Nutrition Services, Population and Public Health

Evidence Review: Nutrition-related Chronic Disease Prevention Interventions

A review of the effectiveness of various universal population health promotion nutrition interventions for adults (≥18 years)

Full Report

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Alberta Health Services

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Supplemental documents such as the one page summary and executive summary are available: Nutrition-related Chronic Disease Prevention Interventions. The literature synthesis report (100+pages) is available by request via email: publichealthnutrition@ahs.ca

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Executive Summary

Poor nutrition is a leading risk factor for chronic diseases such as heart diseases, diabetes and cancer[1]. Most Canadians are not eating well.[2] For example, 2 out of 3 Canadians are not meeting recommendations for vegetables and fruit intake, an indicator of unhealthy eating.[2] Low vegetables and fruit intake alone results in over 3 billion dollars in direct healthcare and indirect costs each year.[3]

About this report

Canadians' food choices are affected by their food environment and preferences.[4] This evidence review synthesizes findings from 90 systematic reviews (SR) on 13 universal population health promotion nutrition interventions that target the adult population (18 years+). The literature synthesis and conclusion statements were reviewed by AHS and external content experts to ensure accuracy in their interpretation and synthesis.

It aims to support individuals and organizations with priority setting or planning for actions that promote healthy eating and, in turn, reduce the risk of chronic diseases.

Key findings

- Taxes and subsidies, changes to the food environment, trans-fat regulations, and multi-component interventions are effective in changing nutrition intake and behaviour.
- Interventions should be included as part of multi-component strategies to increase positive impact on nutrition outcomes

Suggested actions based on findings

- Support the development of regulatory and fiscal food & nutrition policies led by municipal, provincial and federal governments.
- Lead and/or collaborate to promote the adoption of policies and initiatives to improve the food environments using effective interventions identified in the report.
- Plan interventions using evidence informed best practices. This includes conducting a situational analysis specific to the context of the targeted population or community.
- Incorporate evaluation into planning to measure intended outcomes and unintended effects, which strengthens the evidence base for practice.
- Explore opportunities to complement existing knowledge and skill building interventions with environmental interventions that makes it easier for individuals to implement changes.
- Explore targeted population health interventions to support the needs of those at higher risk of chronic diseases.

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Background

This report provides a summary of the effects of various population level interventions that aim to reduce nutrition-related chronic disease. It uses current evidence to answer the following questions:

- Which universal population health promotion interventions are recommended to improve *healthy eating behaviors* of adults (≥18 years)?
- Which universal interventions are recommended for the *primary prevention of chronic diseases* amongst adults, through improved nutrition outcomes?

The findings from this report will help inform chronic disease prevention stakeholders (CDP) in Alberta, primarily decision makers, policy and program planners in the community, health organizations and different levels of government, of the current evidence on nutrition related CDP interventions. The information can also help stakeholders initiate discussions about collaboration opportunities with their partners and inform decisions related to priority setting and planning for actions that promote healthy eating and prevent chronic disease.

Literature reviewed:

- Assessed the effect of different types of interventions. Exploration of various implementation practices was not included in this review.
- Evaluated interventions on their ability to improve nutritional knowledge, attitude and behavior or clinical indicators for chronic disease.
- Focused on interventions targeted towards the general population.
- Focused on literature where the results would be applicable to the Alberta context.

Universal Population Approach

A universal population approach is designed to apply to an entire population. "Eligibility and access are based simply on being part of a defined population[5]."

Targeted Population Approach

A targeted population approach is intended to apply to a priority sub-group within the broader, defined population. "Eligibility and access to services are determined by selection criteria, such as income, health status, employment status, age, gender or neighbourhood[5]."

Implication on practice

Readers are encouraged to use this report as a first step for intervention planning, to select appropriate intervention based on evidence, opportunity, roles and capacity. Once this has been done, readers are recommended to undertake a situational analysis around the identified intervention, to support its planning and design specific to their target population. Decisions about implementation should reflect the local contexts and the target population's

needs and priorities. Additional evidence is needed to identify interventions targeted to sub-groups, including populations at higher risk of poor health outcomes.

