.

Several meetings will be held between the research team and the technical team of Salud Escolar in order to define key aspects of the methodology, such as the documents to be reviewed and the key actors to interview (if necessary), as well as for the review, discussion, and socialization of the preliminary results. The analysis will be carried out from October to November 2019 through the following phases:

Desk-review
Administrative records, databases, documents and public documentation related to Salud Escolar will be gathered. Additional information or documents considered as relevant by Salud Escolar technical team will be included. An adaptation of CONEVAL's design evaluation Terms of Reference (TOR) will be used as an instrument to conduct the desk-review (Table 2). In addition, references from the United Nations Children's Fund (UNICEF) will be considered to include a gender perspective during the analysis (Table 3). This approach considers the differences in roles and responsibilities attributed to women and men, girls and boys (UNICEF South Asia, 2018).

Three main documents have been considered for the desk-review to answer the questions of CONEVAL's instrument (Table 2): 1) Document Salud Escolar: Escuelas Saludables y Activas, 2) Program diagnostic and supervision instruments, 3) results of other international school-based programs that have been successful in promoting healthy habits in children and adolescents,. Additionally, the following documents could be considered as well:

- General guidelines for the sale and distribution of prepared and processed foods and beverages in the schools of the National Educational System (Diario Oficial de la Federación, 2015a).
- Official Mexican Standard NOM-251-SSA1-2009, Hygienic practices for the process of food, beverages or supplements (Diario Oficial de la Federación, 2015a).
- Official Mexican Standard NOM-043-SSA2-2005, Basic health services. Promotion and education for health in nutrition. Criteria for providing guidance (Diario Oficial de la Federación, 2005).
- General guidelines for the installation and maintenance of drinking fountains in the schools of the National Educational System (Diario Oficial de la Federación, 2015b).
- Official Mexican Standard NOM-201-SSA1-2002, Products, and services. Water and ice for human consumption, loose and packaged (Diario Oficial de la Federación, 2002a).

- Official Mexican Standard NOM-230-SSA-2002, Environmental Health. Water for human use and consumption, sanitary requirements that must be met in public and private supply systems during water management (Diario Oficial de la Federación, 2002b).
- Guidelines for the Comprehensive Strategy for Food Social Assistance - School Breakfasts (Secretaría de Salud, 2019).

CONEVAL's instrument includes questions with dichotomous response options (YES / NO), which should be supported by documentary evidence. When the answer is YES, one of the four levels of response defined for each question will be selected (https://www.coneval.org.mx/Evaluacion/MDE/ Documents / TDR_Diseno.pdf) considering the adaptations made by the evaluation team (Table 2). Questions that do not have binary answers (do not include response levels) should be answered based on the desk-review and providing a rationale for the response. Each question will be answered in a maximum of one page. The following concepts will be included: a) the question, b) the binary (YES / NO) or open answer (as appropriate), and c) the analysis that justifies the answer. When the characteristics of Salud Escolar do not allow answering a specific question, the option "Does not apply" will be also available requesting an explanation of this.

Table 2 Research questions contained in the CONEVAL's instrument

Section	Questions
Creation of program creation and design	Is the priority problem or need that the program seeks to solve identified in a document? Is there any diagnosis of the problem that the program is aiming to address? Is there theoretical or empirical evidence that support the type of intervention in the program? Does the program have a theory of change? Is there evidence that a formative research has been carried out whose results have been contemplated in the program design?
Contribution to national goals and objectives	The program purpose is linked to the objectives of the sectoral, special, or institutional program? Which goals and objectives, transversal strategies of the current National Development Plan are linked with the sectoral, special, or institutional objectives associated with the program? How is the purpose of the program linked to the Sustainable Development Goals?
Potential and target population	Are the populations (potential, objective, and attended) defined in official documents and/or in the diagnosis of the problem?
Record of beneficiaries and service mechanisms	Is there evidence of the goods and services of the program recipients? Do the procedures for granting the goods or services to the beneficiaries have the desired characteristics?

Results Indicator Matrix (MIR)	Is there one or a group of activities for each of the MIR components of the program? Do the components in the MIR meet the expected characteristics? Does the purpose of the MIR have the desired characteristics? Does the end of the MIR have the desired characteristics? Is it possible to identify the narrative summary of the MIR in the normative document of the program? Are there indicators to measure program performance with the desired characteristics at every level of the program's MIR? Do the program indicator technical sheets have the desired information? Do the goals of the program's MIR indicators have the desired characteristics? How many of the MIR indicators have means of verification specified with the desired characteristics? Is it possible to identify the desired information considering the verification set objective-indicators-means? Do you suggest modifications to the MIR of the program or adding changes to solve the drawbacks identified.
Budget and accountability	Does the program identify and quantify the goods and services expenses and break them down into the recommended categories? Does the program have transparency and accountability mechanisms with the recommended characteristics? Do the procedures for the execution of works and / or actions have the recommended characteristics?
Complementarities and coincidences with other federal programs and / or social development actions	The evaluated program could be complementary and / or coincide with other federal programs and / or social development actions?

