

Review

Monitoring foods and beverages provided and sold in public sector settings

M. L'Abbé^{1*}, A. Schermer^{1*}, L. Minaker^{2*}, B. Kelly^{3*}, A. Lee^{4*}, S. Vandevijvere^{5*}, P. Twohig^{6*}, S. Barquera⁷, S. Friel⁸, C. Hawkes⁹, S. Kumanyika¹⁰, T. Lobstein^{11,12}, J. Ma¹³, J. Macmullan¹⁴, S. Mohan¹⁵, C. Monteiro¹⁶, B. Neal¹⁷, M. Rayner¹⁸, G. Sacks¹⁹, D. Sanders²⁰, W. Snowden^{19,21}, B. Swinburn^{5,19} and C. Walker²² for INFORMAS[†]

¹Department of Nutritional Sciences, University of Toronto, Toronto, Canada; ²ProPel Centre for Population Health Impact, University of Waterloo, Waterloo, Canada; ³School of Health and Society, University of Wollongong, Wollongong, New South Wales, Australia; ⁴School of Public Health and Social Work and School of Exercise and Nutrition Sciences, Queensland University of Technology, Brisbane, Australia; ⁵School of Population Health, University of Auckland, Auckland, New Zealand; ⁶Libin Cardiovascular Institute of Alberta, University of Calgary, Calgary, Canada; ⁷National Institute of Public Health, Mexico City, Mexico; ⁸National Centre for Epidemiology and Public Health, Australian National University, Canberra, Australia; ⁹World Cancer Research Fund International, London, UK; ¹⁰Perelman School of Medicine, University of Pennsylvania, Philadelphia, PA, USA; ¹¹International Association for the Study of Obesity, London, UK; ¹²Public Health Advocacy Institute of Western Australia, Curtin University, Perth, Australia; ¹³Chinese Center for Disease Control and Prevention (CCDC), Beijing, China; ¹⁴Consumers International, London, UK; ¹⁵Public Health Foundation of India, New Delhi, India; ¹⁶School of Public Health, University of São Paulo, São Paulo, Brazil; ¹⁷The George Institute for Global Health, University of Sydney, Sydney, Australia; ¹⁸British Heart Foundation Health Promotion Research Group, University of Oxford, Oxford, UK; ¹⁹WHO Collaborating Centre for Obesity Prevention, Deakin University, Melbourne, Victoria, Australia; ²⁰School of Public Health, University of the Western Cape, Cape Town, South Africa; ²¹Pacific Research Centre for the Prevention of Obesity and Non-communicable Diseases (C-POND), Suva, Fiji; ²²Global Alliance for Improved Nutrition (GAIN), Geneva, Switzerland

Summary

This paper outlines a step-wise framework for monitoring foods and beverages provided or sold in publicly funded institutions. The focus is on foods in schools, but the framework can also be applied to foods provided or sold in other publicly funded institutions. Data collection and evaluation within this monitoring framework will consist of two components. In component I, information on existing food or nutrition policies and/or programmes within settings would be compiled. Currently, nutrition standards and voluntary guidelines associated with such policies/programmes vary widely globally. This paper, which provides a comprehensive review of such standards and guidelines, will facilitate institutional learnings for those jurisdictions that have not yet established them or are undergoing review of existing ones. In component II, the quality of foods provided or sold in public sector settings is evaluated relative to existing national or sub-national nutrition standards or voluntary guidelines. Where there are no (or only poor) standards or guidelines available, the nutritional quality of foods can be evaluated relative to standards of a similar jurisdiction or other appropriate standards. Measurement indicators are proposed (within 'minimal', 'expanded' and 'optimal' approaches) that can be used to monitor progress over time in meeting policy objectives, and facilitate comparisons between countries.

Keywords: Food provision, INFORMAS, public settings, schools.

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Address for correspondence: M L'Abbé, Department of Nutritional Sciences, Faculty of Medicine, University of Toronto, FitzGerald Building, 150 College Street, Rm 315, Toronto, ON, Canada M5S 3E2.
E-mail: mary.labbe@utoronto.ca

*Members of the writing group for this manuscript, listed in order of their contribution to the writing of the manuscript.

[†]INFORMAS is the International Network for Food and Obesity/non-communicable diseases Research, Monitoring and Action Support. All authors who are not members of the writing group are listed in alphabetical order, and contributed to discussion of the key concepts and issues raised in this manuscript as part of the first formal meeting of INFORMAS from 19 to 23 November 2012.