Note: Background information on the burden of disease from poor nutritional intake is available in *The burden of chronic disease and associated risk factors* report prepared by AHS PPIH CDPOH Integration & Innovation team with contributions from NS.

Findings

The information in this section reflects the current evidence and considerations for each category of intervention. A review of implementation approaches for each intervention (e.g. programs, policies, campaigns) was not undertaken as part of this review. How an intervention is implemented should reflect the needs and context of each target population and community, therefore, readers are recommended to complete a situational analysis, specific to their population group and community, to inform implementation planning.

Interventions identified through the search strategy:

- Trans-fat regulations
- Food taxation and subsidies
- Restaurant interventions
- Menu labelling
- Vending machine interventions
- Food/grocery store interventions
- Workplace interventions
- Post-secondary interventions
- Community gardens
- Financial incentives programs
- Education interventions
- Collective kitchens
- Mass media campaigns

Nutrition interventions that have been evaluated but not reviewed in a SR are not included in this review. Interventions reviewed were not mutually exclusive. For example, interventions used for setting based approaches may include menu labelling or food taxation, which were examined in separate reviews.

The dimensions considered to formulate conclusions and the conclusion statements for interventions are described in Table 1. They are aligned with *A framework for analyzing public policies* from the National Collaborating Centre for Healthy Public Policy.[6]

Table 1. Dimensions considered to formulate conclusions & conclusion statements	
Dimensions	Description
Effectiveness	What effects do the intervention have on nutrition outcomes (i.e. knowledge, attitude, behavior or clinical indicators)? How strong or consistent is the evidence?
Unintended effects	What are the unintended effects of the intervention?
Equity	What are the effects on different groups, in particular individuals of lower socioeconomic status (SES)?
Other considerations*	
Cost	What are the financial costs of this intervention, as noted in the SRs? Note that the actual cost will vary based on the design of the intervention as tailored to the needs of a community.
Feasibility	What are some challenges with implementation, as noted in the SRs? Is this intervention technically feasible?
Acceptability	How does the population targeted for behavior change (e.g. customers or participants) perceive this intervention? Is it acceptable to them? This review did not examine the perspectives of other stakeholders such as supporting agencies or operators.
* While noted where reported in SRs, the dimensions of cost, feasibility, and acceptability will vary based on implementation approaches. Hence only the dimensions of effectiveness, unintended effects, and equity were included in the formation of conclusions.[6]	
Conclusion statements	
Recommend	Consistent evidence on the effects of the intervention. Benefits outweigh risks with respect to other dimensions considered.
Suggest	Promising evidence on the effects of the intervention. Benefits generally outweigh risks with respect to other dimensions considered.
Do not suggest	Lack of evidence to support – mixed evidence or no direct evidence available on the effects of the intervention in the SRs reviewed. Risks may outweigh benefits with respect to other dimensions considered.
Do not recommend	Consistent evidence on the ineffectiveness of the intervention. Risks outweighs potential benefits with respect to the other dimensions considered.

Effects of nutrition interventions

The evidence for each intervention is summarized in below. A list of abbreviations used are outlined in Appendix A. A full synthesis of the literature reviewed and data extraction tables with references is available for each intervention in *Nutrition-related chronic disease prevention interventions: a review of the effectiveness of various universal population health promotion nutrition interventions for adults, literature synthesis.* Readers are encouraged to review this document for detailed information about the findings.

Insert table on each page

Table 2 summarizes the conclusion statements for all interventions reviewed. While the effects on nutrition outcomes outlined below are specific to the intervention reviewed, the results may provide transferable learnings for similar policies or interventions. For example, the effects of regulations on trans-fat may inform regulations on sodium content in the food supply, which was not reviewed as part of this report.