If missing elements are identified in the Matrix of Results Indicators (MIR, by its Spanish initials) during the desk-review, the research team will propose an adequate indicator. The MIR will represent the summary of the strategy in a four-row by four-column matrix describing the purpose, components, activities, and the means of verification and assumptions for each objective of the strategy (UNICEF South Asia, 2018). The desk-review will conducted by INSP researchers with extensive experience in the evaluation of health and nutrition policies and programs in Mexico and Latin America with at least a master degree.

Data gathering

Based on the results of the desk-review, semi-structured interviews with key actors will be conducted. The mapping of actors will be carried out in coordination with the technical team of Salud Escolar to identify the key actors that may be related to the design of the program. An agenda with the identified key actors will be prepared.

Recruitment of participants

After mapping the key actors, the technical team of Salud Escolar will send an invitation e-mail to each key actor. Then, the INSP research team will explain potential participants the nature and objectives of the project and provide a short summary with the main activities in which they would participate. Interviews will be scheduled for all informants who consent to participate in the study.

Table 3 UNICEF references for gender mainstreaming in program design

Program phase	Reference
Planning	1 B. During the planning, was accurate information collected about women, men, girls and boys for the design of the program?
Design	2b. Were concerns about the role of gender included? 3b. Is the full participation of women and girls ensured?
Implementation	4b. Do the planned actions ensure the participation of all gender-aware groups?
Monitoring	5.b Is monitoring of the program gender-sensitive using data disaggregated by sex and age?
Evaluation	6b. Does the program use indicators based on gender and human rights?

Note. Source: Gender Toolkit. Integrating Gender in Programming for Every Child in South Asia, 2018.

Techniques and instruments for data collection

Interviews will be conducted with the purpose of strengthening and complementing the results derived from the desk-review. The instruments will be piloted before data collection.

Semi-structured interviews

Qualitative methodologies have been widely used to explore the limitations of health interventions or programs (Farquhar *et al.*, 2006). A purposive sample of key actors will be selected according to the purpose of this analysis. An average of ten semi-structured interviews will be conducted. Table 4 describes the sectors and areas to which these key actors participate within the program, as well as the mechanism that will be used to record the data from the interviews. The profile of the key informants and the final number of interviews will be defined according to the needs identified in the desk-review. An interview guide in the semi-structured format previously designed and discussed with the technical team of the School Health Program will be used (Appendix 1). Before conducting the interviews, an informed consent will be sough (Appendix 2), and the character of voluntary participation will be highlighted. The interviews are planned to last 50 minutes.

Table 4 Description of the objective, sectors, and areas of interference of the participants in the semi-structured interviews

Technique	Objective	Participants	Sectors	Areas	Data register
Semi-structured interviews	Strengthen and complement the results derived from the cabinet analysis	4 4 2	Health Education DIF	Health promotion Planning SEDIF and SNDIF	The interviews will be audio recorded, transcribed verbatim and analysed.

Note. SEDIF= State System for the Integral Development of the Family, SNDIF=National System for the Integral Development of the Family.

The content of the interview guides is summarized in Table 5.

Table 5 Description of the thematic axes and subtopics to be addressed in the interviews

Topics	Subtopics
Creation of the School Health Program	Role in the design of the program Formulation process Program communication plan Training plan The problem to be solved
Content and focus of the School Health Program	Objectives Components Activities
Potential and target population	Coverage Procedures for granting goods and services Information recording systems
Budget and accountability	Transparency and accountability mechanisms Budget allocated
Complementarians and coincidences with other federal programs	Sectors involved in its implementation Complementarity between programs
Gender perspective	Mainstreaming gender in the phases of the Program

Fieldwork

The staff responsible for data collection will have a minimum level of expertise with experience in qualitative research and in research projects associated with public health policies.

Analysis and systematization of information
Interviews will be transcribed verbatim. Transcriptions will be carried out by specialized personnel following guidelines previously established by the research team. The analysis will be guided by the principles of the thematic analysis, which consists in a method for identifying, analysing and reporting patterns (themes) within the data (Braun and Clarke, 2006). Themes and codes will be identified a priori from the objectives of this study considering the thematic axes previously described, and according to the information collected in the field (emerging themes and codes). Subsequently, the categories and codes initially developed will be refined to proceed with the analysis of the entire data (Liamputtong, 2016). A codebook with be developed to define and name the themes and codes. The collected data will be coded using the software NVivo 12.