Background

Nutrition policies/programmes in public sector settings are important for making healthy foods more available, and they provide a way of standardizing the nutritional quality of foods offered across a jurisdiction. For the purposes of this paper, a policy is a guiding principle (or set of principles) used to meet objectives and set direction. A policy is usually established by government, government organizations or non-government organizations (NGOs), while a programme is a set of efforts or tools (e.g. specific standards or guidelines) used to address the policy and its objectives, and can be managed by diverse groups, often at the community or local level. Many public sector settings have no nutrition policies or programmes in place, and little information on the nutritional quality of foods in these settings has been collected. For those jurisdictions that have existing nutrition policies/programmes, few have evaluated available foods in relation to these. Internationally, schools seem to be the public sector setting where most efforts to implement, monitor and evaluate nutrition policies/programmes have taken place. In addition, schools have been identified as fundamental settings for establishing healthy eating patterns (1). Monitoring of other public sector settings, such as hospitals, has been conducted mainly by independent researchers (2,3) who operationalize nutrition policies differently, or have compared foods available in other settings (e.g. hospitals) to nutrition guidelines for schools (4,5).

Ideally, the nutritional quality of foods should be measured against nutrition standards (the national or sub-national set of mandatory requirements that must be met) or guidelines (similar to standards but voluntary in their application) that are established to meet the policy objectives of the particular jurisdiction. For example, nutrients of public health concern vary by country. In low- and middle-income countries (LMICs), the policy goal may be to ameliorate micronutrient deficiencies (e.g. iron, vitamin A, zinc, iodine and folate (6)); thus, feeding programmes may be designed to meet such a policy goal, which, in turn, may be implemented by guidelines or standards mainly focused on micronutrients. In high-income countries, reducing sodium or fat intake may be a priority (7), and in high latitude countries, a high prevalence of vitamin D deficiency (8) may increase political will for public sector nutrition policies/programmes. Additionally, globally, a number of key nutrients of public health concern have been identified (9,10), which may warrant broadening of current programmes to meet these identified goals; details of which are discussed in the following section.

The International Network for Food and Obesity/non-communicable disease Research, Monitoring and Action Support (INFORMAS) is a global network of public-

interest NGOs and researchers that aims to monitor, benchmark, and support public and private sector actions to create healthy food environments and reduce obesity, non-communicable diseases and their related inequalities (11). This paper introduces the food provision module of INFORMAS that seeks to answer the research question, 'What is the nutritional quality of foods and non-alcoholic beverages provided in different settings (e.g. school, hospitals, workplaces)?'. This paper focuses on monitoring food environments and nutrition policies and programmes in public sector settings, using schools as an example of one such setting. The application of the proposed monitoring framework to other public sector settings is also discussed.

In this paper, school food environments are examined in terms of both provided foods and sold foods (e.g. those available in vending machines, foods sold in cafeterias or school canteens). There are many important research areas implicated by school food environments and nutrition policies/programmes that are beyond the scope of this paper, including implications for food systems (including potential support of local food systems) (12) and associated environmental impacts and economic development (13), school gardens (14,15), boarding schools, school kitchen facilities, and availability of home economic classes and local food environments surrounding schools (16,17). Retail food environments around schools, and the nature and extent of exposure to food and non-alcoholic beverage promotions in schools are addressed in two other papers in this supplement (18,19).

The objective of this paper is to propose a global framework for monitoring foods and beverages provided or sold in public sector settings that can be used to compare and evaluate the nutritional quality of the foods, compared with specific policies/programmes within and across jurisdictions and over time, in a consistent fashion. To accomplish this objective, we firstly reviewed examples of studies across a variety of jurisdictions that have monitored the nutritional quality of school foods in relation to school nutrition standards in order to document some of the lessons learnt. Details of this review are provided in the Supporting Information. We then developed a step-wise framework for monitoring the foods and beverages provided or sold in publicly funded institutions, including details for data collection and evaluation. This included proposed measurement indicators that can be used to assess progress in meeting the nutrition standards (or voluntary guidelines, if applicable).

Existing guides for monitoring school foods are presented in Table 1. Key findings from the guides are synthesized to provide a comprehensive monitoring framework that can also be adapted for use in public sector settings more broadly.

Table 1 Available guides for implementing, monitoring and evaluating food policies and programmes in public sector settings