Conclusion	Interventions & effect on nutrition outcomes
Recommended (Consistent evidence; benefits outweigh harm)	*Leads to behaviour change* • Fiscal policy (taxes or subsidies on food & drink) • Pricing interventions in vending machines and food/grocery stores • High proportion of healthy foods in vending machines (>50%) • Multi-component or environmental interventions in workplaces • Mass media campaigns as part of a multi-component strategy • Mandatory regulations to limit industrially produced TFA content in foods (will be implemented in Canada in 2018) • Education interventions for individuals with risk factors only, but not for the general population
Suggested (Promising evidence; benefits outweigh harm)	*Leads to behaviour change* • Menu labelling as part of a multicomponent strategy • Multi-component interventions in food/grocery stores • Multi-component interventions in post-secondary settings
Not suggested (Lack of evidence to support – mixed evidence or no direct evidence available)	• Point of purchase information at vending machines and food/grocery stores to shift purchases as a sole intervention • Education interventions for sustained behaviour changes for general population (without risk factors) • Community gardens for nutrition related outcomes • Collective kitchens for nutrition related outcomes
Not recommended (Consistent evidence on ineffectiveness; risks outweigh benefits)	• Financial incentive programs for sustainable weight loss • Community gardens to reduce the prevalence of household food insecurity • Collective kitchens to reduce the prevalence of household food insecurity

Discussion

Nutrition interventions that target the population as a whole (i.e. universal) vary in their effects on nutrition outcomes and primary chronic disease prevention. Findings from this review indicate that regulatory, fiscal, environmental and multi-component interventions are the most effective in decreasing the risk for chronic disease at a population level. These types of interventions are considered to be more upstream and are recommended to be undertaken as part of multi-component strategies to promote healthy eating and chronic disease prevention.

These findings align with current perspectives on behaviour change and health promotion, which frame individual behaviours as an interplay between personal and external influences. Food choices are affected by the determinants of health, which include an individual's food environment, knowledge and skill, food preferences, and resources. As identified in this report, regulatory, fiscal and environmental interventions are the most effective in changing nutrition behaviours. They act on the food environment (e.g. foods available nationally and locally, food prices, food preferences and attitudes towards healthy eating in the community) and increases the opportunity and capacity of all individuals for healthy eating. Their effectiveness is strengthened when undertaken as part of a multi-component strategy, to address the myriad of factors that affect eating behaviours through complementary and synergistic interventions.

When selecting interventions for population health promotion, it is also important to examine their effects on healthy equity. More upstream interventions that affect the availability or accessibility of healthy and unhealthy foods in the environment, such as regulations on trans-fat content or taxes and subsidies on less healthy foods, are not only more effective for primary prevention at the population level, their ability to impart benefits on a population level makes them less likely to widen the health gap based on socio-economic status compared to individual focused downstream interventions.[8]

Three levels of nutrition interventions are described below:

Upstream interventions address socio-economic structure or environmental factors that affect the availability and accessibility of healthy and unhealthy foods. Examples include regional, municipal or organizational level policies such as national regulations on trans-fat content, taxes on less healthy foods, procurement policies.[9,10]

Midstream interventions promote healthy eating through influencing food norms.[9]

Downstream interventions seek to change behaviours through harm reduction strategies at the individuals or families level (e.g. building skills and knowledge on nutrition through education classes).[9,10]

While interventions that target individual behaviours, such as education programs and providing nutrition information at the point of purchase, are effective for individuals with known clinical risk factors for chronic diseases or individuals who are more health conscious, they exert limited effects on the general population. Firstly, they rely on individuals' motivation for change. Secondly, regardless of the quality of the knowledge and skill building intervention, it is difficult for individuals to make changes when they are still living in the same environment and exposed to the multitude of messages, norms and access to unhealthy foods that played a role in the food choices they made. Without changes to these environmental and social influences, by means of midstream and upstream interventions, individuals have to rely on their knowledge, motivation, and resources to make changes, which can be difficult. Accordingly, findings from SRs suggest downstream interventions are less impactful for individuals of lower socioeconomic status (SES) as they are less able to change and sustain their behaviour without adequate socio-economic and environmental supports compared to individual of higher SES, who have more resources that enable change.[8] Thus, knowledge and skill building interventions, such as menu labelling interventions, when implemented as a sole intervention may risk widening the health gap between those who are of higher SES or more health conscious and those are not. This reinforces the importance of incorporating downstream individual level interventions within a broader multi-component strategy that includes interventions that improve the physical and social food environment. Furthermore, a comprehensive analysis of the risk and benefit of each intervention is recommended to determine the intended and unintended effects prior to implementation.

