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Original Research Article

# Proposing a framework for school food program evaluation in Canada

Tracy Everitt[a*], Stephanie Ward[b], Wanda Martin[c], Rachel Engler-Stringer[d]

[a] St. Francis Xavier University; ORCID: 0000-0002-9483-4828, [b] Université de Moncton; ORCID: 0000-0002-5289-3440, [c] University of Saskatchewan; ORCID: 0000-0002-9774-1790, [d] University of Saskatchewan; ORCID: 0000-0003-1976-1339

## Abstract

Healthy eating in school-aged children supports optimal growth and learning; however, diet quality and food insecurity are a source of concern for many school-aged children in Canada. Canadian school-aged children's diets are a concern. In 2019 the Canadian federal government announced the intention to work towards a National School Food Program. A nationally organized program can evolve and meet the needs of children if there is a national evaluation strategy developed along with the program. A scoping review published in 2019 consisted of reports of school food programs in Canada evaluating nutritional impacts and food system sustainability. Food system sustainability recognizes the full impact that school food programs can have on individual, community, and environmental health by integrating social determinants of health, food systems, and economic sustainability. We conducted a content analysis of the evaluation strategies of these programs. Of the 17 peer-reviewed and 18 grey literature publications in the initial scoping review, 12 peer-reviewed and seven grey literature publications contained an evaluation component. Components assessed social determinants of health, including changes in food intake, knowledge about local foods, educational and behavioural outcomes, general knowledge, intention to eat, and willingness to try new foods. An evaluation template for school food programs including categories for social systems, environmental and economic sustainability would capture elements contributing to program impact.

*Corresponding author: teveritt@stfx.ca

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Evaluation that includes reach, efficacy, adoption, implementation, and maintenance would capture the complexity of the potential impact of sustainable school food programs.

## Résumé

Une alimentation saine chez les enfants d'âge scolaire favorise une croissance et un apprentissage optimaux. Cependant, la qualité de l'alimentation et l'insécurité alimentaire sont problématiques pour de nombreux enfants d'âge scolaire au Canada. L'alimentation des enfants canadiens d'âge scolaire est une préoccupation. En 2019, le gouvernement fédéral canadien a annoncé son intention de travailler à l'élaboration d'un programme national d'alimentation scolaire. Un programme national peut évoluer et répondre aux besoins des enfants si une stratégie d'évaluation nationale est développée conjointement. Un examen de la portée publié en 2019 a rapporté les programmes d'alimentation scolaire au Canada qui ont évalué les impacts nutritionnels et les systèmes d'alimentation durables. Les systèmes d'alimentation durables reconnaissent tous les effets que les programmes d'alimentation scolaire peuvent avoir sur la santé individuelle, communautaire et environnementale en intégrant les déterminants sociaux de la santé, les systèmes alimentaires et la durabilité économique. Nous avons effectué une analyse du contenu des stratégies d'évaluation de ces programmes. Parmi les 17 publications évaluées par les pairs et les 18 publications de littérature grise contenues dans l'examen de la portée initiale, 12 de la première catégorie et sept de la seconde intégraient une composante d'évaluation. Ces composantes ont mesuré les déterminants sociaux de la santé, incluant des changements de l'apport alimentaire, les connaissances sur les aliments locaux, les résultats éducatifs et comportementaux, les connaissances générales, l'intention de manger et la volonté d'essayer de nouveaux aliments. Un modèle d'évaluation pour les programmes d'alimentation scolaire, incluant des catégories pour les systèmes sociaux et la durabilité environnementale et économique, permettrait de capter les éléments qui contribuent à l'impact des programmes. Une évaluation qui inclut la portée, l'adoption, la mise en œuvre et le maintien permettrait de capter la complexité de l'impact potentiel des programmes d'alimentation scolaire.

**Keywords**: School food program; school meal program; school snack program; milk program; evaluation; sustainable food systems in schools

## Introduction

Healthy eating in school-aged children supports optimal growth, development, and learning while establishing significant long-term dietary patterns with positive health impacts (Ballard, 2013; Roustit et al., 2010). However, in Canada, food insecurity affects sixteen percent of all children under 18 years of age, which drastically limits their ability to consume healthy foods (Tarasuk & Fafard St-Germain, 2022). In addition, the diet quality of children while at school is poor, with up to thirty-seven percent of calories coming from minimally nutritious foods (Tugault-Lafleur et al., 2017). Parents can experience many challenges with packing lunches, including time constraints (Russell et al., 2007), lack of lunch ideas that fit school allergy policies, food safety guidelines, and child preferences (Hawthorne et al., 2018), as well as finding foods that fit social norms and that can be eaten in limited time (Bathgate & Begley, 2011). Providing all children with daily access to healthy food at school would positively impact all families, particularly parents who invest a significant amount of time preparing food for school. While schools are responsible for caring for children during school hours, food provisioning is still largely seen as a personal responsibility in Canada (Patico, 2020). The majority of that burden still falls on mothers, who now often do "double duty", commonly working in the paid labour force, but also, on average, performing more hours of housework and childcare than men (Neilson & Stanfors, 2014). Providing healthy foods that are available to all children addresses food insecurity and diet quality, while also addressing the challenges and burden of packing lunches.

Despite concerns over the diets of school-aged children, there is no Canadian national school food program. In response to student need, some jurisdictions have initiated school food programs by providing breakfast, lunch, snack, or milk programs (Everitt et al., 2020a) These schools rely primarily on grants or local or regional charities for support. However, not all schools have the same ability to procure funds, which can be particularly challenging in low-economic areas (Social Research and Demonstration Corporation, 2010). Insufficient funding can reduce program frequency (Edward, 1998) and compromise program effectiveness (Valatis, 2009). Sufficient funding, leading to the institutionalization of programs in schools and communities, can promote program improvement over time (Skinner et al., 2012) and contribute to the strengthening of local food systems (Naylor & Bridgewater, 2007). Therefore, multiple national organizations have called for a National School Food Program that would enable all students in Canada to have access to healthy meals at school every day.