Jurisdiction	Guide	Description	Location online
Global	The World Health Organization's (WHO's) Global strategy on diet, physical activity and health: a framework to monitor and evaluate implementation (2008) (33)	This report recommends five steps to be taken when implementing monitoring and evaluation of any activity promoting a healthy diet (p. 8) and specifically identifies key indicators to consider for the monitoring of school foods (p. 19)	http://www.who.int/dietphysicalactivity/M&E-ENG-09.pdf
Canada	Web-based Healthy School Planner developed by the Joint Consortium for School Health in partnership with the University of Waterloo	The planner includes a self-evaluation function by schools that addresses healthy eating. Note that this planner does not provide a quantitative assessment of compliance with a nutrition policy. However, this tool may be useful to jurisdictions where a quantitative assessment is deemed onerous and unfeasible.	http://www.healthyschoolplanner.uwaterloo.ca/
United Kingdom	Audits and Inspections Toolkit. School Food Trust (2011).	This toolkit can be used to help schools and caterers evaluate available evidence of compliance with the food-based and nutrient-based standards against the recommended minimum evidence	http://www.childrensfoodtrust.org.uk/the-standards/nutrient-based/guides-and-reports/guide-to-the-nutrient-based-standards
Australia	National Healthy School Canteens Evaluation Toolkit. Australian Government, Department of Health and Ageing (2010) (28)	See the evaluation framework on pp. 7–8 and the research protocol on pp. 11–20. Note that the evaluation is based on reported compliance by Canteen Managers rather than actual compliance assessed by a third party.	http://www.health.gov.au/internet/main/publishing.nsf/content/E957A2FD2F25C36BCA2574830007BAF2/\$File/Evaluation%20Toolkit.pdf
United States	U.S. Department of Agriculture (USDA) Food and Nutrition Services (2012) SP34–2012: Child Nutrition Reauthorization 2010: Certification of Compliance with New Meal Patterns – Certification Tools, Specifications, and Prototype Attestation Statement (27)	This website provides information to support the <i>Certification of Compliance with Meal Requirements for the National School Lunch Programme under the Healthy, Hunger-Free Kids Act of 2010</i> . Section SP34–2012 provides FNS-developed Certification Tools, each of which includes a Menu Worksheet Module and a Simplified Nutrient Assessment Module.	http://www.fns.usda.gov/cnd/Governance/Legislation/nutritionstandards.htm
United States	Committee on Nutrition Standards for Foods in Schools (2007). Chapter 6 Next Steps: Implementation of School Standards: Evaluating Progress and Impact. In <i>Nutrition Standards for Foods in Schools: Leading the Way Toward Healthier Youth</i> (pp. 141–150) (54)	'While proposing a complete implementation and evaluation plan is beyond the scope of this committee, this chapter provides a framework and a set of benchmarks on which such a plan can be developed.' (p. 141)	http://www.nap.edu/openbook.php?record_id=11899&page=103

Nutrition standards for schools

The extent to which students eat meals provided at school varies between countries, from the majority of students eating meals brought from home to up to 90% eating meals provided by canteen-style services in the school (20). In addition to the provision of school meals (low or no cost meals provided by the school), students may also purchase foods and beverages from vending machines, and from school stores/canteens (21). Given their many opportunities for selling or providing foods, and the central role that schools play in children's development, changing the school food environment has been proposed as an effective approach to reducing obesity in children and youth (9).

To facilitate change, a number of key documents have called for nutrition standards in schools. In the 2004 World Health Organization (WHO) *Global Strategy on Diet, Physical Activity and Health*, governments were 'encouraged to adopt policies that support healthy diets at school and limit the availability of products high in salt, sugar and fats' (9). Agencies such as the WHO (9), the Center for Disease Control and Prevention (22), the Institute of Medicine (IOM) (23) and the WHO EU (24) have also recommended that nutrition standards be developed for all foods provided or sold in schools. Schools fulfilling certain criteria can be certified as Nutrition Friendly Schools under the Nutrition Friendly Schools Initiative of the WHO (25). This initiative is a whole of school approach that calls for healthy diet and eating practices, although it does not articulate specific standards related to the nutritional quality of foods. To date, 16 countries have pilot tested this initiative (25).

Nutrition standards determine the types of foods available in schools. In recent years, a number of policies and/or programmes regarding nutrition standards in schools have been developed and implemented by various levels of government around the world. Such nutrition standards may be set by legislation at the national (as in the United Kingdom), state/provincial (as in Australia and Canada) or local level (as in New York City before federal standards were introduced), and may vary in their application (mandatory or voluntary implementation) and monitoring criteria (e.g. from no monitoring to performing random audits to detailed assessments) (see Supporting Information Table S1, Section B). The standards may also be applied in a variety of ways: e.g. just to meals/foods served to children or available for purchase or to the whole school food environment, including sponsorship, fundraising and the use of food as rewards. The standards may also be applied at the food procurement level by the education or health authority.

The nutrition standards themselves may also vary widely in how they are developed, e.g. by reference amount of products (e.g. per serving, per 100 g or per 100 kJ) and the

basis for qualification of foods as healthful or unhealthful (e.g. the 'Choose Most, Choose Least' approach, or a graded approach such as 'Choose most, Choose Sometimes, Avoid,' or the food is either 'in' or 'out' depending on whether it meets the criteria) (see Supporting Information Table S1, Section C). The standards can also be of two different types: nutrient-based standards, which may vary by target nutrients (e.g. sodium, fat, saturated fat, dietary fibre, energy or essential nutrients), and food-based standards, which may vary in the food categories used (e.g. adherence to numbers of food guide servings or multiple food categories). For both types of standards, both processed foods and freshly prepared meals may be taken into consideration; however, for schools that provide mainly freshly prepared meals, it may be more feasible to use food-based standards alone. For example, it would be easier to determine the proportion of the meal that was whole grain or the number of vegetable or fruit servings (food-based) rather than performing a nutrient analysis (nutrient-based).