A healthy food environment is essential towards making healthy eating easier for all, regardless of knowledge, attitude and motivation for healthy eating. Regulatory, fiscal, and environmental interventions, which are more upstream, are recommended for prevention of nutrition-related chronic diseases. While outside the scope of this evidence review, it is important to support upstream national and provincial policies, such as income and employment related policies, which affect an individual's resources for healthy eating (e.g. money to spend on food or equipment for cooking) and act to reduce health inequities in order to make healthy eating possible for everyone.

Based on the findings, actions to promote healthy eating and prevent chronic diseases include:

- Support the development of regulatory and fiscal food and nutrition policies led by government and organizations through participation in consultations.
- Lead and/or collaborate to promote the adoption of policies and initiatives to improve the food environment using effective interventions identified in this report.
- Plan interventions using evidence informed best practices. This includes conducting a situational analysis specific to the context of targeted population or community.
- Plan and develop interventions through evidence informed best practices. This includes a situational analysis and exploring unintentional effects of intervention specific to the targeted population or community.
- Incorporate evaluation into planning to measure intended outcomes and unintended effects, which strengthens the evidence base for practice.
- Explore opportunities to complement existing knowledge and skill building interventions with setting- based interventions that makes it easier for individuals to implement their learnings as part of a multi-component intervention.
- Explore targeted population health interventions to support the needs of those at higher risk of chronic diseases, which includes addressing underlying social determinants of health that affect their ability to eat healthfully.

Conclusions

Nutrition interventions differ in their effects on nutrition outcomes for the general population. Overall, the evidence is strongest for upstream interventions such as regulatory, fiscal, environmental and multi-component strategies. How an intervention is implemented will affect its effectiveness, cost, and acceptability to the stakeholders, therefore implementation should be guided by a situational analysis of the specific needs and characteristics of the target group or community.

Lastly, reducing health inequality is a priority of population health. While this evidence review presented some universal strategies which have been found to be effective in narrowing the health gap, further exploration of targeted population health interventions is warranted to support the needs of those at higher risk of chronic diseases, such as individuals of low SES and Indigenous populations, to improve nutritional outcomes. Together, the combination of universal and targeted population approaches can help reducing the prevalence of chronic disease across the whole population.

Methods

One member of the NS PPH Strategy Team was responsible for developing this evidence review. Consultation and discussions with other team members were completed at each stage to ensure consensus on decisions made. Content experts were identified and engaged to review the findings and recommendations for sections relevant to their areas of expertise. This process assured accuracy in the interpretation of the literature. More details about the methods used, including the search terms and strategy, are available in the *Primary Prevention of Chronic Disease in the Adult population: a review of the effects of various universal population health promotion nutrition interventions, Literature Synthesis.*

Search Strategy

The scope of this literature review is limited to systematic reviews (SR) published between January 2010 and April 2016. The literature on this topic is vast; including only SR allowed assessment the whole body of literature to inform decision-making in a time efficient manner. Only SRs published after January 2010 were included in the review, as literature published prior to this time would have been captured by the 2010 PPH Nutrition Evidence Summary.

Search terms and parameters were determined by members of the NS PPH provincial team based on the 2010 NS PPH Evidence Summary. They were refined with an AHS librarian who subsequently retrieved articles using the strategy discussed. Figure 1 illustrates the Article identification process.

