STUDY PROTOCOL

Barriers and facilitators to the implementation of nutrition standards for school food: a mixed methods systematic review protocol [version 1; peer review: 1 approved, 2 approved with reservations]

Breda O'Mahony1,2, Claire Kerins2, Celine Murrin3, Colette Kelly4

1Home Economics Department, St. Angela's College, Sligo, Ireland
2Discipline of Health Promotion, National University of Ireland Galway, Galway, Ireland
3School of Public Health, Physiotherapy and Sports Science, University College Dublin, Dublin, Ireland
4Health Promotion Research Centre, School of Health Sciences, National University of Ireland Galway, Galway, Ireland

Abstract

Background: The importance of nutrition during childhood and the high prevalence of child and adolescence obesity has resulted in several countries implementing nutritional standards for school food as a way of providing healthy school food environments. Yet there has been less focus on the barriers and facilitators influencing the process of implementing school food standards. This mixed methods systematic review aims to address this evidence gap by synthesising the empirical evidence on the factors that may influence implementation of school food standards.

Methods: This mixed methods systematic review will use qualitative, quantitative and mixed methods evidence from peer reviewed publications retrieved from the following databases; PubMed, CINAHL, Scopus, EMBASE, PsycINFO and Web of Science. Grey literature will be accessed through Google Scholar, Open Access Theses and Dissertations, OpenGrey, RIAN, ETHOS, ProQuest, WorldCat, Networked Digital Library of Theses and Dissertations, and public health organisation websites will also be accessed. Screening reference lists and citation chaining of all included studies will also be undertaken. No restrictions on publication date or language will be applied, however, only primary research studies relevant to supply-side stakeholders will be eligible for inclusion. Study quality will be assessed using the Mixed Methods Appraisal Tool. Study titles and abstracts will be screened to decide whether the full text manuscript should be retrieved. For screening reliability, a second review author will assess a random sample of 20%. Kappa statistics will be used to assess inter-rater reliability, with values of 0.75 and higher representing high agreement. Two authors will independently extract data and factors reported to influence implementation. This will be synthesized using the Theoretical Domains Framework.

Discussion: A comprehensive understanding of these factors can provide
guidance to relevant stakeholders to enhance the adaption, implementation and sustainability of nutrition standards for school meals. 

**Systematic review registration:** PROSPERO CRD42019117904

**Keywords**
Mixed methods, Systematic review, Barriers, Facilitators, School meal standards, School food guidelines, Implementation, Schools

This article is included in the Maternal and Child Health collection.

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**Corresponding author:** Breda O’Mahony (b.omahony6@nuigalway.ie)

**Author roles:**
- **O’Mahony B:** Conceptualization, Funding Acquisition, Methodology, Writing – Original Draft Preparation, Writing – Review & Editing;
- **Kerins C:** Conceptualization, Methodology, Writing – Original Draft Preparation, Writing – Review & Editing;
- **Murrin C:** Conceptualization, Methodology, Writing – Original Draft Preparation;
- **Kelly C:** Conceptualization, Funding Acquisition, Methodology, Supervision, Writing – Original Draft Preparation, Writing – Review & Editing

**Competing interests:** No competing interests were disclosed.

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Abbreviations
McSH, Medical Subject Headings; MMAT, Mixed Methods Appraisal Tool; PRISMA-P, Preferred Reporting Items for Systematic Reviews and Meta Analysis Protocols; PROSPERO, International Prospective Register of Systematic Reviews; TDF, Theoretical Domains Framework

Background
Schools are a key setting for the promotion of health and well-being. They are one of the most effective ways of reaching a large segment of the population, with no other institution having as much continuous contact and influence during the first stages of their life.

One of the many ways that schools can support health is by the food that they provide. Good nutrition is associated with academic performance, psychological well-being and school attendance. Up to a third of a child’s daily micronutrient intake can come from a school lunch. Additionally school meals can provide between 20 to 70% of a child’s energy requirements, thus further strengthening the need for healthy school meals. Coupled with this, is a high prevalence of obesity among young people and the critical influence schools can play in supporting active living, healthy diets and body weight. This has resulted in many governmental school-based nutrition initiatives and policies, including nutrition standards for school meals being adopted. However, the effectiveness of school based policies on childhood and adolescence nutrition and obesity depends on their implementation, which is often less than optimal, even when these policies are obligatory.