Information about available school nutrition policies and standards are collected in component I of the proposed framework (see Table 2 and Supporting Information Table S1) and will allow for the identification of international benchmarks or good practice exemplars. On their own, however, nutrition standards are not sufficient to ensure that healthy foods are provided in schools. The monitoring of adherence to the standards (component II) helps ensure they are properly implemented and achieve the desired policy objectives, and can also identify any unintended consequences (26). Such monitoring activities also contribute to accountability measures to stakeholders and government funders, and provide a basis for future actions, including the development of new or strengthened standards.

Review of previous monitoring activities of school food standards

There is a paucity of data examining the nutritional quality of foods provided and sold in schools, particularly in relation to established nutrition standards. Some nutrition standards have only been recently introduced or revised (e.g. the U.S. Department of Agriculture's Nutrition Standards for School Meals in 2012) (27), and therefore, it may be too early to evaluate the effects of these changes. Several jurisdictions, mainly developed countries, have evaluated foods provided in schools relative to their nutrition standards and are summarized in the Supporting Information (United Kingdom, France, Italy, Canada and the United States). These examples were selected as they provided a range of useful learnings (described below) that were used to establish the proposed monitoring framework. Although school nutrition standards exist in other countries, very little monitoring has been performed on a national level, or

Table 2 Monitoring methods

Component I: Policy and programme assessment and analysis (data collection detailed in Supporting Information Table S1, Sections A–E)

Search for information (including contact with policymakers) on nutrition policies/programmes and nutrition standards or guidelines associated with the policies/programme in public sector settings

Literature search, key informants, government or organization responsible for development of nutrition programme (e.g. Ministry of Health or Ministry of Education)

Component II: Monitoring policy and programme implementation in public sector settings (data collection detailed in Supporting Information Table S1, Sections F–I)

Time frame

At least 12 months after implementation, and then periodically thereafter, or after any significant changes

Sampling design

Nested survey design (randomly or by applying the probability-proportional-to-size ([PPS] approach*):

1. Select representative regions within the country (e.g. rural and urban, different language or cultural regions).
2. Within each region, select neighbourhoods that represent the diversity of the region (e.g. low, medium and high income)
3. Within each neighbourhood, select a subsample of schools – at least 10–20 schools at each school level (e.g. primary, middle and secondary)

Note that a successful sampling design should consider available local input and country statistics.

Point of contact

Contact school principals, administrators and foodservice providers (e.g. canteen managers) via telephone, Internet, in person or other survey technique (which could be fairly broad in distribution)

*In PPS sampling, larger clusters have a higher probability of being sampled. Apply this method if auxiliary information (number of schools and students in each school) is available (e.g. from Ministry of Education) or, alternatively, census data can be used. It can be applied at each level of sampling.

even on a state/provincial level, and major gaps exist where monitoring has occurred, particularly in LMICs (see Supporting Information: Public Health Nutrition Special Issue on School Foods). Furthermore, some jurisdictions have monitored whether schools reported implementation of a programme, but have not objectively assessed compliance (e.g. Queensland, Australia).

Key lessons learnt

The timing of monitoring compliance with nutrition standards is important. Low compliance may indicate a short lead time between introduction of the standards and evaluation. Therefore, it is recommended that evaluations are conducted at least 12 months following the introduction of policies/programmes, as suggested in Australia's National Healthy School Canteens Evaluation Toolkit (28). Time for proper implementation may need to be increased if the setting is known to typically offer mostly unhealthy food choices before the introduction of standards, although earlier evaluations will determine if at least some improvements have been made.

Ideally, monitoring should be overseen by independent reviewers rather than relying on self-reported data from schools or food providers. The examples from France (29) and the United Kingdom (30) showed that actual

compliance can be much lower than reported compliance. The experiences from Rome, Italy, indicate that the ability to take appropriate corrective action if a vendor or third party does not meet the contractual obligations can be an effective lever to improving compliance over time (31).

The introduction of nutrient-based standards alone can inadvertently lead to the introduction of replacement foods that are low in nutritional quality, such as replacement of unhealthy items with highly processed foods that, although reduced in fat and sugar, remain energy-dense and nutrient-poor (as seen in the United States (32)). Nutrition standards that incorporate both food and nutrient requirements (such as those in the United Kingdom (20)) may help overcome this issue. In Australia, nutrient criteria are used to differentiate between 'red' (unhealthy) and 'amber' products, while food-based standards based on the Australian Guide to Healthy Eating are used to distinguish 'amber' and 'green' (healthy) products.