Internationally, school food programs are drivers of improved health, education, and economic growth (World Food Programme, 2016). Nevertheless, Canada is one of the only highly industrialized countries within the Organization for Economic Cooperation and Development without a national school food program (Koç & Bas, 2012). Families struggle to introduce healthy foods for various reasons (Bauer et al., 2012; Daniel, 2016; Engler-Stringer, 2010; Slater et al., 2012). Globally, school food programs help to address many of these challenges. Over 368 million children in 151 countries (seventy-seven percent of all countries) receive free or subsidized school meals supported by state and national governments (Rutledge, 2016). India has the largest school food program, feeding ninety million children, followed by Brazil and China that each feed 40 million, and the United States which feeds thirty million (World Food Programme, 2020). Characteristics of school food programs in other countries may help

inform program development in Canada. For example, in France and Japan, school food programs are seen to address childhood health concerns at a systems-level (Moffat & Thrasher, 2016). In Finland, the lunch program is universal, is incorporated into the education system through the curriculum, and supports environmental, cultural, social, and economic sustainability (Pellikka et al., 2019). According to a review of international literature, integrating school meals with classroom curricula in a healthy and culturally appropriate food environment helps to promote both healthy and sustainable food behaviours (Oostindjer et al., 2017). This is accomplished by taking an education-integrated approach that involves children in growing and preparing food, teaching about food system sustainability, and healthy behaviour.

School food program development in high-income countries has progressed in three phases, as described by Oostindjer et al. (2017). The first phase provides calories to reduce hunger, regardless of food quality. In response to concerns about the impact of poor-quality diets, the second phase shifts to healthier, more nutrient-dense, and lower-calorie foods. The third phase integrates food system sustainability in school food programs to ensure that school meals promote healthy and sustainable eating patterns. Specifically, school food programs in this third phase integrate social determinants of health, the food system, and economic sustainability (Everitt et al., 2020a). From a social determinants of health perspective, sustainable school food programs integrate food literacy, food systems, and environmental and cultural knowledge within the curriculum while also providing healthy sustainable food (Oostindjer et al., 2017). School food programs may also address food systems by targeting environmental sustainability, which includes measures or practices that minimize or reduce environmental impacts. Environmental sustainability may involve focusing on local foods or using reusable, recyclable, or biodegradable dinnerware. Finally, economic sustainability in school food programs means there are sufficient resources to procure food, staff the program, build capacity, and monitor and evaluate the program (Hernandez et al., 2018). School food programs in Canada are currently at the beginning of this third phase, as few schools have incorporated some components of food systems or environmental or economic sustainability in their food programs.

In a recent scoping review, we described a broader perspective on components of Canadian school food programs as they relate to social determinants of health, food systems, and economic sustainability, and identified the extent to which these components were included in Canadian school food programs (Everitt et al., 2020a). Specifically, we found that the social determinants of health component of school food programs focused on improving nutritional intake, contributing to food literacy, supporting educational attainment (i.e., educational outcomes, attention, attendance), promoting health equity, addressing school stigma related to program use, including culturally appropriate food, and increasing cultural knowledge (Everitt et al., 2020a). Of the twenty-four programs described, six described food systems in the school context. Three programs incorporated gardening (Hanbazaza et al., 2015; Triador, 2013; Triador et al., 2015), one incorporated eco-friendly practices (Social Research and Demonstration Corporation, 2010), two incorporated local food systems (Abrey, 2008; Naylor & Bridgewater, 2007), and one discussed the importance of building a community network (Edward, 1998). Several programs included in the scoping review discussed challenges created by having insufficient resources and the importance of having adequate resources to operate the program (Edward, 1998; Naylor & Bridgewater, 2007; Skinner et al., 2012; Social Research and Demonstration Corporation, 2010; Valatis, 2009).

In 2019, the Canadian government announced its intention to work with the provinces and territories to develop a National School Food Program. However, no timeline was set, and no funding was committed (Government of Canada, 2019); this provides a prime opportunity to look at evaluation methods used in Canada to develop a national evaluation framework to inform program planning. A national evaluation framework or template could provide data for provincial and municipal comparisons, to ensure that programs have optimal impact and guide program enhancements toward equitable outcomes. Additionally, giving schools guidance will facilitate completing evaluations even for schools with limited resources. Therefore, the purpose of this paper is to determine how school food programs are evaluated in Canada, including how different components of social determinants of health, food systems, and economic sustainability have been assessed, using the literature incorporated in our previous scoping review.

## Methods

### Identification and selection of relevant publications

The initial scoping review included peer-reviewed and grey literature publications in English or French published after 1970. Databases searched included OVID Medline, OVID ERIC, PsycINFO and Web of Science. The initial Ovid peer-reviewed search strategy can be found in Table 1. This Ovid search strategy was adapted to optimize the search in other databases and was also the basis of the grey literature search. The search was conducted on June 5, 2018. Publications retained had to both describe a Canadian school food program that provided food to children during school hours for nourishment purposes and include an evaluation component. Publications for this initial scoping review were excluded if they did not have an evaluation component, provided food only for educational purposes, focused on adherence to policy, or discussed foods available for purchase in cafeterias or vending machines. Further details on methods used in the original scoping review are described in detail elsewhere (Everitt et al., 2020a). A total of seventeen peer-reviewed and eighteen grey literature publications were identified and retained for the initial scoping review (Everitt et al., 2020a).

Publications included in the current analysis were drawn from this initial scoping review (Everitt et al., 2020a). Publications were excluded if they only described program implementation (Abrey, 2008), factors contributing to program acceptance (Scott et al.,

2017), perceptions of the program (Russell et al., 2007), or nutrient composition of the school meals (Gougeon, 2008; Gougeon et al., 2011), only reported characteristics of program users (Godin et al., 2018), or only evaluated program delivery (Valatis, 2009). Studies that solely described qualitative self-reported program impacts (Act Now BC, 2008; Edward, 1998; Goss Gilroy Inc., 2013; He et al., 2008, 2012; Policy and Planning Branch, 2006; Prowse, 2011) were also excluded, as the validity of the data cannot be confirmed. Furthermore, issues with the representativeness of findings, heterogeneity of data collection methods, and analysis complexity limit the appropriateness and feasibility of using qualitative data to evaluate school food programs on a national scale. A similar systematic review of peer-reviewed literature published between 1990 and 2017 did not reveal any further studies that fit our inclusion criteria (Colley et al., 2019).

### Data synthesis

We scanned the peer-reviewed and grey literature publications included in the original scoping review for evaluation strategies related to the components of social determinants of health, food systems, and economic sustainability in school food programs (Everitt et al., 2020a). Based on the initial scoping review's findings, we specifically identified evaluation strategies in the areas of educational outcomes, behaviours such as attention and attendance, changes in food intake, knowledge, attitudes and preferences, impact on food security or health equity, and assessment of social benefits. We also determined how school food programs evaluated food literacy as well as food systems, environmental, or cultural knowledge. We selected these areas to reflect how a curriculum-integrated sustainable school food program could manifest in Canada.