To date, a number of countries and regions around the world have introduced nutrition standards for school food on a mandatory basis. These include Sweden in 1997, Finland in 1943, Norway in 2001, Slovenia in 2010, a reintroduction of compulsory guidelines after 21 years in England in 2001 and an updated National School Lunch Programme in America in 2012, which will be phased into all schools by 2023.

Differences exist in the provision of school food in Europe and internationally, and even from school to school within countries. Providing school food that meets nutritional guidelines or standards is complex. Some countries provide school meals for all their students, regardless of their socio-economic environment, whilst in other jurisdictions the responsibility lies with the individual school. Other factors that contribute to the complex provision of school food include ensuring canteens make a profit and organisational implications for principals; for example, contracts between food operators and schools, agreed based on the provision of catering infrastructure in schools.

Critical stakeholders involved in the implementation of food based guidelines are supply-side stakeholders, i.e. food service directors, catering managers and staff, school management, programme coordinators and contracted catering suppliers. Some of the factors related to implementation in schools include: difficulties associated with preparing and serving fresh food at school; inadequate canteen facilities; spending excessive time completing funding applications; and the requirement of staff training around the food guidelines. Positively, in contrast, caterers in the UK found the food standards relatively easy to achieve. However, there has been little synthesis of this research, particularly from the perspective of supply-side stakeholders.

Developing and improving strategies to increase supply side stakeholders conformity of school meal standards requires a comprehensive understanding of the factors that enable and hinder implementation. One such framework that can allow us to apply theory to comprehensively identify factors that need to be addressed is the Theoretical Domains Framework (TDF). The TDF was developed from 128 theoretical constructs from 33 theories that were perceived to be most relevant to implementation questions. It was first published in 2005 but later validated in 2012 (version 2 (v2)). It has been used in numerous reviews to understand barriers and facilitators to a wide variety of behaviours. Such reviews include implementation of dietary guidelines in early childhood education centres in Australia and barriers and facilitators to the implementation of physical activity policies in schools. The framework (v2) provides 14 domains, which can capture a range of factors that influence implementation outcomes. These include knowledge, skills, memory, attention and decision processes, behavioural regulation, social/professional role and identity, beliefs about capabilities, optimism, beliefs about consequences, intentions, goals, reinforcement, emotion, environmental context and resources, and social influences.

A number of studies have identified various factors, however, to the best of our knowledge, there has been no previous systematic review undertaken in this area. Seward and colleagues’ systematic review analysed the implementation of dietary guidelines, however this was in relation to childcare services. Given this evidence gap, the primary aim of the systematic review is to collate the factors that influence the implementation of nutrition or food standards for school food provision in primary and post primary settings (children aged 5–18 years). The use of the TDF will ensure a comprehensive range of implementation factors are examined. Using a theory provides a strong foundation for policy development, in contrast to simply identifying the barriers and facilitators. Understanding these factors from a theoretical perspective will provide a list of modifiable factors to target. This will help to inform future planning, improve uptake and practice of standards. Essentially, this review can guide policy makers, researchers and individuals responsible for devising and implementing nutrition standards in schools.

Review objectives
The primary objective is to identify and synthesise the existing evidence on the barriers and facilitators to implementing food or nutrition standards for school food from supply-side stakeholders. A secondary objective may include comparing the barriers and facilitators between a primary and post primary school setting.
Methods
This mixed methods systematic review is registered with the international database of prospective systematic review; Prospective Register of Systematic Reviews (PROSPERO): CRD42019117904 (25th June 2019). The Preferred Reporting Items for Systematic Reviews and Meta-Analysis Protocols (PRISMA-P) checklist has been assessed in the preparation of this protocol (see Reporting guidelines)\(^4\). The review will be conducted in accordance with PRISMA statement guidelines.

Study eligibility criteria
The PICOS acronym (Population, Intervention, Comparison, Outcome and Study design) will be used to select study criteria, as described below. PICOS was selected due to achieving a comprehensive search with greater sensitivity than specificity\(^4\).