Taking into consideration the lessons learnt from the monitoring activities of various countries, as well as the WHO's *Global strategy on diet, physical activity and health: a framework to monitor and evaluate implementation* (pp. 8, 19) report (33), and by synthesizing key elements of existing monitoring guides (Table 1), we propose a monitoring framework to assist countries with monitoring public sector foods. The type of monitoring will

depend on the policy/programme and the nutrition standards or voluntary guidelines that are in place. Therefore, it is likely that monitoring will vary somewhat by jurisdiction and the associated nutrients of public health concern. The framework also takes a global perspective as it can be used both by countries that have and have not established nutrition standards or guidelines or monitoring frameworks. The overall aim of this framework is to create a consistent and graded system (with progressively more detail, dependent on resource availability) for monitoring to allow comparisons within a jurisdiction over time and between jurisdictions, and ultimately improve the quality of foods in publicly funded institutions.

Proposed monitoring framework and indicators

The following steps are recommended for monitoring the foods sold or provided in publicly funded institutions and can be divided into two components. The purpose of component I is to describe the nutrition standards or guidelines that are in place to implement specific policies or programmes within these settings or sectors. The purpose of component II is to evaluate the nutritional quality of the foods and beverages sold or provided in these settings or sectors. For institutions that include both foods sold and provided, the evaluations could be conducted separately if needed (foods sold are evaluated separately from foods provided). The resulting data should inform the implementation of policies/programmes and monitoring systems in individual countries or regions. Table 3 provides details relative to 'minimal', 'expanded' and 'optimal' monitoring activities. Given the step-wise nature of the proposed framework, efforts can be undertaken to move towards 'optimal' levels of monitoring activities based on the resources and expertise within a given jurisdiction.

Component I: policy and programme assessment and analysis

This component involved a search for information on nutrition policies/programmes in place and associated nutrition standards or guidelines.

Survey design

Descriptions of food nutrition policies/programmes within a jurisdiction can be compiled by performing a literature search and gathering information from key informants and government departments (national and/or sub-national) or organizations responsible for the development of these policies/programmes (see Table 2).

The following information should be documented to describe the policy environment (see Supporting Information Table S1 for specifications). Note that some of the sections in component I may not be applicable to certain

jurisdictions (for guidance on collecting applicable information, see Supporting Information Table S1: Guide to Completing Components I and II).

1. Nutrition policies/programmes: Identify nutrition policies/programmes that exist within the country (see Supporting Information Table S1, Section A). Ideally, a country should have nutrition policies/programmes for a variety of public settings at national or sub-national level. Of interest to school food environment assessments are policies and programmes related to provided foods (e.g. through school feeding programs) and sold foods (including within school canteens, exclusive pouring rights agreements with soft drink companies and vending machine availability). School policies on food on field trips and fundraising, food safety (e.g. access to free and safe drinking water, and staff training policies) and nutrition curricula are of additional interest for monitoring purposes.

2. Details of policy/programme: Identify the approach used for each policy/programme. Ideally, each policy/programme should include nutrition standards, resources to guide implementation and a monitoring framework. Participation in the programme should be mandatory rather than voluntary (see Supporting Information Table S1, Section B). Also, it is important to identify whether the policy/programme applies to both foods provided and sold, or only to foods provided.

3. Nutrition standards: Identify the type of nutrition standards (or voluntary guidelines) used in the programme, if any (see Supporting Information Table S1, Section C). Ideally, a nutrition programme should include age-specific requirements, and both food group-based and nutrient-based programme standards.

- Food group-based standards: Describe the food group standards used in the programme, including the recommended *quantity* of food group servings and the recommended *quality* of foods within each food group and other food compositional criteria, as applicable (see Supporting Information Table S1, Section D). Describe also the basis of the food group standards (i.e. per serving or per 100 g). Ideally, the programme should base its food group standards on national food group guidelines and global or national nutrient intake recommendations (i.e. by converting nutrient intake recommendations to the appropriate proportions of food group servings).

- (i) Foods to encourage and limit: Ideally, food group-based standards should be set for both 'healthy' foods, or foods to encourage, and 'unhealthy' foods or foods to limit. Foods to encourage would include fruits and vegetables, milk and alternatives, meat and alternatives, and grain products, while foods to limit would include foods that are high in calories, sugar, fat or salt.