## Results

This analysis included twelve peer-reviewed and seven grey literature publications that evaluated social determinants of health, food systems, or economic sustainability. The publications covered two programs in British Columbia (n = 3 grey literature), two programs in Alberta (n = 3 peer-reviewed, n = 1 grey literature), one program in Saskatchewan (n = 2 peer-reviewed), seven programs in Ontario (n = 7 peer-reviewed, n = 2 grey literature), and one program in Prince Edward Island (n = 1 grey literature), as shown in Table 2. School food programs included breakfast (n = 2), lunch (n = 1), snack (n = 4), milk (n = 3), lunch salad bar (n = 1), gardening (n = 1), and vegetable and fruit offerings (n = 6).

Some publications reported on existing programs (Leatherdale et al., 2016; Muthuswamy, 2012; Ransome et al., 1998; Skinner et al., 2012), while others reported on interventions (Context, 2013; Gates, 2010; Gates et al., 2013a, b; Hanbazaza et al., 2015; He et al., 2009; Saksvig et al., 2005; Sangster Bouck et al., 2011; Social Research and Demonstration Corporation, 2010; Taylor et al., 2003; Triador, 2013; Triador et al., 2015). In terms of food systems, three programs included environmental sustainability within their program, one program included local foods (Context, 2013), one used reusable plates (Social Research and Demonstration Corporation, 2010), and a third considered food waste (Sangster Bouck et al., 2011). As for social determinants of health, nutrition education

was included in the curriculum in five programs (Gates et al., 2013a; Hanbazaza et al., 2015; Saksvig et al., 2005; Sangster Bouck et al., 2011; Triador, 2013; Triador et al., 2015). Six programs focused solely on providing healthy foods to students (Gates, 2010; Gates et al., 2013b; Leatherdale et al., 2016; Muthuswamy, 2012; Ransome et al., 1998; Skinner et al., 2012; Taylor et al., 2003), and two publications focused on interventions aimed at lowering sugar intake from flavoured milk (Henry et al. 2015, 2016). None of the programs evaluated economic sustainability.

## Frameworks and study designs used in school food program planning and evaluation

Of the nineteen publications, eight reported using a theoretical or conceptual framework to plan or evaluate their school food program, including Social Cognitive Theory (Bouck et al., 2011; Gates, 2010; Gates et al., 2013a, b; Saksvig et al., 2005; Triador et al., 2015), the Comprehensive School Health model (Gates et al., 2013b), the Centers for Disease Control and Prevention (CDC) framework (Gates, 2010), the Ecological Model (Saksvig et al., 2005) , the Logic Model (Context, 2013), and Ponza et al.'s (1999) framework (Muthuswamy, 2012). Most publications reported using a pre-post study design, either alone (Gates et al., 2013b; Hanbazaza et al., 2015; Saksvig et al., 2005; Taylor et al., 2003; Triador et al., 2015; Triador, 2013) or as part of a mixed-methods approach (Henry et al., 2015; Gates, 2010; Gates et al., 2013b; Muthuswamy, 2012), to assess the program's impact. Experimental designs were used in six studies, including cluster RCT (He et al., 2009; Ransome et al., 1998), non-randomized controlled trial (Leatherdale et al., 2016; Skinner et al., 2012), or cross-over trial (Henry et al., 2015, 2016), while process evaluation was assessed in eight of the publications (Bouck et al., 2011; Context, 2013; Gates, 2010; Gates et al., 2013a, b; Muthuswamy, 2012; Naylor & Bridgewater, 2007; Social Research and Demonstration Corporation, 2010).

## Social determinants of health in school food program evaluation

Peer-reviewed publications reported outcomes related to food intake, knowledge, attitudes, and preferences. Food intake was measured using questionnaires or surveys (Hanbazaza et al., 2015; Triador et al., 2015), twenty-four-hour recall (He et al., 2009; Saksvig et al., 2005), web-based twenty-four-hour recall (Gates et al., 2013a, b; Skinner et al., 2012), or a food or beverage frequency questionnaire (FFQ or BFQ) (Henry et al., 2015; Ransome et al., 1998). Food waste was measured using plate waste in two studies (Henry et al., 2015, 2016), while another study used tracking sheets from food preparers to assess the degree of wastage of different vegetables and fruits (Bouck et al., 2011). Food literacy, which included knowledge of vegetables and fruits, self-efficacy, preferences, and intention to eat certain foods, was assessed in five studies (Gates et al., 2013a; Hanbazaza et al., 2015; He et al., 2009; Saksvig et al., 2005; Triador et al., 2015). One study looked at multiple domains of health, including eating behaviours, tobacco use, physical activity, obesity, bullying, and substance use (Leatherdale et al., 2016), and body mass index was measured in two peer-reviewed publications (Gates et al., 2013b; Saksvig et al., 2005). No peer-reviewed publications assessed educational outcomes or behaviours such as attention and attendance.

Grey literature publications reported on measures for several components of social determinants of health. Food intake was measured using web-based twenty-four-hour recall (Gates, 2010) and surveys (Context,

2013; Muthuswamy, 2012; Social Research and Demonstration Corporation, 2010; Triador, 2013). Surveys were also used to identify the number of foods tried (Context, 2013), perceptions of availability as a result of the food program (Context, 2013; Muthuswamy, 2012; Social Research and Demonstration Corporation, 2010), intentions or willingness to try foods (Context, 2013; Gates, 2010; Social Research and Demonstration Corporation, 2010; Taylor et al., 2003), and knowledge of and preferences for certain foods (Triador et al., 2013; Gates 2010). Surveys were used to capture perceptions of the social environment related to vegetables and fruits (Context, 2013) and changes in food system knowledge, specifically by asking what local vegetables and fruits were available (Context, 2013). Qualitative methods in the grey literature included key informant interviews to assess how the school food program strengthened the local food system (Context, 2013). One publication addressed educational outcomes by looking at grades, attendance by looking at attendance rates, and also used qualitative methods to determine the impact on independent work and problem solving (Muthuswamy, 2012). Neither peer-reviewed nor grey literature addressed environmental knowledge, cultural knowledge, attitudes, or practices, nor did they measure improvements in health equity or assess the social benefits of participating in the school food program.