Population. To be eligible for this review, studies have to include data which focuses on stakeholders who have a role in the implementation of nutrition or food standards or guidelines for school food within primary and post primary school settings. This refers, but is not limited to catering management and staff, school principals/managers, contracted catering suppliers, food service directors and managers, programme coordinators. It will also include studies that allude to officials from government organisations that may influence food provision in schools e.g. policy makers. As this is an international review and to avoid differences that exist from country to country, e.g. age, all types of primary and post primary schools will be included (Junior, Elementary, Middle, Secondary, Senior and High school). Standards in pre-schools and third level settings will not be included. Furthermore, studies involving school children’s perceived barriers and facilitators will also be excluded.

Intervention. We will include studies of interventions delivered in educational establishments where the standards for school food have been implemented on a voluntary or mandatory basis. This includes food and nutrient standards for all meals and snacks provided in schools. There will be no restriction on the type of standard i.e. nutrient and food based standards will be included. Studies on school nutrition polices and healthy eating interventions will not be included, unless such policies and interventions are based on school meal standards. Similarly, studies on health promoting schools will not be included unless data specific to school based standards can be extracted.

Control. Whilst no comparator is being studied in this review, studies will not be excluded on the basis of having a comparator or control group.

Outcome. The primary outcome will include any barrier or facilitator to the implementation of nutrition and food based standards for school food. For this review, we will use a similar definition that Kerins et al. applied in a systematic review protocol\(^4\). A barrier is defined as any variable that impedes or obstructs the implementation of nutrition standards, whereas a facilitator is defined as any variable that eases and promotes the implementation of nutrition standards. The findings will include the following: (i) verbatim quotations from research participants; (ii) excerpts, quotations or entire passages from studies using documentary analysis; (iii) narrative descriptive summaries of results; and (iv) statistical analyses from surveys and questionnaires. A secondary outcome may include comparing the barriers and facilitators between a primary and post primary school setting.

Study design. We are conducting a mixed method systematic review, therefore quantitative, qualitative and mixed method studies will be accessed. The rationale for this choice is to capture a comprehensive understanding of the factors that affect implementation. This may include, but is not limited to, the following studies which use appropriate methods of data collection and analysis (i) qualitative studies; case studies, grounded theory, ethnography, action research studies (ii) quantitative studies; case control studies, quasi-experimental studies, randomised controlled trials, cross sectional studies and (iii) mixed methods (combining qualitative and quantitative methods of data collection and analysis); focus groups, interviews, surveys, questionnaires, observation. This review will disregard editorials, commentary and opinion pieces.

Language. There will be no restriction on language.

Publication year. There will be no restriction on publication year.

Search strategy
A search of peer reviewed literature combining, where possible, published search filters for school meals, barriers or facilitators, will be undertaken. Guidance of an experienced librarian and discussion amongst the review team will also take place to inform the strategy. Broad search terms will be used to garner greater sensitivity than specificity so as to ensure a comprehensive search is undertaken\(^4\). Databases relating to various fields, including education, food, and nutrition will be used. Each search strategy will be database specific and will include applicable elements such as Medical Subject Headings (MeSH) (or equivalent), truncation, Boolean operators and will be adapted where appropriate. Initial searching searches will be undertaken by the lead review author to refine the search strategy. Table 1 illustrates a sample search strategy for the CINAHL database. The following electronic databases will be searched: PubMed, CINAHL, Scopus, EMBASE, PsycINFO and Web of Science.

To identify published government reports and other grey literature, searches through Google Scholar, Open Access Theses and Dissertations, OpenGrey, RIAN, EThOS, ProQuest, WorldCat, Networked Digital Library of Theses and Dissertations, and public health organisation websites will also be undertaken. Furthermore, this minimises the influence of publication bias. To identify any additional studies, the reference lists of all included studies will be screened to retrieve additional eligible articles\(^4\). All search results will be reviewed for eligibility, except in the case of Google Scholar where the first 200 citations will be screened. A priori decision to screen the first 200 hits on Google Scholar, as sorted by relevance, was decided after considering the time required to screen each hit\(^4\). The lead or corresponding authors for all included studies will be contacted (via email with
two attempts) so as to identify on-going or unpublished research studies that may be relevant to this review. To ensure that the search strategy is undertaken in a systematic way, a memoing method will be used to record the working notes when conducting preliminary searches as well as documenting the protocol-driven search strategy.47

Study selection

Data management. EndNote X9 will be used to manage references throughout the review. Once the searches have been carried out, the search results will be exported to EndNote. This will identify any duplicates, which will then be removed.