The results derived from semi-structured interviews will be triangulated with the findings of the desk-review. According to Denzin (Denzin, 1978), triangulation refers to the use of qualitative and quantitative methodology, as well as data sources, theories and researchers for the study and understanding of a phenomenon. In the case of this evaluation, triangulation includes different: 1) times for data collection, 2) places for data collection, and 3) participants. Within the framework of a qualitative investigation, the triangulation of data includes the use of various strategies to study the same phenomenon, for example, the use of various methods (individual interviews, focus groups, observation, etc.) (Mathison, 1988). When performing the triangulation of different techniques or strategies, it is believed that the weaknesses of each particular strategy do not overlap with those of the others and instead their strengths add up. Data triangulation will be conducted to visualize the phenomenon from different angles and to complement the information

Preparation of SWOT analysis and formulation of recommendations
Based on the results of the previous stages, the main strengths, opportunities, weaknesses, threats (SWOT), and recommendations associated with each of the sections considered in the framework of this evaluation will be integrated into a table.

7.2 Short-term results analysis (baseline measurement)

The results of Salud Escolar will be estimated by measuring changes in knowledge, attitudes, and practices related to correct nutrition, adequate hydration and physical activity. The Health and Nutrition Questionnaire, prepared by the Ministry of Health, will be used. This questionnaire has two versions [for 3rd grade of primary school (Appendix 3); and for 4th to 6th grade (Appendix 4) and consists of 3 main sections (Figure 6).The questionnaires were previously used in the Health in your School program. Data collection will be conducted by the Ministry of Health and the INSP research team will be solely responsible for data analysis.

Sample
The questionnaire is addressed to all girls and boys from 3rd to 6th grade (n = approximately 20,000 girls/boys) of the 58 primary schools selected for the implementation of the first phase of Salud Escolar. As part of Salud Escolar, staff from the Ministry of Health will go to the schools on the first day and give teachers a diptych announcing the Program, actions, and objectives (Appendix 5) and informed consent for parents. Teachers will send these documents in children's backpack and parents will review and return the signed consent (if given) on the next day.

Data collection
The Ministry of Health staff will apply the questionnaires with the support of the teaching staff. The questionnaires will be administered indoors (e.g. classroom) during school hours. Children whose parents have given their consent to participate will be included and children's oral assent will be obtained.

Data processing and analysis
Data will be coded by the Ministry of Health staff using an automated system and the database will be given to the INSP research team for subsequent analysis. A descriptive analysis of the data will be carried out, estimating means standard deviations for the continuous variables and proportions (%) for the categorical variables. Likewise, all available information will be disaggregated by sex and age.

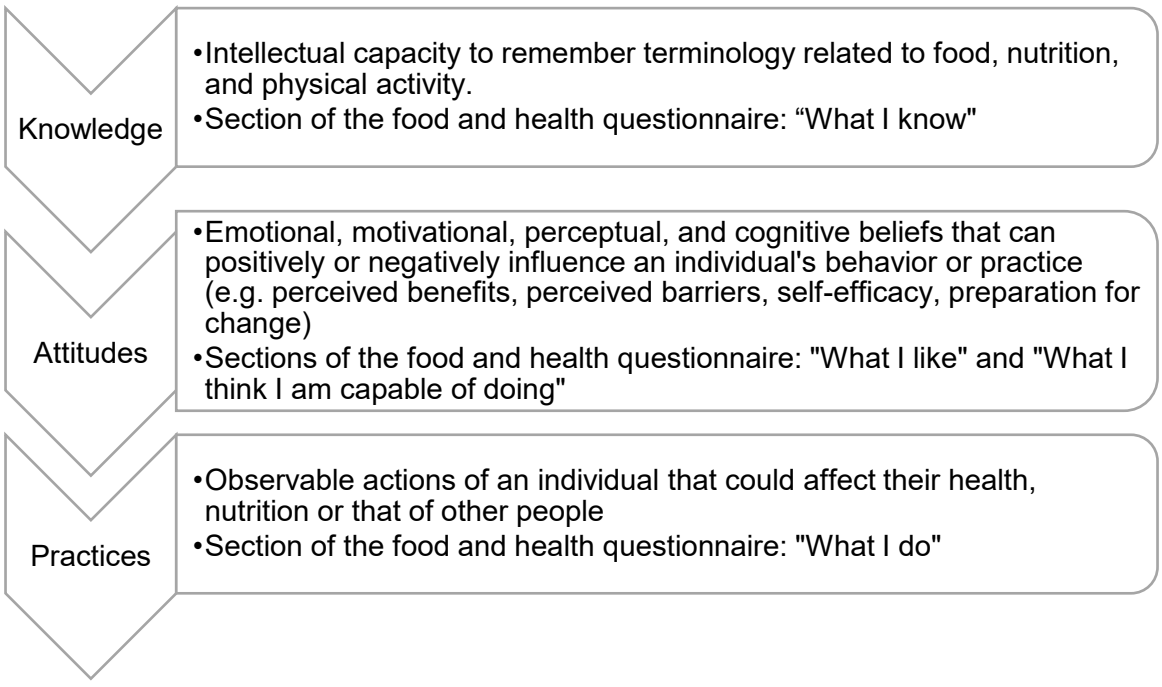

Figure 7 Sections included in the Health and Food Questionnaire

7.3 Impact analysis (baseline measurement)

Considering that Sauld Escolar aims at creating healthy school environments, the impact analysis will be focused on the evaluation of some individual and environmental indicators.