### Food system and economic sustainability in school food program evaluation

Although three studies incorporated aspects of food systems and economic sustainability within their program, none of the publications (neither peer-reviewed nor grey literature) assessed the impact of school food programs on these outcomes. However, some publications commented on the importance of sufficient financial resources and support (Bouck et al., 2011; Naylor & Bridgewater, 2007; Skinner et al., 2012), the challenges that insufficient financial resources created (Gates et al., 2013a), and the challenges of fundraising in low-income areas (Social Research and Demonstration Corporation, 2010).

## Discussion

This review found that only some components of sustainable school food programs have previously been evaluated in Canada, particularly as they relate to social determinants of health. These included changes in food intake, educational outcomes, attendance and attention, and food literacy. However, these outcome indicators were measured using varied assessment tools, which limits comparisons between programs. Other components, such as food security, health equity, environmental knowledge, cultural knowledge, attitudes and practices, or the social benefits of participating in school food programs, have not been evaluated. None of the programs assessed outcomes related to food systems or economic sustainability. Of the few school food programs that have been evaluated, even fewer have used a framework to guide this evaluation. This review highlights the lack of school food program evaluation in Canada, and demonstrates the heterogeneity of outcome indicators and methods used by the few programs that have been evaluated. This further illustrates the importance of developing a national evaluation framework for school food programs in Canada.

Program evaluation is essential, as it provides valuable information on the program and its effectiveness, as well as on avenues for improvement, that can help inform or guide future program development. Despite the importance of program evaluation, few school food program evaluations have been conducted in Canada. Furthermore, only seven programs' evaluations have been guided by a theoretical or conceptual framework. Most refer to Social Cognitive Theory as the framework used for their program. While theories such as Social Cognitive Theory can help with program development, they do not necessarily provide a framework to assess the impact of a school food program on specific outcomes. Although reporting on program impact is important, additional information is often needed to better understand the outcomes of those evaluations. Evaluating the impact of public health programs, such as school food programs, incorporates many components (Glasgow et al., 1999). Therefore, more robust frameworks should be used. An evaluation template would provide necessary structure while allowing school personnel and community members to determine the most appropriate indicators. Community control over evaluation strategy is important, especially in Indigenous communities. Stakeholder input from students, parents, and caregivers would provide a feedback mechanism to gather information on participants' needs, program acceptance, and factors that discourage participation.

One approach is the RE-AIM framework, which covers the reach, efficacy, adoption, implementation, and maintenance of programs (Glasgow et al., 1999). This process evaluation framework provides a structured approach to program evaluation that can help increase our understanding of how a program is delivered in complex settings. This framework can provide important data on the program's effectiveness and highlight the reasons why it may or may not have had the intended consequences. Reach of a program, for example, is the percentage of the target population who participate in a program or intervention (Glasgow et al., 1999). In the context of school food, a universal program would have a larger impact than a program that targeted those in need. Efficacy considers both positive and negative outcomes of the program, and includes behavioural factors, satisfaction, and achievement of endpoints (Glasgow et al., 1999). Efficacy in the context of school food programs that incorporate sustainable food systems would include indicators related to social determinants of health, food systems, and economic sustainability. Adoption within the RE-AIM framework refers to individuals or settings that adopt the intervention (Glasgow et al., 1999). At the school level, this could be the number of classrooms that participate. At provincial or national levels, this could include the number of participating schools. Implementation considers the degree to which the program is adopted (Glasgow et al., 1999). Some programs, for example, intend to implement several components, but, because of logistical or other challenges, are unable to fulfil that intention (He et al., 2008). Maintenance refers to the long-term maintenance of the program (Glasgow et al., 1999).

## Social determinants of health

Outcomes related to social determinants of health comprised the most reported outcomes. Changes in dietary intake were measured in both peer-reviewed and grey literature publications using several methods. Although the methods chosen are appropriate from a research perspective, converting data to reveal nutrient breakdown would require significant resources and expertise for analysis and interpretation. A simplified approach would be more realistic, as schools generally

are not paired with academic departments that can help them with these analyses. One possibility for addressing nutritional intake would be to explore using the healthy eating index adapted for school-time intake. A challenge, however, is that the version of Canada's Food Guide that was the basis for the school-adapted Healthy Eating Index has been replaced by a version that lacks serving-size information. Researchers would therefore need to develop a revised composite measure based on the new food guide and assess it for appropriateness in the school context. One advantage of using a composite measure like the Healthy Eating Index is that it looks beyond health components to consider minimally nutritious foods, sodium, and saturated fat. When looking at school-aged children's diets during the school day, it is important to examine both healthy and minimally nutritious components, because over thirty percent of calories come from minimally nutritious foods (Everitt et al., 2020b; Tugault-Lafleur et al., 2017).

Educational outcomes were evaluated in one grey literature publication by comparing achievement scores between participants and non-participants of school food programs (Muthuswamy, 2012). Authors outside Canada have used grades or standardized test scores to assess the impact of meal programs on educational outcomes (Imberman, 2012; Kleinman et al., 2002; Rampersaud et al., 2005; Rodgers & Milewska, 2007). Using data that schools are already collecting keeps the burden of program evaluation low. The authors who collected data on educational outcomes were also the only ones looking at attendance and attention (Muthuswamy, 2012). Muthuswamy (2012) assessed attendance and achievement by comparing attendance rates and achievement scores between food program participants and non-participants and concluded that the breakfast program improved both metrics (Muthuswamy, 2012). These findings were supported by teacher interviews, which indicated that students who attended the breakfast program did better in terms of achievement scores, independent work, initiative, and problem-solving abilities compared to those who did not participate in the breakfast program (Muthuswamy, 2012). Although conducting interviews strengthened these findings, a less onerous evaluation method would be beneficial for a national evaluation strategy. Researchers outside of Canada have also used attendance rates to indicate program success (Deavin et al., 2018; Imberman, 2012; Kleinman et al., 2002; Rampersaud et al., 2005; Rodgers & Milewska, 2007). Grades, standardized test scores, and attendance would also provide the means to assess the outcomes of meal programs. There are, however, limitations to these measures, as there may be other potentially causative variables acting in the school context that are unknown. Comprehensive evaluation to determine the true impact of school food programs on attendance and attention would require time and money that are not available in many Canadian schools.