Screening. Search results will be imported into an online systematic review software, Rayyan. This will enable screening, data extraction and quality assessment. This will be undertaken after a piloted, clear and detailed set of inclusion and exclusion criteria has been drawn up (see Extended data). The lead author will screen study titles and abstracts to decide whether the full text manuscript should be retrieved. For screening reliability, a second review author will assess a random sample of 20%. Kappa statistics will be used to assess inter-rater reliability, with values of 0.75 and higher representing high agreement.48 Each study will be categorised into (a) potentially meeting the eligibility criteria or (b) not meeting the eligibility criteria. For all potentially eligible studies, full text manuscripts will be obtained. A full-text screening process will then commence by two independent reviewers, which will then produce a final set of papers to be included in the review. In situations where the study eligibility cannot be resolved via consensus, a third review author will be consulted. A flow diagram will be completed to record the numbers of papers through each stage of the search and screening process, as recommended by the PRISMA guidelines.49

Data extraction. Two review authors, not blind to author or journal information, will independently extract from all the full text studies that fulfil the inclusion criteria, using a data extraction form. To ensure validity and reliability, a pilot be will undertaken to allow the review authors to compare data extraction and implement modification, if required. Data to be extracted will include, but is not limited to, the following: (a) key study information, (b) a coding manual with definition for each of the 14 TDF constructs (c) new themes (d) the quality assessment criteria. Key study information will include author(s), title, year of publication, country, language, study type (qualitative, quantitative and mixed methods), study design (education setting/school type), participant characteristics (principal, catering staff, catering provider), sample size, data collection and analysis methods. Data on the factors affecting implementation will be extracted from the results and discussion sections of the included studies. This will include exact participant quotes, excerpts, quotations or entire passages from studies using documentary analysis, narrative descriptive summaries of results and statistical analysis from surveys and questionnaires. If any discrepancies arise during this process, they will be resolved through discussion with a third reviewer.

Quality assessment/risk of bias

Quality appraisal will be conducted by two independent reviewers, using the Mixed Methods Appraisal Tool (MMAT) (2018 version). This assessment tool was selected as it is used to efficiently appraise the most common methods and methodologies i.e. qualitative, quantitative and mixed methods studies, with few generic quality criteria.46 Additionally, the tool was designed to appraise the methodological quality of studies in a mixed methods systematic review and not the quality of report writing.47 The MMAT focuses on methodological criteria and includes two screening questions and nineteen questions corresponding to the following five categories of study design; qualitative research, randomized controlled trials, non-randomized studies, quantitative, observational descriptive, and for mixed methods studies.48 For each study type, reviewers will quality score using a MMAT table. When disagreements between reviewers cannot be easily resolved, a third independent reviewer will be required and a will be reached consensus reached post discussions.

Data synthesis

Barriers and facilitators reported to influence implementation will be synthesized using the TDF. This framework can allow us to apply theory and comprehensively identify factors that need to be addressed.44 The TDF includes 14 theoretical domains synthesized from 33 behaviour changes theories and 128

Table 1. Sample CINAHL title and abstract search strategy.

<table>
<thead>
<tr>
<th>Search number</th>
<th>Search string</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>recommend* OR guideline adherence [mh] OR guidance* OR protocol* OR nutrition policy [mh] OR strategy* OR standard* OR nutrition [mh] OR health promotion [mh]</td>
</tr>
<tr>
<td>#2</td>
<td>school lunch* OR school meal* OR canteen* OR food services [mh] OR school food OR menu planning [mh] OR food program* OR school* meal* program* OR school dinner*</td>
</tr>
<tr>
<td>#3</td>
<td>school*</td>
</tr>
<tr>
<td>#4</td>
<td>#1 AND #2 AND #3</td>
</tr>
</tbody>
</table>

Mh MeSH headings
implementation of school meal standards. To the best of our knowledge, this is the first systematic review of this type, and that uses the TDF. We are confident that the depth of this review will provide a holistic understanding of the factors as all types of studies; qualitative and quantitative or both, including grey literature, will be accessed. Furthermore, there will no language or publication date restrictions. The review will follow academic rigour and will include a number of strategies for validity, reliability and to reduce the effects of bias. This will be achieved by having clear and detailed inclusion and exclusion criteria, independent reviewers, the use of PRISMA guidelines, a MMAT, and by using computer packages for data and quality management. Finally, where deviations from this protocol occur, this will be justified and discussed in the systematic review upon publication and will be documented on PROSPERO.