Study design

A quasi-experimental design with baseline and endline evaluation will be used in schools where the School Health Program will be implemented (intervention group), and in schools where the program will not be implemented (control group). Measurements will be made prior to the start of the school program (pre-intervention), and 10 months after its implementation (post-intervention).

Study hypothesis

Based on similar studies previously carried out in the school population (Carriedo *et al.*, 2013; Safdie, Jennings-Aburto and Lévesque, 2013; McKenzie, 2015), we hypothesized the following changes in the endline measurement among children exposed to Salud Escolar, in comparison with those in the comparison group (not exposed to the intervention program):

- water consumption will increase by 171 ml (Carriedo *et al.*, 2013),
- time engaged in MVPA will increase in total 10 minutes per day, with an increase of 4 minutes per day during school recess and 4 minutes per day during physical education classes (Haerens *et al.*, 2007),
- the percentage of girls/boys who consume fruits and vegetables daily in the school environment will increase by 6.7% (Safdie, Jennings-Aburto and Lévesque, 2013).

Sample size calculation

The impact analysis study will be carried out in 30 primary schools in Mexico City (Intervention group = 15; Control Group = 15). The number of schools included was defined to better identify the effect (with a small number of schools the effect of the intervention could be confused with the characteristics of the schools) (Soto-Estrada *et al.*, 2016). Other criteria considered were the short time available for data collection (no more than three months according to reports by the Ministry of Health based on their experience during the implementation of the Health in your School program), as well as the available funds.

Table 6 presents the sample size necessary for hypotheses testing, considering a significance level of $\alpha = 0.05$, a statistical power of 80%, and a correlation of 0.2 between the basal and final measurements. Considering that the largest sample size required is the one to estimate the effect of the intervention on fruit and vegetable consumption (n = 388), a design effect of 2, and 20% losses to follow-up, it is estimated that a total of 980 girls and boys (n = 490 per intervention group) are needed.

A baseline measurement of 1000 girls and boys has been proposed. Considering the same assumptions of design effect and loss to follow-up, it was estimated that a sample size of 595 girls and boys is required for accelerometry measurements and the System for Observing Fitness Instruction Time (SOFIT).

Table 6 The sample size required to estimate expected differences

Indicator	Standard deviation	Expected difference	Sample size
Water consumption (ml/day)	631	171	384
MVPA (min/day)	40	10	248
MVPA (min/PE)	9	3.8	248
MVPA (min/recess)	12	3.9	244
Fruit and vegetable consumption (% of schoolchildren)		6.2%	388

Note. MVPA= moderate to vigorous physical activity; PE= physical education.

Schools selection

The intervention group schools will be selected randomly from the predefined list of 58 schools selected by the Ministries of Health and Education to participate in the first phase of implementation of Salud Escolar. The control group will be selected from a list of schools available in Mexico City provided by the Ministry of Education, where the program will not be implemented. Given that the selection of the 58 schools of the intervention group will not be at random, schools from the control group will be as similar as possible to those in the intervention group. Thus, it will be sought that the schools of both groups (i.e, intervention and comparison) are paired based on the following characteristics:

- Location: schools should be in the same geographical area< 5 km.
- Basic Geostatistical Area (BGA): within a similar BGA level
- Type of working day: in the same type of working day (regular, extended or full time)
- Hours: both in the morning or in the afternoon
- Size: schools from both groups will be expected to have a similar number of students and classes.

Participants

For the evaluation of the individual indicators, boys and girls from 1st to 6th grade of primary school will be selected at random from the attendance lists of the school groups. A written consent from parents will be requested (Appendix 6) and and an assent from the participants (Appendix 7). In the case of the evaluation of environmental indicators in schools, all schools´ principals will be invited to participate and a written consent will be requested (Appendix 8).

Inclusion and exclusion criteria for schools and participants

Students who have provided assent to participate and who have the informed written consent of parents or caregivers will be eligible. Children who have a physical or mental disability to participate the program will be excluded.

Measurements

Healthy diet. Two instruments will be used, a 24-hour recall to estimate the total diet of schoolchildren, and food weighing to estimate food consumption within the school environment.

24-hour recall. This instrument will be used to measure and evaluate the total diet of schoolchildren. A 24-hour recall will be applied to mothers, fathers, or caregivers of participants responsible for feeding and preparing meals at home (Appendix 9). The registration system used for the National Health and Nutrition Surveys will be used (Shamah-Levy *et al.*, 2018). The 24-hour recall consists of an interview in which participants are asked to remember and describe all the food and beverages consumed the day before the interview, from the first intake of any food or drink, up to the last food or drink consumed before sleeping (Shim, Oh and Kim, 2014). The adult responsible for feeding the child will be asked to name, describe and quantify the amounts of all the food and drinks consumed by the participant the previous day. The information collected will include the characteristics of the food or drink, including preparation method, brands and quantity consumed (considering edible portion and total proportion consumed). Food and beverages consumed at school or outside the home without the adult being interviewed will be reported by schoolchildren. The instrument will be applied by trained staff and will be collected with the use of a laptop, using a software to collect 24-hour recalls in the Mexican population.