Curriculum integration improves food literacy and provides knowledge and skills for health-supporting decisions (Ismail et al., 2021). Food literacy is defined as "a collection of inter-related knowledge, skills and behaviours required to plan, manage, select, prepare and eat foods to meet needs and determine intake" (Vidgen & Gallegos, 2014, p.54). It involves varying levels of skills, from simple to complex. For example, interpreting food labels, understanding how food choices impact health, and having the skills to procure healthy food are entry-level skills, while a critical perspective along with advanced knowledge of the food system to promote action and improvement represent advanced skills (Anderson & Falkenberg, 2016; Azevedo Perry et al., 2017; Robertson & Scheidler-Benns, 2016; Truman et al., 2017). In one study, food literacy was addressed by asking students in grades one

through six to identify familiar vegetables and fruits along with the number of recommended daily servings (Hanbazaza et al., 2015). These measures may not adequately evaluate the complexity of food literacy.

Food literacy is a broad concept that includes developing food skills, having a healthy relationship with food, and being able to navigate the complex food system while supporting personal and environmental health (Cullen et al., 2015). Beyond that, critical food literacy is based on individual values and understanding of the sociopolitical context of sustainable and culturally appropriate foods (Classens & Sytsma, 2020). Practical knowledge and skills extend to learning how to take action for better food (Yamashita & Robinson, 2016). Students' food literacy may best be achieved by integrating it into the curriculum and incorporating gardening, cooking, or social studies within school food programs (Nowak et al., 2012). Farm-to-school programs, for example, can be instrumental in supporting food literacy through classroom learning, tasting new foods, field trips, and eating local foods in meal and snack programs (Joshi et al., 2008). Identifying age-appropriate knowledge and skills is also important to effectively address food literacy within school food programs. Home economics teachers, who are present in many elementary and secondary schools across Canada, contribute considerable expertise in food literacy and can help provide age-appropriate learning opportunities to children and adolescents, and therefore support the implementation of school food programs. Providing professional development opportunities for home economic teachers could help strengthen and expand their knowledge of critical food literacy, particularly with regard to sustainable food systems. By strengthening food literacy early, students will be prepared to challenge the status quo and contribute to a sustainable, just, and healthy food system (Classens & Sytsma, 2020; Yamashita & Robinson, 2016).

### Missing Evaluative Components

No publications included in this review measured changes in food security, yet this is paramount in the argument for school food programs (Godin et al., 2018; Roustit et al., 2010; Skinner et al., 2012). There are different definitions of food security. The Food and Agriculture Organization states that food security exists when "all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life" (FAO Rome World Food Summit Secretariat, 1996, n.p.). As a result, the extent to which a school can provide sufficient, safe, and nutritious food may be an appropriate indicator, but this would be restricted to school days unless schools offered low-cost market items or take-home meals. Household food insecurity, on the other hand, has been defined as "the inadequate or insecure access to adequate food due to financial constraints" (Tarasuk et al., 2014, p.5). In research, food security surveys have been used to assess the impact of school food programs on household food insecurity (Bartfeld & Ahn, 2011; Petralias et al., 2016); however, this may be challenging to administer and interpret in the school context due to the complexity and sensitivity of this issue.

Early childhood experiences influence health and social circumstances throughout the lifespan (Rasali et al., 2016). During the school-aged period, disadvantages can impact school success, thereby determining employment opportunities, socio-economic status, and health later in life (Rasali et al., 2016). Despite its importance, no publications in this review explicitly measured the impact of school food programs on health equity. Extra funding could be contingent on schools

identifying vulnerable populations along with plans of how to address equity issues. A literature review conducted to capture research done outside of Canada also did not identify any measurement methods for changes in health equity resulting from school food programs. This is an area for further development.

Neither peer-reviewed nor grey literature studies addressed environmental knowledge, cultural knowledge, attitudes, practices, or the social benefits of participating in school food programs. These findings reflect Canada's position at the beginning stages of a new paradigm of school food programs that include social and environmental determinants of health (Everitt et al., 2020a). Further work is needed to develop assessment methods in these areas. Addressing the cultural relevancy of school food programs is especially important in Canada, a multicultural country, to ensure that programs are acceptable and appropriate for all students. To cultivate social benefits, school food programs can help foster a sense of community and become part of the school culture (Goss Gilroy Inc., 2013; Policy and Planning Branch, 2006), improve classroom environments (Deavin et al., 2018), and provide meaningful social opportunities for students. School food programs can provide social opportunities through family dinners, cooking classes, sit-down meals, and eating with teacher role models (Chatterjee et al., 2015; Perry et al., 2004). Educators can integrate food systems, environmental, and cultural knowledge into the curriculum, which can be demonstrated through operationalizing the school food program. This may also help students develop their critical food literacy skills, making them more likely to participate in public discourse and adopt food-related behaviours that support socially, economically, and ecologically just food systems (Wever, 2015).

Economic sustainability is an integral part of school food programs; however, the best way to evaluate this is unclear. It is important to have ongoing funds for operational expenses to keep costs low so students can participate (Social Research and Demonstration Corporation, 2010) while also creating jobs that do not exploit school food workers (Gaddis, 2019). Food programs that are economically sustainable can become institutionalized in the community and school, which can support program improvement and increase program impact (Gates et al., 2013a; Skinner et al., 2012). Economic sustainability is also challenging in low-income areas if fundraising efforts are needed (Social Research and Demonstration Corporation, 2010). If Canada's National School Food program is designed to cover operational expenses and funding disbursements reflect the economic means of low-income neighbourhoods, food programs will be better positioned to support their intended purpose rather than staff spending their energy procuring additional resources to meet their students' needs.

Table 3 identifies components to include in a sustainable school food program, evaluation strategies included in the scoping review, limitations and challenges to measuring the indicators, and concluding remarks, along with next steps. We identified suggestions for several indicators needing further development. These evaluation strategies apply to the local school level. Compiling findings will help determine impacts at the local (school division), provincial, and national levels to determine the true impact of school food programs in Canada.

## Limitations

This study incorporated publications from across Canada, including those from British Columbia, Alberta, Saskatchewan, Ontario, and Prince Edward Island. However, the breadth and depth of data on school food programs in Canada are lacking. Research-

based peer-reviewed publications that describe extensive data collection may not reflect what is achievable with available resources in practice. As well, some of the nutrition interventions discussed were of short duration (Gates et al., 2013a; Henry et al., 2015, 2016), so they do not address whether the intervention is sustainable in the long term. Drawing conclusions from short study durations fails to recognize the complexity of food choices and the length of time required to elicit behaviour change. Furthermore, details of evaluation strategies were only captured if they were included within the relevant publications. There are likely school food evaluations currently being conducted that were not part of this review. Canada is only beginning to show signs of integrating environmental sustainability into its programs, so few publications have included this component.