Table 3 Step-wise framework for monitoring foods provided or sold in public sector settings

	'Minimal' approach	'Expanded' approach*	'Optimal' approach*
Indicators	<p>Jurisdictions with nutrition standards/guidelines:</p> <p>% of schools or other publicly funded institutions that implemented the policy or programme (Supporting Information Table S1, Section H)</p> <p>% of schools or other publicly funded institutions complying with the policy or programme (Supporting Information Table S1, Section H)</p>	<p>Jurisdictions with/without nutrition standards/guidelines:</p> <p>% of schools or other publicly funded institutions that implemented the policy or programme (Supporting Information Table S1, Section H)</p> <p>% of schools or other publicly funded institutions complying with the policy or programme (Supporting Information Table S1, Section H)</p> <p>% of foods provided and sold meeting food group- or nutrient-based standards (Supporting Information Table S1, Section I)</p> <p>% of schools or other publicly funded institutions meeting food group- or nutrient-based standards (Supporting Information Table S1, Section I)</p> <p>Foods or standards most or least compliant (Supporting Information Table S1, Section I)</p> <ul style="list-style-type: none"> For food group-based standards, report on a sub-set of either key foods to encourage and/or key foods to limit (Supporting Information Table S1, Section D) For nutrient-based standards, report on key nutrients (Supporting Information Table S1, Section E) 	<p>Jurisdictions with/without nutrition standards/guidelines:</p> <p>% of schools or other publicly funded institutions that implemented the policy or programme (Supporting Information Table S1, Section H)</p> <p>% of schools or other publicly funded institutions complying with the policy or programme (Supporting Information Table S1, Section H)</p> <p>% of foods provided and sold meeting food group- and nutrient-based standards (Supporting Information Table S1, Section I)</p> <p>% of schools or other publicly funded institutions meeting food group- and nutrient-based standards (Supporting Information Table S1, Section I)</p> <p>Foods or standards most or least compliant (Supporting Information Table S1, Section I):</p> <ul style="list-style-type: none"> For food group-based standards, report on both foods to encourage and foods to limit (Supporting Information Table S1, Section D) For nutrient-based standards, report on key nutrients and other nutrients (Supporting Information Table S1, Section E) <p>Qualitative assessment of food products relative to food-based and/or nutrient-based standards (Supporting Information Table S1, Section I)</p>
Data source	Self-reported from schools or caterers via telephone or internet	Self-reported or Third party review or On-site visits	Third party review or On-site visits
Settings	Schools only (primary and secondary)	Schools, day cares and/or preschools	Schools, day cares and/or preschools Other public sector settings such as hospitals, workplaces, universities and prisons (see Table 4)
Sampling method	Collect data for the most representative locations/sites	Collect data for representative locations/sites in an increased number of geographical areas	Collect data at multiple representative locations/sites across a broad range of geographically and socioeconomically diverse areas (see Table 2 for guidance)

*Jurisdictions without nutrition standards or guidelines may still use the expanded or optimal approach by assessing the nutritional quality of foods relative to the standards of a similar jurisdiction or other authoritative body or other appropriate standards used for defining 'healthy'.

(ii) Proposed benchmarks: Regarding programmes serving one meal per day, the foods served or at least the menus planned should provide at least one-third of the national recommended number of food guide servings for core food groups and adjusted accordingly if snacks are provided. This is based on the assumption that people generally eat three meals per day. Therefore, if a programme serves two meals per day, the foods served should be providing at least two-thirds of the recommended number of servings.

(iii) Absence of food group-based standards: If the country does not have food group-based standards, they should consider the development of such standards using the WHO/Food and Agriculture Organi-

zation (FAO) 1998 report, Preparation and Use of Food-Based Dietary Guidelines, as a guide (pp. 30–39) (34). Note that several technical reports were written after this document that are specific to certain jurisdictions (35).

- Nutrient-based standards: Describe the nutrient standards used in the programme, including the minimum and maximum levels set for each nutrient as well as any differences in nutrient levels within or between food groups, if applicable (see Supporting Information Table S1, Section E). Ideally, a nutrient-based programme globally (and nationally) should use a standardized approach to setting 'healthy' levels for nutrients (e.g. the amount of sodium that is used to include or exclude foods from being sold) and deciding

on a standardized process to set them, although there will be regional differences in key nutrients of concern.

(i) Key nutrients to monitor include energy, total fat, saturated fat, sodium, (total or added) sugars and important micronutrients (e.g. in countries with a high prevalence of deficiencies).

(ii) Proposed benchmarks: Similar to the proposed benchmarks for food group-based standards, for programmes serving one meal per day, the foods served or at least the menus planned should provide at least one-third of the national recommended intakes and less than one-third of the upper level, appropriate to the age group.

(iii) Absence of nutrient-based standards: In the absence of global or national standards, levels such as those recommended by the UK Government in the School Food Trust's Guide could be adopted: *A guide to introducing the Government's food-based and nutrient-based standards for school lunches* (36). At a global level, nutritional requirements as established by the WHO in collaboration with the FAO of the United Nations should be used as a basis for evaluating such standards (35).