Since part of the objectives of Salud Escolar is to improve the quality of the schoolchildren's diet and reduce the consumption of highly processed foods, the information obtained from the 24-hour recall will be used to evaluate the consumption of fruits and vegetables, sugar sweetened beverages (SSBs), and highly processed foods. A comparison will be conducted between participants consumption against the recommendations established in the Dietary and Physical Activity Guidelines in the Context of Overweight and Obesity in the Mexican Population (Bonvecchio, 2015). The proportion of schoolchildren who consume fruits and vegetables, and ultra-processed foods as outcome variables will be estimated.

Food and drink consumption during recess. Trained staff will record the food and drinks consumed during recess (snack or lunch) to objectively measure food consumption at school. Schoolchildren will be asked to show their lunch and beverages (brought from home or purchased at school) and what is contained will be recorded and weighted. This process will allow the detailed recording of the consumption of food and beverages at school campus, and the evaluation of the changes in food and beverages brought from home and purchased at school.

Correct hydration.
To analyze the impact of Salud Escolar on water consumption, a Beverage Diary will be applied to participants from 3rd to 6th grade (Appendix 10). The diary has been previously used and validated in different studies carried out by the INSP among schoolchildren (unpublished data) (Safdie *et al.*, no date; Pérez, 2016). Participants will receive a hard copy of the diary and will be asked to complete it at

home during three days. Data will be coded in Excel format and the consumption of water and SSBs (ml/day) will be estimated based on previously standardized procedures (Salud, 2015).

Physical activity
Direct observation and accelerometry will be used to measure physical activity.

Direct observation. This will be used to analyze the effect of Salud Escolar on the quality of physical education (PE) classes and active recess of the program (minutes of MVPA). The System for Observing Fitness Instruction Time (SOFIT) will be used to evaluate PE and an adapted version will be used to measure physical activity during recess. SOFIT is a comprehensive tool for evaluating physical education in terms of student physical activity levels, class context, and teacher or instructor behavior (McKenzie, 2015). This is a validated and reliable tool, which can be used in multiple contexts (McKenzie, 2015). Prior to the start of the lesson, target students will be selected. One student will be observed for 4 minutes, then the observer will focus on the other remaining students for 4 minutes (each) until class ends. Prerecorded verbal prompts on CDs, MP3s, or audiotapes will be used to help the observer to systematically follow up the class on a 10-second intervals basis throughout the class. During each registration interval, the observer records a code corresponding to the behaviors of interest (students, context, or teacher).

All data will be recorded in a specific format for subsequent analysis (Appendix 11). Data will be summarized by time (3 intervals = 1 minute), percentage of intervals or class time, or estimated energy expenditure. Comparisons may be made between different categories, between classes over time, or against established standards. The main variables to obtain from this observation method are:

- The physical activity levels of students: Minutes and % of the PE class in each of the intensities of physical activity (including minutes of MVPA), energy expenditure estimated per session (kcal/kg) and rate of the estimated energy expenditure (kcal/kg/min) (Department of Health & Human Services, 2018).
- Physical education schedule: frequency of sessions and adherence to the proposed schedule, scheduled duration and actual duration of the sessions.
- Context of the session: minutes and % of the session time spent in administrative matters, instruction, physical fitness, skill exercises, play time and others.
- Teacher behavior: % of the class that the teacher or instructor invests in promoting the activity during and outside of class time.

Accelerometry
Actigraph GT3X + accelerometers (ActiGraph, LLC, Pensacola, FL, USA) will be used to assess the effect of the intervention on total physical activity (minutes per day of MVPA). Accelerometry is a method for objectively monitoring physical activity and providing rich data about users' physical activity intensities. Accelerometers will be distributed to a subsample of participants in schools by

trained staff who also will record allocation and collection of the devices (Appendix 12).

Participants will be asked to wear an accelerometer with a flexible belt, on the right side at the axillary midline, for at least 7 full days (plus one day of familiarization and the morning of the last day), including two weekend days. Wearing time will be at least for 7 days in order to maximize the number of participants with sufficient valid data (minimum wearing time of 4 days with 10 hours each day). Participants and their parents or caregivers will be explained to remove the accelerometer only during bedtime and water-based activities (e.g. swimming), clear information and a demonstration of wearing the device will be provided by trained staff (Appendix 14). To ensure the adequate use of accelerometers, a daily checklist (Appendix 13) will be used to record the use of the accelerometer every morning at the school by trained staff. This school visits will be an opportunity for the trained staff to clarify participants questions about the accelerometer. Phone messages and calls, and small incentives (stickers) at the time of verification by the staff will be used as compliance enhancing strategies.