## Conclusion

School food programs in Canada have been operating independently, and, as such, evaluation methods have been variable to non-existent. With the move towards a national school food program, developing a school food evaluation framework that uses a simplified, standardized evaluation method would support schools in achieving an equitable distribution of resources to maximize program impacts. The shift towards designing and evaluating school food programs to include social determinants of health, food systems, and economic sustainability will help demonstrate the impact of sustainable school food programs. Identifying outcome indicators and considering RE-AIM components can provide a more comprehensive evaluation of sustainable school food programs at regional, provincial, and national levels.

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**Dr. Everitt** is a Registered Dietitian and an Assistant Professor in the Department of Human Nutrition at St. Francis University. Her professional and scholarly work supports sustainable, resilient, and healthy systems and people. Her work expands the role of sustainability in dietetic education, practice, and research and supports the development of a national school food program through research on school food and sustainable food systems in school.

**Dr. Stephanie Ward** is a Registered Dietitian and a professor at the École des Sciences des aliments, de nutrition et d'études familiales at the Université de Moncton. Dr. Ward's research focuses on the role of school and childcare environments, both physical and social, on the development of healthy behaviours among children and adolescents. She has been involved in the evaluation of various programs at the regional, provincial, and national levels, which aim to increase food literacy, physical activity and improve healthy eating.

**Wanda Martin (RN, Ph.D.)** is an Associate Professor in the College of Nursing at the University of Saskatchewan, Canada. Her work engages systems thinking and the use of novel methodologies addressing public health problems for applied outcomes. Her program of research is on the Sustainable Development Goals, specifically focused on health equity, food systems, and climate change.

**Dr. Rachel Engler-Stringer** is a Professor in the Department of Community Health and Epidemiology in the College of Medicine at the University of Saskatchewan and a researcher with the Saskatchewan Population Health and Evaluation Research Unit. She convenes the School Food Working Group of the Canadian Association for Food Studies. She currently leads a curriculum-integrated universal school lunch program intervention study, a study examining promising school food programs in every province and territory and an Indigenous school food program development project.

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# Appendix

Table 1: ovid medline search strategy

| |
|---|
| 1. canada.ab,ti. |
| 2. canadian.mp. |
| 3. canada/ or alberta/ or british columbia/ or manitoba/ or new brunswick/ or newfoundland/ or labrador/ or northwest territories/ or nova scotia/ or nunavut/ or ontario/ or prince edward island/ or quebec/ or saskatchewan/ or yukon territory/ |
| 4. 1 or 2 or 3 |
| 5. breakfast/ or lunch/ or snacks/ |
| 6. breakfast*.mp. |
| 7. lunch*.mp. |
| 8. snack*.mp. |
| 9. MEALS/ |
| 10. (Meal* adj2 (plan or plans or program* or intervention*)).mp. |
| 11. (food* adj2 (plan or plans or program* or intervention*)).mp. |
| 12. (nutrition* adj2 (plan or plans or program* or intervention*)).mp. |
| 13. MILK/ |
| 14. (milk* adj2 (plan or plans or program* or intervention*)).mp. |
| 15. fruit*.mp. |
| 16. (fruit* adj2 (plan or plans or program* or intervention*)).mp. |
| 17. (vegetable* adj2 (plan or plans or program* or intervention*)).mp. |
| 18. (garden* adj2 (program* or intervention*)).mp. |
| 19. (cook* adj2 (program* or intervention*)).mp. |
| 20. farm-to-school*.mp. |
| 21. farm-to-fork*.mp. |
| 22. (eat* adj2 (plan or plans or program* or intervention*)).mp. |
| 23. 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 |
| 24. (elementary adj school*).mp. |
| 25. (middle adj2 school*).mp. |
| 26. (high adj2 school*).mp. |
| 27. (primary adj2 school*).mp. |
| 28. (secondary adj2 school*).mp. |
| 29. (grade adj2 (school* or student*)).mp. |
| 30. kindergarten.mp. |
| 31. (kindergarten adj2 student*).mp. |
| 32. ((boarding or private) adj2 (school* or student*)).mp. |
| 33. 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 |
| 34. 4 and 23 and 33 |

Table 2: Summary of Programs and Publications per Program Evaluation

| Province | Program Name | Program Type | Publication | Type of Literature | Theoretical or conceptual framework | Evaluation type/ design | Outcomes and outcome measures |
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| British Columbia | BC Farm to School Salad Bar | **Lunch salad bar** | Social Research & Demonstration Corporation (2010)*** | Grey literature | None reported | Process evaluation | **Survey based on the ProChild Questionnaire** with students (Grades four and up): Reported on V&F intake, school eating behaviour, awareness and knowledge of healthy eating and farm-to-school salad, and willingness to try new foods. **Interviews and focus groups** with principals, coordinator, food service staff, volunteers, local food security champion, local producers/farmers: Assessed program motivation, success indicators, practicalities, relationships with stakeholders, community response to the program and unintended consequences. |
| | BC Fruit and Vegetable Snack Program | **Fruit and vegetable snack** | Context (2013)** | Grey literature | Logic model | Process evaluation | **Survey** with students (Grades three and up): Reported on willingness to try V&F, number of V&F tried at home, acceptability of V&F, knowledge of local V&F, and perception of availability of fresh V&F at school. **Electronic survey** with teachers and coordinators: Assessed perspectives on program implementation, capacity to implement, increased awareness of BC V&F, increased awareness of safe handling practices, enhanced relationships with BC Agriculture in the Classroom Foundation, perspectives on increased availability of V&F at school, and changes in students' willingness to try and accept V&F. **Interviews** with administrators, produce partners: Assessed relationships with local growers and distributors, information and support to deliver produce, increased business for local growers and |