Study status
This study has not yet commenced.

Discussion
The internal school food environment is considered to have a significant influence on student’s food consumption\(^{20}\). It is believed that over 35% of their energy is obtained at school\(^{21}\). Moreover, in many instances a school meal may be the only complete meal that students have access to\(^{22}\). In response to the need of schools to play a more supportive role in obesity prevention\(^{23}\), many jurisdictions have implemented policies and practices, one of which is food or nutrition standards for school meals\(^{13,24}\).

It is believed that the UK has the most comprehensive set of nutritional standards for school meals. However, the implementation of these standards has not necessarily resulted in better consumption and nutritional outcomes\(^{25}\). Therefore, it is important to evaluate the process, to aid the full implementation of nutrition standards. Implementation evaluation measures the results from a process\(^{26}\) and enables the transformation of policy plans into action\(^{27}\). However there are many individual, environmental and socio cultural factors that can affect the successful implementation of policies\(^{28}\). This is particularly pertinent to schools which are complex, with numerous factors that can influence implementation\(^{29}\), the quality of implementation and the expected outcomes of the policy\(^{30}\). The use of the TDF provides a holistic approach as it considers the complex interaction of the how and why\(^{31}\), which must be taken into account when considering how nutrition standards for school meals are implemented in school settings.

Given the potential impact that school meal guidelines and standards can have on the health and wellbeing outcomes of children and adolescents, understanding the factors that affect their implementation is key. This mixed methods review will address this evidence gap and will provide a comprehensive account of the barriers and facilitators that affect the implementation of school meal standards. To the best of our
References


18. Uradni list RS: Zakon o solski prehrani (ZSoliPre-1), Ljubljana. 2001. Reference Source


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Open Peer Review

Current Peer Review Status: ⚫ ⚫ ⚫

Version 1

Reviewer Report 20 July 2020

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Sze Lin Yoong
School of Medicine and Public Health, University of Newcastle, Callaghan, NSW, Australia

Thank you for the opportunity to review this protocol. It is clear and well-conducted.
I have provided some minor comments below for the authors to consider:

1. In the introduction, it may be worth including information on the lack of implementation of food-based guidelines routinely to highlight the challenges with implementing these guidelines and thus enforce the rationale for this review.

2. Some of the rationales for using the TDF may not be relevant to the study. For example, you say that using the TDF will ensure a range of factors examined, but this is only relevant if it is examined in the primary study. Perhaps it is sufficient here to say that using the TDF to synthesis findings provides you with a way of identifying theoretical constructs to target in the development of interventions.

3. The review has two aims – the second aim is not clearly addressed in the methods and synthesis. Are you planning to do this in a subgroup analysis?

4. Repopulation – will you include vocational/technical schools (post-secondary schools) or is this excluded?

5. You say that studies including children’s perceived barriers will be excluded – is this because these are demand focused interventions. Or that children are not involved in implementing food standards? Please provide a rationale.

6. Can you provide a definition or specific example of what constitutes a food standard?

7. The search string looks reasonable although I’m not sure you need a third category (for school only) if your search #2 includes school in most of the search terms. Will you be exploring your mesh headings?
8. Can you provide more information about coding and extraction according to the TDF and how that will be done?

9. Can you add how the second aim will be analysed/explore? Are you exploring barriers by different subgroups? Are you describing your finding narratively or in tabular form?

**Is the rationale for, and objectives of, the study clearly described?**
Yes

**Is the study design appropriate for the research question?**
Yes

**Are sufficient details of the methods provided to allow replication by others?**
Partly

**Are the datasets clearly presented in a useable and accessible format?**
Not applicable

**Competing Interests:** No competing interests were disclosed.

**Reviewer Expertise:** Implementation science, child nutrition, systematic review

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Reviewer Report 13 July 2020

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**Katie A. Weatherson**
Faculty of Medicine, University of British Columbia, Vancouver, BC, Canada

The review will address an important question- how to improve the implementation of food and nutrition standards/policies in schools. In general, the study protocol is clearly written and the use of the TDF to categorize barriers and facilitators is a useful addition. I have the following points to clarify the study and overall methodology:

**Abstract:**

- Keywords: suggest adding ‘nutrition’

**Background:**

- Clarify “their”. E.g., Children, youth.
• Be consistent with use of term “school-based” and “supply-side”. In some places you do not use hyphens.