The software ActiLife 6.13.4 will be used for accelerometer initialization prior to allocation and data download after collection. Daily MVPA will be estimated using an algorithm prepared by the research team. Freedson's cut-off points will be used to estimate the schoolchildren time per day spent at different intensities of physical activity (Department of Health & Human Services, 2018).

Other variables

Anthropometry
Weight and height will be measured in the whole sample (Hernández and Rivera, 2006).[96] Weight will be used as an indicator of total body mass and will be measured using portable scale with an accuracy of ± 200 g. The scale will be placed on a flat surface in vertical line to a wall, at a 90-degree angle. The weight will be recorded with the participant standing in the central part of the scale, behind the wall, in a straight position (barefoot, with heels together, toes slightly apart and arms hanging parallel to the axis of the body). Participants should be barefoot and in light clothing (no sweater or objects in the bags) during weight measurement.

Height will be used as an indicator of schoolchildren linear growth. A stadiometer will be used to measure height. This consists of a flexible metal measuring tape with a length of 2 m and a portable square that is placed on a right wall at a 90-degree angle with the floor. The height will be measured in a straight position with the back and head resting on the wall. Participants´ heads will be oriented by looking for the Frankfort plane (horizontal line from the lower orbital end to the upper edge of the external ear canal that keeps the head parallel to the floor). Participants will be asked to remove their shoes and any objects on their head (e.g. pins, buns, high hairstyles). The size will be recorded to the tenth centimeter (0.1cm).

Socioeconomic status

The questionnaire from the Mexican Agency for Market Research Agencies (AMAI, by its Spanish initials) will be used to estimate the socioeconomic level of the family (Appendix 15) (AMAI, 2018). This questionnaire considers the following variables: 1) number of full bathrooms, 2) number of cars, 3) home broadband, 4) household income of more than 14 years, 5) average monthly salary (<$ 2,699; $ 2,700 - $ 6799; $ 6,800- $ 11,599; $ 11,600- $ 34,999;> $ 35,000). This model defines a total number of points for each of the items and uses a maximum score of 300 points that are distributed among 7 socioeconomic levels from A/B to E.

- A/B. The socioeconomic level A/B includes 82% of households in which the head of the family has professional studies, of these 98% of households have home broadband. In this level there is the highest investment in education (13%) and one with the lowest proportion spent on food (25%).
- C+. The 89% of households at this level have one or more transport vehicles and 91% have home broadband. Around 31% of their spending goes to food and 5% to footwear and clothing, which is, similar to other levels.
- C. The 81% of the households at this level have a head of household with studies higher than primary and 73% have home broadband. Of the total expenses of this level, 35% are destined to food and 9% to education.
- C-. In the 73% of households at this level have a head of household with studies above. Of these homes 47% have home broadband, 38% of the expenses is allocated for food, and 5% is for clothing and footwear
- D+. In 62% of households at this level, the head of the household has a higher education than primary. Only 19% have home broadband, 41% of the expenses is in food and 7% to education
- D. In 56% of households the head of the household has studies until primary school, 4% has home broadband, and 46% of the expending is in food.
- E. Most households at this level (95%) have a head of household with studies not higher than primary education and only 0.1 % have home broadband. The spending at this level allocated to food is 52%) and this is the group with the lowest proportion of spending dedicated to education (5%).

Environmental indicators

The School Audit Tool developed for the International Study of Childhood Obesity, Lifestyles and the Environment (ISCOLE) will be used to measure school environment (Broyles *et al.*, 2015). This tool has been found feasible and reliable to be applied in school contexts in different countries (Broyles *et al.*, 2015). The tool will be applied in the school of intervention and comparison groups. The School Audit Tool evaluates school policies and practices related to healthy eating and physical activity and will be carried out through direct observation and questionnaires applied to the school's administrative staff.

This tool was developed based on surveys from *The school administrator survey* (Council of Chief State School Officers, no date), from the “School Health Policies

and Practices" (SHPPS) study (Council of Chief State School Officers, no date), from the Health Behavior in School-Aged Children (HBSC) survey (Council of Chief State School Officers, no date), and from the School Health Environment Survey (SHES) (Kroeker *et al.*, 2006). The components of the School Audit Tool assessing the school's built physical environment were taken from the school audit tool of the Sport, Physical activity and Eating behavior: Environmental Determinants in Young people (SPEEDY) study showing acceptable validity and reliability (Jones *et al.*, 2010). The tool also includes items to characterize the school grounds, the aesthetics of the school, the supply of food and access to fast-food restaurants around the school, and the amount of class time spent on physical education (Appendix 16).