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| | | | | | | | distributors, collaborative relationships among produce partners<br>**Direct observation** by program coordinators: Reported program implementation and the number of children trying and wasting snacks at school. |
| | | | Naylor & Bridgewater (2007)* | Grey literature | None reported | Process evaluation | **Survey** with the school administrator or parent advisory committee (PAC) coordinator: Measured stakeholder satisfaction, implementation facilitators and barriers, benefits, drawbacks for the school, and desire to participate again.<br>**Focus groups and interviews** with teachers, administrators, suppliers/distributors, PAC members: Addressed impact in the school, implementation facilitators and barriers, evaluation of the overall program, and key components.<br>**Logs** completed by PAC members: Record of receipt of V&F, product condition, returns from the classroom, distribution of extra product, related issues. |
| Alberta | School Milk Program | **Milk** | Ransome et al. (1998) | Peer-reviewed | None reported | Cluster RCT | **Food Frequency Questionnaire** with students (Ages six to twelve)**:** Reported usual intake in dairy and alternate food sources of calcium. |
| | Central Alberta First Nations gardening and snack program | **Gardening and Snack** | Hanbazaza et al. (2015)* | Peer-reviewed | None reported | Pre-post test | **List of V&F** by students (Grades one to six)**:** Assessed students' knowledge of V&F by writing down five V&F they know.<br>**Survey** completed by students: Rated their preferences towards nine vegetables and eight fruits and reported their consumption of these V&F at home (yes/no). |

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| | | | Triador et al. (2015)* | Peer-reviewed | Social cognitive theory | Pre-post test | **Survey** with students (Grades one to six): Rated their preferences towards seventeen V&F and reported their consumption of these V&F at home (yes/no). |
| | | | Triador et al. (2013)* | Grey literature | None reported | Pre-post test | **List of V&F** by students (Grades one to six)**:** Assessed students' knowledge of V&F by writing down five V&F they know.<br>**Vegetable and Fruit Knowledge Survey and Vegetable and Fruit Attitude Survey** completed by students: Rated their preferences towards nine vegetables and eight fruits and reported their consumption of these V&F at home (yes/no). |
| Saskatchewan | Elementary School Milk program | **Milk** | Henry et al. (2015) | Peer-reviewed | None reported | Cross-over trial<br>Mixed methods | **Plate waste** among students (Grades one to eight): Measured milk consumption as milk sold minus milk discarded.<br>**Beverage Frequency Questionnaire** with students (Grades five to eight): Reported consumption frequency of sixteen different drinks and three calcium-rich foods.<br>**Focus groups** with students (Grades five to eight): Identified benefits/barriers to milk consumption at home and school, attitudes/perceptions when chocolate milk was removed from schools, and suggestions for improving the school's milk program. |
| | | | Henry et al. (2016) | Peer-reviewed | None reported | Cross-over trial | **Plate waste** among students (Grades one to eight): Measured milk consumption as milk sold minus milk discarded. |
| Ontario | Ontario Northern First Nations | **Snack** | Skinner et al. (2012) | Peer-reviewed | None reported | Quasi-experimental study | **Web-based Eating Behaviour Questionnaire (WEB-Q)** completed by students (Grades six to ten): Measured types and amount of foods consumed the previous day (twenty-four-hour dietary recall), participation in the program, |

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| | Snack Program | | | | | | appreciation of the program, suggestions for improvement, and personal impact of the program. |
| | Sandy Lake school-based diabetes prevention program | **Lunch** | Saksvig et al. (2005)* | Peer-reviewed | Ecological model<br>Social cognitive theory | Pre-post study | **Anthropometric measurements**: Recorded height, weight, and percentage of body fat (bioelectrical impedance)<br>**Twenty-four-hour recall** reported by students (Grades three to five): Measured foods and drinks consumed.<br>**Health knowledge and behaviour questionnaire** with students (Grades three to five): Measured dietary intention, dietary fat knowledge, behavioural capabilities (label reading skills), dietary self-efficacy, food preferences, knowledge and perceptions about diet, physical activity, and diabetes. |
| | Feeding our Future | **Breakfast** | Muthuswamy (2012) | Grey literature | Framework from Ponza et al. (1999) | Mixed methods Process evaluation | **Survey** with students (Grades six and up): Assessed participation in the program, eating habits, quality and quantity of foods provided, perceived well-being and program satisfaction.<br>**Focus groups** with students: Assessed participation, program satisfaction, perception of benefits.<br>**Site visits** to schools<br>**Interviews** with school administrators, nutrition coordinators, teachers and educational assistants, school head caretakers, program managers/staff, and volunteers: Assessed program benefits, training and orientation, meal setting, promotion, participation, decision-making, school operations, menu, and resources.<br>**Document review**: Identified participation rates and implementation communication.<br>**System data**: Used to assess achievement, absenteeism, and suspensions. |

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| | First Nations Fruit, Vegetable and Milk Programs | **Fruit and vegetable and milk offerings** | Gates et al. (2013b) | Peer-reviewed | Comprehensive school health<br>Social cognitive theory | Mixed methods (pre-post and qualitative)<br>Process evaluation | **Web-based Eating Behaviour Questionnaire (WEB-Q)** completed by students (Grades six to eight): Assessed intakes of milk and alternatives, calcium and vitamin D (twenty-four-hour dietary recall), and program impressions (open-ended questions).<br>**Anthropometric data** among students: Analog scale and stadiometer were provided to students to record their weight and height; BMI was calculated.<br>**Informal conversations** with program coordinators and school administrators: Provided information on program integrity and program impressions.<br>**Focus group** with teachers: Assessed program impressions. |
| | | | Gates (2010)* | Grey literature | US CDC framework<br>Social cognitive theory | Mixed methods (pre-post and qualitative)<br>Process evaluation | **Web-based Eating Behaviour Questionnaire (WEB-Q)** completed by students (Grades six to eight): Assessed intakes of milk and alternatives, calcium, and vitamin D (twenty-four-hour dietary recall), and program impressions (open-ended questions).<br>**Anthropometric data** among students: Height was measured by trained assistants, and participants weighed themselves using an analog scale; BMI was calculated.<br>**Informal discussions** with school administrators and a **Focus group** with teachers: Assessed program impressions.<br>**Knowledge, Self-Efficacy, and Intentions Questionnaire (KSIQ)** completed by students: Assessed knowledge, intentions, self-efficacy for milk and alternative consumption, number of milk and alternatives tried and liked. |