• Paragraph 3 – This section would benefit from a few concrete details of existing nutrition or food standards for school food (meals/snacks). I suggest adding a couple of examples.

• Add citation: “…difficulties associated with preparing and serving fresh food at school;”

• Paragraph 6 – suggest adding definition of ‘implementation’.

• Add citation : “…later validated in 2012 (version 2 (v2)).”

Methods:
• Inclusion criteria – does this include standards for snacks sold in vending machines at school or breakfast programs?

• “The findings will include the following: (i) verbatim quotations from research participants; (ii) excerpts, quotations or entire passages from studies” – change to “may include”

• Outcome sub-section, last sentence: this is a secondary outcome of your review, not of the studies you are including in your review. Revise.

• “The lead author will screen study titles and abstracts to decide whether the full text manuscript should be retrieved. For screening reliability, a second review author will assess a random sample of 20%. Kappa statistics will be used to assess inter-rater reliability, with values of 0.75 and higher representing high agreement.” What will happen in cases of disagreement? Full article will be screened?

• Data extraction sub-section: Revise. You will be extracting barriers and facilitators, NOT a coding manual. “Data to be extracted will include, … (b) a coding manual with a definition for each of the 14 TDF constructs…”.

• Also, revise “study design (education setting/school type).” Education setting/school type does not reflect study design. Based on your secondary outcome, you should be extracting Education setting (e.g., primary or post primary) data.

• Please provide a rationale for why barriers and facilitators will be extracted from both the results and the discussion sections of included articles. It seems a more valid approach would be to only extract data from the results section, as the discussion section is where authors compare their findings in light of other literature. Extracting information from the discussion would likely lead to double extraction of the same barrier/facilitator (and thus greater emphasis placed on these factors), and/or errors in extraction (extracting results from other comparative studies).

• I also suggest adding more specific details about extraction for qualitative vs quantitative studies. For example, in qualitative studies, results are often presented as themes, with individual quotes used to highlight the theme. Will both the theme and the individual quotes be extracted? In quantitative studies, will all findings be extracted, irrespective of how many participants agreed/reported that the barrier/facilitator existed (i.e., frequency)? I see now that you have reported this under data synthesis – however, I suggest adding to data extraction sub-section. It is
important to think through how extracted data will be quantified in your review.

- Quality assessment sub-section: the last sentence does not make sense.
- Data synthesis sub-section: I recommend adding specific mention of the coding manual in this section. Will only one author code the extracted barriers/facilitators to the TDF domains?

Discussion:
- Paragraph 3 – Add sentence about specific evidence gap before referring to it in sentence two.

Is the rationale for, and objectives of, the study clearly described?
Yes

Is the study design appropriate for the research question?
Yes

Are sufficient details of the methods provided to allow replication by others?
Yes

Are the datasets clearly presented in a useable and accessible format?
Not applicable

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: My research primarily focuses on the implementation and effectiveness evaluation of initiatives aiming to improve the health of populations. Specifically related is a review of factors influencing the implementation of physical activity policies in schools.

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Reviewer Report 21 May 2020
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Suzanne Spence
Human Nutrition Research Centre, Population Health Sciences Institute, Faculty of Medical Sciences, Newcastle University, Newcastle upon Tyne, UK

This is an interesting and well thought through concept for a systematic review. I am not an expert in systematic review methodologies and therefore cannot comment in great detail on that aspect. Overall, the rationale is clear, I have a few wider comments for the authors to consider for this review.
**Objectives:**
- The authors have a primary objective to identify and synthesise the existing evidence on the barriers and facilitators to implementing food or nutrition standards for school food from supply-side stakeholders. Would you please clarify the term supply-side stakeholders: does this include school caterers, headteachers, school business managers, and canteen staff too?
- The authors also mention a secondary objective may be included to compare the barriers and facilitators between a primary and post-primary school setting. I think this objective should be included from the outset - primary schools are very different settings to secondary schools/academies and will be an important aspect of the review to reflect this in the analysis and discussions.