Component II: monitoring policy and programme implementation

Survey design

It is recommended that the quality of the food environment is measured against the jurisdiction's nutrition standards (or voluntary guidelines). If nutrition standards/guidelines are not available, the nutritional quality of foods can be compared with standards from a similar jurisdiction, other authoritative body or other appropriate standards used for defining 'healthy' foods and beverages. Ideally, the evaluation should be conducted at least 12 months after implementation using a third party review, which may include government agencies or other organizations. These evaluations should be conducted periodically thereafter to allow adjustment of the policy/programme over time, or after any significant changes occur in the food environment or to the policy/programme itself. Furthermore, administrative data quantifying the number or proportion of the population that is participating in, or complying with the policy/programme, should be collected on a regular basis.

For monitoring of school food environments, as the number of schools in a country is likely very large, a representative sample of schools should be selected based on a random or proportionate-to-size nested survey design to ensure representation of the population (see Table 2 for details). The choice of sampling frame should consider available local input and country statistics. Information on compliance and menu offerings may be collected from principals, administrators and/or foodservice providers via

telephone, Internet, in person or other survey techniques. Evaluations of foods actually provided or sold can be evaluated through on-site visits of a representative number of schools, as described in the survey design (see Table 2).

Evaluations of the food environment should document the following information (see Supporting Information Table S1 for specifications):

1. Status of monitoring: Ideally, each policy/programme should have its own monitoring framework with monitoring data available (see Supporting Information Table S1, Section F).

2. Details of monitoring data: The monitoring data available should ideally have sampled a representative portion of the population using a third party review.

- Overview of available monitoring data: Sources and types of monitoring data should be compiled. This will aid in the selection of the most relevant data or synthesizing multiple sources of complementary data (see Supporting Information Table S1, Section G).

- Minimal data: The data should quantify the number or proportion of the population that is participating in, or complying with the programme (i.e. number and percentage of participating sites and number and percentage of individuals attending the schools participating in or complying with the programme standards). This is particularly important where participation is voluntary (see Supporting Information Table S1, Section H).

- Recommended data ('expanded' and 'optimal' approaches): A more detailed monitoring system should also assess the nutritional quality of foods using both: (i) *food group*-based assessments and (ii) *nutrient*-based assessments. Ideally, this should be measured relative to the nutrition standards used by the jurisdiction (or relative to a similar jurisdiction or other appropriate standards). An assessment can include both quantitative components and qualitative aspects where appropriate. Recommended monitoring should be based on the foods planned (e.g. menus) or based on the actual foods that were provided or sold. Financial and logistical constraints often limit the feasibility of assessing the latter. Further considerations are detailed below (see Supporting Information Table S1, Section I).

3. Details regarding assessment of the nutritional quality of foods: This assessment may be carried out in various ways. One of the ways assessments may differ is whether they are relative or not relative to nutrition standards or guidelines (see Supporting Information Table S1, Section G). The literature review showed Manitoba, Canada, as an example of a jurisdiction that assessed the nutritional quality of foods, not relative to any standards, but by reporting on the top 10 foods sold (37). Assessments may also differ by reporting quantitative and/or qualitative

information (see Supporting Information Table S1, Section I). *Quantitative assessments* are preferred and may include the proportion of foods meeting nutrition standards, the proportion of schools meeting standards and/or provide details concerning the foods or standards most or least compliant. *Qualitative assessments* may describe the food environment based on interviews with those in the environment (e.g. school pupils or canteen managers) or based on third party inspections. Lastly, assessments may be based on the foods planned (i.e. menu analysis from several meal cycles) or based on the actual foods provided or sold.

Discussion

Much of the extant public sector monitoring of food provision has been insufficient and inconsistent, and the methods used do not facilitate global monitoring. The aim of such a global monitoring programme is to contribute to improved nutritional quality of foods provided and sold in public sector settings by raising awareness of key issues in individual jurisdictions and comparing jurisdictions across time and place. This paper has proposed a step-wise monitoring framework for assessing food environments in public sector settings, using schools as a case study. Data collection and evaluation is performed in two components: (i) (policy/programme analysis) compiling information on existing nutrition standards/guidelines within settings/sectors and (ii) evaluation of the nutritional quality of foods provided and/or sold in publicly funded institutions. Table 4 discusses key considerations in adapting the proposed monitoring framework for use in other public sector settings, including day-care centres, universities, hospitals, workplaces and prisons. Several notable public sector nutrition policies or recommendations exist, including the U.S. Centres for Disease Control's Workplace Health Promotion Nutrition policies (38), federal government food procurement standards (22), and the WHO's Prisons and Health: Nutrition recommendations (39).