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| | | | | | | | **Questionnaire** with parents: Assessed parental impressions of the program. |
| | | | Gates et al. (2013a)* | Peer-reviewed | Social cognitive theory | Pre-post test Process evaluation | **Web-based Eating Behaviour Questionnaire (WEB-Q)** completed by students (Grades six to eight): Assessed intakes of milk and alternatives, calcium, and vitamin D (twenty-four-hour dietary recall).<br>**Knowledge, Self-Efficacy, and Intentions Questionnaire (KSIQ)** completed by students: Assessed knowledge, intentions, self-efficacy for milk and alternative consumption, number of milk and alternatives tried and liked.<br>**Methods used to assess attendance and program integrity were not described.** |
| | Northern Fruit and Vegetable Pilot Program | **Fruit and vegetable offering** | He et al. (2009)* | Peer-reviewed | None reported | Cluster RCT | **Twenty-four-hour recall** with students (Grades five to eight): Assessed V&F intake<br>**Survey based on the ProChild Questionnaire**: Assessed students' awareness, knowledge and preferences with regards to V&F consumption, attitude, self-efficacy, intention, willingness, and habit. |
| | Northern Fruit and Vegetable Pilot Program | **Fruit and vegetable offering** | Sangster Bouck (2011)*∞ | Peer-reviewed | Social cognitive theory | Process evaluation | **Qualitative interviews** with food preparers, teachers and principals, local site coordinator, Ontario Fruit and Vegetable Growers' Association: Assessed what worked well, areas of improvement, facilitators, challenges, the overall reaction to the program.<br>**Wastage tracking sheet** kept by food preparers: Used to assess the degree of wastage of different V&F each day. |

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| | | | | | | | **Survey** with teachers: Checklist to document program implementation (lessons and activities implemented). |
| | COMPASS Study | **Breakfast** | Leatherdale (2016) | Peer-reviewed | None reported | Longitudinal quasi-experimental | **Questionnaire** with students (Grades nine to twelve): Assessed eating behaviour, tobacco use, obesity, physical activity, substance use, and bullying.<br>**School Programs and Policies Questionnaire (SPP)** completed by school administrators: Assessed presence or absence of relevant programs/policies, changes to school policies, practices and resources related to student health. |
| Prince Edward Island | Fruit and Vegetable Pilot Program | **Fruit and vegetable snack** | Taylor (2003) | Grey literature | None reported | Pre-post study | **Three-point "schematic faces" questionnaire** with students (Grades one to six): Measured food preferences and willingness to try V&F. |

* Indicates the program included a curriculum-integrated or education component.
** Indicates the program included local foods
***Indicates the program used reusable plates.
∞food waste
Abbreviations used: V&F (vegetables and fruits)

Table 3: Evaluating curriculum integrated school food programs that incorporate food system sustainability

| Indicator for sustainable school food program | Evaluation strategies identified in scoping review | Limitations and challenges | Conclusion | Next steps |
|---|---|---|---|---|
| **Social Determinants of Health** | | | | |
| **Food intake** | Twenty-four-hour recall, web-based twenty-four-hour recall, FFQ/BFQ, questionnaire, plate waste | Time-consuming and require expertise to analyze and interpret | Current methods are not feasible to use. Simplified tool is needed. | Develop a composite measure or checklist (Cade et al., 2006) that could be easily administered, analyzed and interpreted in the school context. |
| **Educational outcomes** | Grades, achievement test scores | Most standardized tests are determined provincially | Achievable if current data can be incorporated. Math (Imberman, 2012; Kleinman et al., 2002; Simeon, 1998), and reading(Imberman, 2012) scores have been used. | Identify optimal achievement score measure, grades, and timing of measure(Hochfeld et al.,, 2016) |
| **Behaviour: Attendance** | School attendance and suspension rates | Other social determinants could impact attendance - it is not specific to meal programs. | Incorporate with data they are already collecting | Determine the best time points to measure and ways to interpret (Ask et al., 2010; Imberman, 2012). |
| **Behaviour: Attention** | Interviews | It is difficult to measure attention, and it is not specific to meal programs. A measurable indicator would be easier to interpret than a qualitative assessment. | A broader, observable indicator may be easier to measure. | Design a scale to measure the degree of classroom disruptions (Friedman, 1995) |
| **Food literacy** | Survey, questionnaire, listing know vegetables and fruits, food rating | Does not fully address the complexity of food literacy | May best be evaluated through innovative curriculum integration components. | Define food literacy from a sustainability perspective and develop age-appropriate indicators (Anderson & Falkenberg, 2016; Dean et al., 2021; National Collaborating Centre of Determinants of Health, 2016; Robertson & Scheidler-Benns, 2016; Slater et al., 2018; Truman et al., 2017). |

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| **Impact on food security** | None identified | No direct cause and effect—hard to recognize in a direct way | Determine how often schools had enough food to feed everyone that wanted to eat | Develop a measurement instrument identifying the number of times per week the school had sufficient, safe, and nutritious food (National Collaborating Centre of Determinants of Health, 2016). |
| **Improving health equity** | None identified | No direct cause and effect—hard to recognize in a direct way | It may be difficult to find outcome indicators for determinants. Match program funding to the degree of vulnerability. | Identify vulnerable populations and develop strategies to assess the degree to which vulnerabilities are addressed (National Collaborating Centre of Determinants of Health, 2016). |
| **Social benefits** | None identified | No direct cause and effect—hard to recognize in a direct way | Design programs to teach about age-appropriate socialization. | Identify social activities, such as family dinners or cooking classes. Track the number of teacher role models (Perry et al., 2004) and participants in attendance. |
| **Food systems knowledge** | Survey: knowledge of local vegetables and fruits | Integrate components into the curriculum | Link curriculum to the food program. Determine the degree to which these are reflected in the classroom. | Develop age-appropriate indicators for food systems (Anderson & Falkenberg, 2016; National Collaborating Centre of Determinants of Health, 2016; Robertson & Scheidler-Benns, 2016; Truman et al., 2017), environmental, and cultural knowledge and determine the degree they are reflected in the curriculum, classroom, and school food program. |
| **Environmental knowledge** | None identified | | | |
| **Cultural knowledge** | None identified | | | |
| **Food systems and economic sustainability** | | | | |
| **Food System Sustainability** | None identified | Many potential components could be measured | Items to evaluate: composting, recycling, gardening, local food procurement, minimizing and diverting waste(Black et al., 2015). | Report on the degree of waste (waste audits) (Cohn et al., 2013; Sangster Bouck et al., 2011) and waste diversion, such as composting. Assess procurement and distribution practices. |
| **Economic sustainability** | None identified | Sustainability could refer to government-funded, cost-shared, or cost recovery. The appropriate method would depend on individual school contexts. | Programs should be adequately funded. | Determine if there is a designated coordinator with sufficient time to operate the program and enough resources to provide food to all children who want to participate. |