Data analysis.
For the baseline evaluation, a descriptive analysis of the sample is contemplated, estimating the means and standard deviations for continuous variables, as well as percentages for categorical variables. Descriptive variables will be estimated in the total sample and by study group. A consistency in the results from the research team and the characteristics of the schools reported in the School Audit Tool will be conducted, using paired t-tests for continuous variables and Chi-square tests for categorical variables. The statistical package Stata 14 will be used for data analysis which will be disaggregated by participants sex and age.
The impact of Salud Escolar will be estimated using a difference in difference analysis considering schools as clustering variables. Behaviors of interest will be the outcome variables and group allocation and time will be the independent variables. The effect of Salud Escolar will be tested by introducing an interaction term between time and group allocation.

Fieldwork
The fieldwork will be carried out by three teams of six members, three supervisors (one for each brigade) and a coordinator. In each team two members will apply accelerometry and anthropometry measurements, four will apply the beverage diary and the 24-hour recall. Each team is estimated to work within each school for approximately one week, which represent a total of 12 schools visited in a month and two and a half months for the full data collection at the baseline stage.

7.4 Implementation analysis **(Second stage)**

An analysis of the implementation of the first phase of Salud Escolar will be carried out approximately 6 months after the program begins. The study will be cross-sectional and mixed methods will be used. The application of both approaches (i.e. qualitative and quantitative) for the analysis of health programs is favorable to understand different aspects of the implementation process (Jones *et al.*, 2010). This analysis will be carried out in the months of January and April 2020, through the phases described below.

Quantitative component
Information gathering

It will take place in the 58 schools selected for the implementation of the first phase of the Program. A checklist designed by the SS will be used to verify compliance with the General Guidelines for the Sale and Distribution of food and beverages prepared and processed in the schools of the National Educational System and the General Guidelines for the installation and maintenance of drinking fountains in the schools of the National Educational System. This instrument will be applied simultaneously by the INSP research team and the SS as follows: 1) verify that the processes are being carried out as established in the Guidelines, and 2) analyze the validity of the instrument.

Field operative
For the instrument validity eight firework teams of two members each will apply the checklist in the 58 schools on two different times (at least 15 days apart), each checklist is estimated to take 60 min. This information will be captured at the time of visiting the schools on the REDCap platform.

Analysis of the information
The statistical package STATA 2015 will be used to conduct a descriptive analysis using means ± standard deviation for continuous variables and n (%) for categorical variables.

Qualitative component
Semi-structured interviews and focus groups will be used as techniques for data collection. Data collection will be conducted in a subsample of six schools, selected according to their degree of deprivation (3 of low level and 3 of medium level). In coordination with the Ministries of Health and Education, the location and school directives will be identified to facilitate the planning of the visits of the fieldwork staff to the school. Participants for the semi-structured interviews and focus groups will be eligible if any of the following profiles are met: 1) institutional managers in the program implementation, 2) school principals and teachers, 3) school food and beverages vendors, 4) mothers and fathers of schoolchildren, 5) schoolchildren. Table 7 describes the specific inclusion and exclusion criteria according to participant profiles.

Table 7 Inclusion and exclusion criteria for the analysis of the implementation of Salud Escolar

Profile	Inclusion criteria	Exclusion criteria
Institutional responsible for the program implementation	In the required position A minimum of 6 months in the position Agree to participate in the study	During vacation, license or commission during data collection
School principals and teachers	In the required position A minimum of 6 months in the position Agreed to participate in the study.	During vacation, license or commission during data collection.

	Being in the position to substitute the titular.	
School food and beverage vendors	Agreed to participate in the study	
Parents of schoolchildren	Agreed to participate in the study	Age<18 years old
Schoolchildren	Having a signed authorization from mother, father or guardian to participate in the study	Refuse to participate in the study

Techniques and instruments

Semi-structured interviews
Participants will be selected using purposive sampling. Profiles considered for the application of the interviews are the following: institutional managers (n = 10), principals (n = 6), teachers (n = 12), managers of the food and beverages school vendors (n = 6).

Semi-structured interviews will be conducted by two members of the research team, one will direct the activity and the other will take notes during its development. Semi-structured interview guides designed and piloted by the INSP research team will be used (Appendix 18). They will be applied once granted the informed consent of the participant (Appendix 19).

Focus groups
In order to accomplish study objectives, the selection of the participants for the focus groups will be purposeful. There will be 12 focus groups with parents, and 12 focus groups with schoolchildren. Each group will be integrated by 8 to 12 members. Focus group guides will be designed and piloted by the INSP research team (Appendix 20) and applied once informed consent from parents and schoolchildren assent (Appendix 21) is obtained. The estimated length of focus groups is of120 minutes.

Participants' profile, instruments, and implementation constructs to be explored are summarized in Table 8. Likewise, the number of interviews and focus groups expected by each profile is included.