The public sector is controlled by local, state/provincial or national governments, and public sector activities are generally funded through tax revenues. Therefore, public and political support will be required to successfully implement any public sector monitoring programme. A key feature that will influence public support in a given jurisdiction is the population served by the institution. Public support seems high for policies/programmes supporting healthy eating for children in Australia (40–42), the United Kingdom (43) and Europe (44,45), although regulations may be less supported than health promotion interventions for children or providing information for adults (46). The general public is more likely to attribute children's obesity to external factors compared to adult or senior citizens, for whom they are more likely to attribute obesity to internal factors (e.g. eating too much) (47). Therefore, public

Table 4 Key factors to consider in adapting the school food environment monitoring framework to other public sector settings

Factor	School	Day care or preschool	University	Hospital	Workplace	Prison
Population served	Children	Infants and children	Adults/young adults	Patients	Government employees	Inmates
Likely political will to develop or implement food or nutrition policy	High	High	Low	Medium	Low – Medium	Lowest
Possible partnerships for monitoring	Local health departments, parent committees	Local health departments, parent committees	Staff unions, student unions, workplace health committees, insurance companies	Staff unions, workplace health committees, insurance companies	Staff unions, workplace health committees, insurance companies	On-site medical staff
Stakeholders	Students, parents, teachers and school staff, foodservice providers, caterers, school boards, ministries of health or education, companies with contracts for exclusive pouring/vending rights	Children, parents, staff, foodservice providers, ministries of health or education	Foodservice providers, students, staff, retail food outlets on campus, campus housing staff, ministries of health or education, companies with contracts for exclusive pouring/vending rights	Foodservice providers, retail food outlets, patients, hospital staff, visitors, ministries of health, companies with contracts for exclusive pouring/vending rights	Staff, foodservice providers, companies with contracts for exclusive pouring/vending rights, ministries of health or corrections	Inmates, prison staff, foodservice providers, ministries of health or corrections

support might be greatest for nutrition policy/programme implementation and monitoring in public sector settings that serve children (e.g. schools and day cares) relative to settings that serve adults. Among adults, public support for nutrition policy/programme monitoring and implementation may also vary based on population served. For example, public support may be higher for nutrition policies at hospitals than at prisons, based on public opinion about the populations served by each institution.

In some countries, assessing the implementation of, or adherence to, nutrition standards presents a considerable challenge. For example, in Canada, the nature of food services varies within provinces and school districts, and many smaller private caterers do not have the resources or food composition data to assess compliance with the standards. Monitoring is also likely to be difficult in jurisdictions where food is not centrally provided by schools. In these settings, the ad hoc nature of school food provision, which may be provided by small independent businesses, would be more difficult to assess.

While low- and high-income countries may differ substantially in their absolute financial capacity to implement and monitor nutrition policies/programmes, their relative capacity (i.e. the extent to which nutrition policy/programme implementation and monitoring competes with other policy/programme priorities) may be similar. Because nutrition policies/programmes will compete with other priorities, organizations interested in implementing or monitoring nutrition policies/programmes in public sector settings should engage in networking with some of the possible partnerships for monitoring identified in Table 4. For example, health insurance companies may be interested in working to monitor nutrition environments in workplaces and hospitals, given that nutrition environments influence the diet, health and potentially long-term healthcare utilization of the populations served. Indeed, large health insurance companies including Bupa (United Kingdom) (48) and Kaiser Permanente (United States) (49) have developed workplace nutrition programs to improve nutrition environments. In Ontario, Canada, a regional public health department developed a toolkit for employers to implement and monitor healthy eating environments in their workplaces (50); such a programme could be adopted by both public and private sector workplaces. For schools, local public health departments may be interested in partnering with school boards to create, implement and monitor nutrition policies/programmes in day cares and schools. In an era of cost-containment and competing priorities, it is essential to make use of possible or existing partnerships or networks for action.

Finally, increasing public support for public sector nutrition policies/programmes funded through tax revenue will be crucial for moving this field forward. It has been argued that an increase in support for obesity prevention (particu-

larly nutrition policies/programmes) may require reframing obesity as caloric overconsumption (which itself is a logical response to 'obesogenic' food environments) (51), and presenting the public with evidence on the external influences on obesity (52). Employing the stages identified in the International Obesity Task Force's framework for evidence-based obesity prevention (53) may facilitate increased public support for public sector nutrition policies/programmes and monitoring.

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Conflicts of interest

Bruce Neal is the Chair of the Australian Division of World Action on Salt and Health (2007–present), was a Member of the Pepsico Global Scientific Advisory Board (2010–2012), was the Independent Adjudicator for the Australian Responsible Marketing to Children's Initiative (2009–2010) and holds funding from the Australian Food and Grocery Council as part of a National Health and Medical Research Council of Australia Partnership project (2010–2014). The other authors declare that they have no competing interests.

Supporting information

Additional Supporting Information may be found in the online version of this article, <http://dx.doi.org/10.1111/obr.12079>

Table S1. Guided approach to monitoring the foods provided or sold in publicly funded institutions.

Appendix S1. Details of previous monitoring activities of school food programs.

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