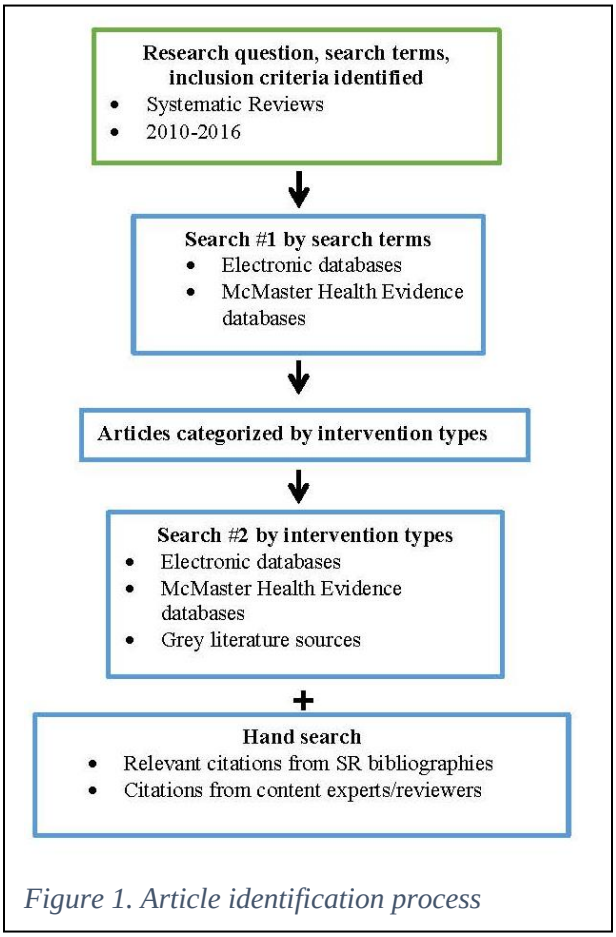

Figure 1. Article identification process

Article selection

A multi-step process was undertaken to exclude SRs at the title, abstract and full text reading stages. Figure 1 outlines the process used to identify SRs.

Quality appraisal

Each SR was critically appraised using the *A Measurement Tool to Assess Systematic Reviews* (AMSTAR) tool[11]. The

majority of SRs were medium or low quality. Common limitations which reduced the quality ratings of the SRs include publication bias (i.e. did not include unpublished studies or grey literature in their review) and conflict of interest (i.e. funding sources of articles reviewed not examined). After reviewing the rating of available SRs, a decision was made to include SRs of all quality (high, medium and low) in this evidence review to obtain a more comprehensive scan of all current findings for each intervention.

Appendix B outlines the results of the article retrieval, selection and quality appraisal process. A full list of included and excluded SRs and the quality ratings for included SRs are available upon request.

Data extraction

The characteristics of each SR, its AMSTAR rating, findings on outcomes, and conclusions were recorded in a summary table. The nutrition-related health outcomes reported by SRs were themed and categorized by their effects on knowledge, attitude, behaviours and clinical indicators. Though not nutrition specific, social outcomes reported for collective kitchens and community gardens were also summarized in this report; social outcomes were commonly reported in the SR reviewed and are interventions that NS are often asked to provide guidance on.

Data synthesis

The effects of an intervention on nutrition outcomes were synthesized in the summary of findings. Where SRs provided conflicting evidence, conclusions were weighted in favour of the highest quality SRs based on the AMSTAR rating. For the majority of interventions, conclusions reported by SRs, regardless of level of quality, were consistent.

To validate the results from the published literature, findings were compared to the grey literature from reputable organizations (e.g. WHO, Health Canada, university publications, Dietitians of Canada). This reduced the risk of publication bias. In addition, the literature synthesis was reviewed by AHS and external content experts to ensure accuracy in the interpretation. Expert reviewers were identified for each intervention using snowball sampling. Their feedback was incorporated into the final document.

Findings and conclusions

The *Framework for analyzing public policies*[6] from the National Collaborating Centre for Healthy Public Policy (NCCHPP) is a comprehensive framework to inform public health decisions. It was used to guide data synthesis and development of conclusion statements. As the framework is intended for policy analysis, adaptation was necessary to make it applicable for the analysis of interventions (Table 1). Conclusion statements for each intervention were primarily informed by its effect on nutrition outcomes as determined through the literature

review, as well as its impact on health equity and unintended effects. To align with the NCCHPP framework, information about acceptability, cost and feasibility were noted where reported in SRs to help inform implementation. However, these dimensions were not considered in the formulation of conclusion as impacts will vary based on where and how interventions are being implemented. The recommendations were shared with expert reviewers for each respective intervention to confirm the final conclusions.