**Population:**
The authors are excluding studies that involve school children’s perceived barriers and facilitators – is it possible to give a rationale for excluding children’s perceptions?

**Intervention/Methods:**
If possible, if the authors could provide some clarification on the following points about the intervention that would be helpful. The authors note they will include studies:
- Where interventions delivered in educational establishments and school food standards have been implemented on a voluntary or mandatory basis.
- No restriction on the type of standard i.e. nutrient and food-based standards will be included.
- And the international span of countries

How do the authors intend to explore/take into account the effect of the difference between voluntary and mandatory on barriers/success of implementation – these are quite different approaches to implementation.
Similarly, food and nutrient-based standards vary globally re requirements/complexity – how will country effect be captured in review? Both complexity of standards and variation by country may well influence the barriers/success of the implementation of standards.
While there is a clear overview/outcome of data extraction for the qualitative component I am unclear about the outcome for the quantitative aspect, is it an effect on nutrition, children’s diets, etc. A bit more clarification for the quantitative outcome is required.

**Is the rationale for, and objectives of, the study clearly described?**
Yes

**Is the study design appropriate for the research question?**
Yes

**Are sufficient details of the methods provided to allow replication by others?**
Yes

**Are the datasets clearly presented in a useable and accessible format?**
Not applicable

**Competing Interests:** No competing interests were disclosed.
**Reviewer Expertise:** Public Health Nutrition, children's dietary intake, policy evaluation of school food and nutrient standards

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

**Author Response 17 Jun 2020**

**Breda O'Mahony**, St. Angela's College, Sligo, Ireland

Dear Dr. Spence,

Thank you for agreeing to be part of the peer review process for this manuscript. We are grateful for all your comments and suggestions on our manuscript. We have carefully considered the comments and have responded to each comment below.

We hope that our response has provided some clarity which will ultimately improve the quality of the manuscript.

Yours Sincerely,

Breda O’ Mahony

**Comment 1**
This is an interesting and well thought through concept for a systematic review. I am not an expert in systematic review methodologies and therefore cannot comment in great detail on that aspect. Overall, the rationale is clear, I have a few wider comments for the authors to consider for this review.

**Response 1**
Thank you for your positive comments in relation to the concept and rationale for this systematic review.

**Comment 2**
Objective 1: The authors have a primary objective to identify and synthesise the existing evidence on the barriers and facilitators to implementing food or nutrition standards for school food from supply-side stakeholders. Would you please clarify the term supply-side stakeholders: does this include school caterers, headteachers, school business managers, and canteen staff too?

**Response 2**
The reviewer’s interpretation of supply side stakeholder is correct. The term supply side stakeholders refers, but is not limited to catering management and staff, school principals/managers, contracted catering suppliers, food service directors and managers, programme coordinators (this is outlined under paragraph ‘Population’ on page 4). Studies involving school children’s perceived barriers and facilitators will not be included. Furthermore, standards in pre-schools and third level settings will also be excluded.
Comment 3
Objective 2: The authors also mention a secondary objective may be included to compare the barriers and facilitators between a primary and post-primary school setting. I think this objective should be included from the outset - primary schools are very different settings to secondary schools/academies and will be an important aspect of the review to reflect this in the analysis and discussions.

Response 3
Thank you for this suggestion. We did not explicitly commit to this comparison as it is dependent on the number of studies retrieved. The manuscript will be amended and will read: “A secondary objective is to compare the barriers and facilitators between a primary and post primary school setting”.

Comment 4
Population: The authors are excluding studies that involve school children’s perceived barriers and facilitators – is it possible to give a rationale for excluding children’s perceptions?

Response 4
This is a valuable point, however we believe that this would greatly expand the focus of this systematic review. This systematic review is focused on supply side stakeholders rather than demand-side stakeholders (i.e. students). However, we acknowledge that student’s perceptions and experiences are key, as they are at the core of the standards. Upon completion of this systematic review, the authors intend to undertake research on student’s experiences of the food standards.

Comment 5
Intervention
If possible, if the authors could provide some clarification on the following points about the intervention that would be helpful. The authors note they will include studies:
Where interventions delivered in educational establishments and school food standards have been implemented on a voluntary or mandatory basis.