Table 8 Techniques and instruments to identify barriers and facilitators for the implementation of Salud Escolar

Participants Profile	Technique	Number	Instruments	Constructs to explore
Institutional directors	Interviews	6-10	Interview guide	Acceptability, adoption, suitability, costs,

				feasibility, fidelity, sustainability, coverage
School principals	Interviews	6	Interview guide	Acceptability, adoption, suitability, costs, feasibility, fidelity, sustainability
Teachers	Interviews	12	Interview guide	Acceptability, adoption, suitability, costs, feasibility, fidelity, sustainability
School vendors	Interviews	6	Interview guide	Acceptability, adoption, suitability, costs, feasibility, fidelity, sustainability
Parents	Focus group	12	Focus group guide	Acceptability, suitability, costs, feasibility
Schoolchildren	Focus group	12	Focus group guide	Acceptability

Semi-structured and focus group interview guides will be piloted as this process provides relevant information on possible failures in the instrument and allows revaluating the design if necessary. Before each interview and focus group, participants sociodemographic data will be collected (age, sex, degree of study, occupation, place of residence, among others) and authorization to audio-record the interviews and focus groups will be obtained.

Analysis and systematization of information
Sociodemographic information will be captured in Excel and next in STATA 2015. A descriptive analysis will be conducted including means and standard deviation for continuous variables and n (%) for categorical variables. Chi square tests and Student's t test will be used to analyze differences between samples.

Interviews will be transcribed Verbatim and coding will be conducted with the support of the software NVivo 11. Analytical categories will be established a priori based on the constructs of the research on the implementation of health policies and programs (Gutiérrez, 2017; Consejo Nacional de Evaluación de la Política de Desarrollo Social CONEVAL, 2019), and according to emerging categories resulting from the reading of the *corpus* of transcripts. A thematic analysis will be carried out (Braun and Clarke, 2006). A triangulation of data (of the different profiles) and of methods (between qualitative and qualitative techniques) will be conducted to strengthen the quality of the analysis (Soto-Estrada *et al.*, 2016).

8. Ethical considerations
This research proposal will be carried out taking into consideration the guidelines contained in the INSP Research Ethics Committee Regulations (Instituto Nacional

de Salud Pública, 2015). In addition, the study will be evaluated by the institutional Research and Biosafety Commissions.

8.1. Design analysis

Key actors participating in the semi-structured interviews will be provided with written informed consent, and they will be able to keep a hard copy of this consent. The consent copy includes contact information of the project manager and the director of the INSP Research Ethics Committee to be able to contact them in case of questions or concerns about the study arose. Participants will be assigned an identification number (ID) that is not related to any personal data or job title. The testimonies of the key informants that are presented in the results reports derived from this study will be identified with the participant ID.

8.2. Impact analysis

Parents written consent will be requested for the application of the sociodemographic questionnaire, and for the authorization of the collaboration of their children in the following activities: 1) diet questionnaire, 2) hydration questionnaire, 3) accelerometry. Likewise, the consent of the schoolchildren will be requested. For the application of the School Audit in the intervention and control schools, the written consent of the schools´ principals will be requested. Each participant will be assigned a unique ID.

The information obtained as part of this research will be kept confidential and will be known by the evaluation team only. All field records will be kept in the principal investigator's office, with restricted access for people who are not involved in the project. The audio files will be deleted once completed data transcription and analysis.

Since the study will not handle human samples, it does not imply biosecurity risks. Regarding the ethical aspects, we consider that the proposal involves minimal risks for the participants since, the ethical principles of the field research will be respected including informed consent, autonomy and freedom to participate or not in the project.

9. Expected results

Knowledge gained from this comprehensive analysis will facilitate the development of further recommendations and strategies to support evidence-based decision-making processes towards the nationwide upscaling of Salud Escolar. These recommendations will be based on the gender perspective grounds. In addition, it will be possible to compare strategies included in Salud Escolar against evidence-based interventions for the prevention and control of childhood overweight and obesity. Results from this study will allow to establish a baseline evidence on the knowledge, attitudes, and practices of schoolchildren attending to public primary schools in Mexico City regarding correct nutrition, adequate hydration, and physical activity. This study will provide an up-to-date data of the schoolchildren physical activity and diet to subsequently analyze the results and impact of Salud Escolar.

10. Timeline

The timeline for the general project is presented in Figure 6. For Stage 1, two weeks of training and two and a half months for gathering information are considered.

11. Funds and deliverables

UNICEF will provide funding for this project resulted from a request of the General Directorate for Health Promotion of the Ministry of Health (Appendix 17). The research team has contacted UNICEF and the collaboration agreement is currently in the process of being signed. The funds breakdown and committed deliverables are summarized in Table 9.

Table 9 Funds breakdown and committed deliverables of the study

Concept	Funding	Deliverables
Stage 1	1,050,634	Protocol and instruments. Report of the results of the design analysis. Recommendations for improving the program.
Stage 2	1,593,807	Report of the results of the analysis of the program implementation process. Recommendations for improving the program for the nationwide dissemination.
Stage 3	1,297,502	Report of the results of the impact analysis
Stage 4	258,854	Six dissemination materials for the general population and decision-makers.
Stage 5	327,314	Outline of two articles publishable in peer-reviewed journals.
Total	4,528,111	

Note. Stage 1 corresponds to the current stage of the study

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