Stakeholders within AHS NS, AHS Strategic Clinical Networks, CDPCC and the Alberta Policy Coalition for Chronic Disease Prevention (APCCDP) were engaged to review and provide feedback on the clarity of the final report. Their feedback informed the content and layout of the final report.

Limitations

Limitations of this evidence review include:

- Limiting to systematic review articles and excluding primary research studies

  The advantage of including only systematic reviews to assess the whole body of literature is to inform decision-making in a time efficient manner. However, it was possible that recently published, high quality studies were not included within the SRs reviewed, which may impact the conclusions. Content experts were consulted to identify any current landmark studies that were not identified and should be considered in the review.

- Including low and medium quality SRs in this review

  High quality SRs appraise the quality of included studies and formulate conclusions based on the strength of the evidence. However, this approach may not be practiced with as high a rigor by lower quality SRs, which decreases the reliability of their findings.

  While excluding low and medium quality SRs in this evidence review would have increased the strength of the findings, with few high quality review articles and randomized studies available for public health interventions, a decision was made to include SRs of all quality (high, medium and low) in this evidence review. This decision provided a more comprehensive scan of the state of the evidence. Several steps were taken to mitigate risks of misrepresenting the available evidence:

  1) The reviewer commented on the quality of studies within the literature synthesis and included the quality rating of each SR in the data extraction table. Available in the *literature synthesis* report.

  2) Conclusions were weighted in favor of higher quality SRs.

  3) Content experts were consulted to review conclusion to ensure it reflects the current state of evidence.

- Reviewer bias

  One reviewer was responsible for screening, data extraction and interpretation. The gold standard for evidence reviews is to have a second reviewer replicate the process to reduce reviewer bias. However, due to limited resources, a second reviewer was not available. To mitigate the risk of reviewer bias, content experts were consulted to review article selection, data extraction and findings to enhance rigor in data interpretation and conclusion formulation.

- Limited information on the applicability of the evidence for subgroups

  General themes on the nutritional impact of interventions are presented in this report. Within the adult population (18+ years), there are subgroups of individuals with distinctive characteristics (e.g demographics, interest and motivation) who may respond differently to an intervention compared to the general population. Where noted in SRs, differential effects of an intervention on subgroups of participants were reported in this evidence review. As part of intervention planning and implementation, users of this report are recommended to undertake a secondary literature search, which may include primary research articles, to understand how the intervention can be tailored to a specific population or community.

  An exception was made in the review of the effects of education interventions. Several of the SRs reviewed included studies with both individuals with and without risk factors for chronic diseases (e.g. family history of CD, high blood cholesterol). As education interventions are a common CDP intervention implemented in Alberta, a decision was made to conduct a sub-analysis to determine whether it is effective for the general population and those with risk factors to provide guidance to stakeholders on the topic.