Response 5
The authors aim to capture all internationally suitable research that relates to the implementation of school food standards. After carrying out a preliminary scoping search, it illustrated that some schools implemented food standards on a voluntary or mandatory basis, e.g. in response to national or regional policy. The scoping search also identified studies where school food standards were voluntarily implemented for research purposes. Such studies will also be included.

Comment 6
If possible, if the authors could provide some clarification on the following points about the intervention that would be helpful. The authors note they will include studies:

No restriction on the type of standard i.e. nutrient and food-based standards will be included
Response 6
After conducting a preliminary search to inform the protocol and systematic review, we found that some jurisdictions used the term nutrient standards (or similar deviations) whilst other jurisdictions used the term food based standards (or similar deviations). Both terms are relevant as they focus on food provision. Nutrient standards are based on limits and promotions of various nutrients whereas food based standards set requirements on what food can and cannot be served and how frequently (Haroun et al., 2011). To ensure all suitable studies are captured, this has been reflected in the eligibility study criteria for inclusion/exclusion. Our eligibility criteria clearly rules out studies based on dietary guidelines, healthy eating policies etc.

Comment 7
If possible, if the authors could provide some clarification on the following points about the intervention that would be helpful. The authors note they will include studies:

And the international span of countries

Response 7
The authors decided rather than selecting certain jurisdictions, to expand and capture all suitable international research on nutrient or food based standards. For this reason, we decided not to apply an English language restriction.

Comment 8
How do the authors intend to explore/take into account the effect of the difference between voluntary and mandatory on barriers/success of implementation – these are quite different approaches to implementation.

Response 8
Due to similarities in responses between comment 8 & 9, the response to comment 8 will be outlined under response 9.

Comment 9
Similarly, food and nutrient-based standards vary globally re requirements/complexity – how will country effect be captured in review? Both complexity of standards and variation by country may well influence the barriers/success of the implementation of standards.

Response 9
The authors acknowledge the implementation is context dependent and have noted to ensure that this forms part of the key information. As part of data extraction and testing of the synthesis, the authors will include the intervention type (i.e. nutrient, food standard) and type of implementation (intervention, voluntary or mandatory participation) and study setting (primary or post primary) as part of data extraction and testing of the synthesis. The authors also recognise that different types of supply-side stakeholders (i.e. canteen staff, school principal) may report different barriers and facilitators to implementation of menu labeling. We will ensure that this forms part of the testing synthesis.

Key study information will include study title, name of the first author, year of publication, country of study, language, study type (qualitative, quantitative and mixed methods studies), intervention type, etc.
type (e.g. food standards, nutrient standards), type of implementation (voluntary or mandatory participation), study setting (primary, post primary, academies etc.) and participant characteristics (canteen staff, head teacher, contracted catering suppliers, food service directors and managers, programme coordinators etc.), sample size, data collection and analysis methods. Data on intervention effects/outcomes, such as change in children’s dietary habits will not form part of this review. The outcome that forms part of PICOS are the barriers and facilitators to the implementation of nutrition standards for school meals.

Moreover, a sensitivity analysis will be conducted in order to determine if the synthesis is sensitive to the following: study design, quality assessment, intervention type (e.g. food standards, nutrient standards), type of implementation (voluntary or mandatory participation), study setting (primary, post primary, academies etc.) and participant characteristics (canteen staff, head teacher, contracted catering suppliers, food service directors and managers, programme coordinators etc.) and location (e.g. Europe, America, Australia). As barriers and facilitators to implementation are highly context-dependent, the sensitivity analysis will be an important step in assessing if the synthesis is sensitive to contextual factors such as intervention type, implementation type and time of data collection.

Comment 10
While there is a clear overview/outcome of data extraction for the qualitative component I am unclear about the outcome for the quantitative aspect, is it an effect on nutrition, children’s diets, etc. A bit more clarification for the quantitative outcome is required.

Response 10
For quantitative studies the proportion of respondents (study participants) that identified each barrier/facilitator will be extracted, coded and mapped against the Theoretical Domains Framework. Study participants will be listed so as to be able to discern between the various supply side stakeholders. To provide some context on the extent of the barrier/facilitator, the frequency of each factor reported within studies will also be calculated. This information will be added to the manuscript.

**Competing Interests:** No competing interests were disclosed.