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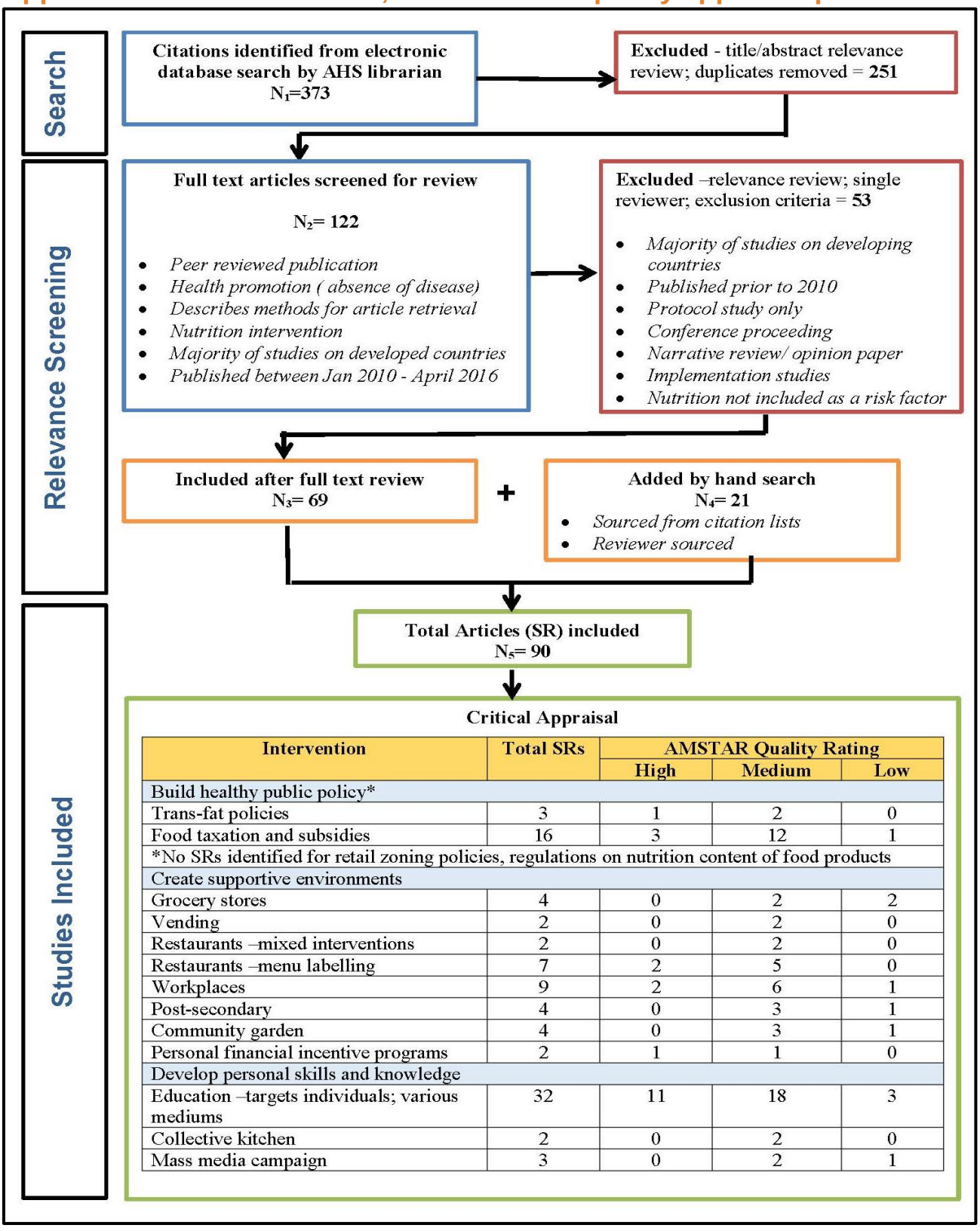
Appendix A: List of Abbreviations

Abbreviation	Term
AHS	Alberta Health Services
AMSTAR	A Measurement Tool to Assess Systematic Reviews
BMI	Body mass index
CD	Chronic disease
CG	Community garden
CK	Collective kitchen
HFI	Household food insecurity
MMC	Mass media campaign
NS	Nutrition Services
PPH	Population Public Health
PPIH CDPOH	Population Public Indigenous Health Chronic Disease Prevention & Oral Health
SES	Social economic status
SR	Systematic review
TFA	Trans-fatty acid
VF	Vegetables and fruit
WHO	World Health Organization

Appendix B: Article retrieval, selection and quality appraisal process



Intervention	Total SRs	AMSTAR Quality Rating		
		High	Medium	Low
Build healthy public policy*				
Trans-fat policies	3	1	2	0
Food taxation and subsidies	16	3	12	1
*No SRs identified for retail zoning policies, regulations on nutrition content of food products				
Create supportive environments				
Grocery stores	4	0	2	2
Vending	2	0	2	0
Restaurants –mixed interventions	2	0	2	0
Restaurants –menu labelling	7	2	5	0
Workplaces	9	2	6	1
Post-secondary	4	0	3	1
Community garden	4	0	3	1
Personal financial incentive programs	2	1	1	0
Develop personal skills and knowledge				
Education –targets individuals; various mediums	32	11	18	3
Collective kitchen	2	0	2	0
Mass media campaign	3	0	2	1