

**A review of the effectiveness of various universal population health promotion nutrition interventions for adults ( $\geq 18$  years)**



Full Report  
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Supplemental documents such as the one page summary and executive summary are available from: [www.ahs.ca/info/Page15343.aspx](http://www.ahs.ca/info/Page15343.aspx). The literature synthesis report (100+pages) is available by request via email: [publichealthnutrition@ahs.ca](mailto: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<sup>1</sup>. Most Canadians are not eating well.<sup>2</sup> For example, 2 out of 3 Canadians are not meeting recommendations for vegetables and fruit intake, an indicator of unhealthy eating.<sup>2</sup> Low vegetables and fruit intake alone results in over 3 billion dollars in direct healthcare and indirect costs each year.<sup>3</sup>

### About this report

Canadians' food choices are affected by their food environment and preferences.<sup>4</sup> 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.

## Table of contents

Acknowledgements	3
Executive summary	4
Table of contents	5
Background	6
Findings	
Interventions identified through search strategy	7
Effects of nutrition interventions	8
Building healthy public policy	
Trans-fat regulations	9
Taxation or subsidies of food and drinks (fiscal policy)	10
Create supportive environments	
Restaurant setting	11
Menu labelling	12
Vending machines	13
Food/grocery store setting	14
Workplace setting	15
Post-secondary setting	16
Community garden	17
Financial incentive programs	18
Develop personal skills	
Education interventions	19
Collective kitchen	20
Mass media campaigns	21
Summary of conclusion statements	22
Discussion	23
Conclusions	25
Methods	26
Limitations	28
References	30
Appendix	
Appendix A: List of abbreviations	32
Appendix B: Article retrieval, selection and quality appraisal process	33

## 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<sup>5</sup>.”

### 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<sup>5</sup>.”

### 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 incentive 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.<sup>6</sup>

<b>Table 1. Dimensions considered to formulate conclusions &amp; conclusion statements</b>	
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. <sup>6</sup>	
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.



**Build healthy public policy-** “Health promotion policy combines diverse but complementary approaches including legislation, fiscal measures, taxation and organizational change. It is coordinated action that leads to health, income and social policies that foster greater equity – WHO, 1986”.<sup>7</sup>

<b>Intervention: Regulations to reduce industrially produced trans-fat (TFA) intake</b>					
Description: Regulations to reduce TFA intake by 1) providing information on TFA content on product labels or 2) imposing limits on the TFA content in food products. These could be implemented as mandatory regulations or voluntary targets.					
<b># SRs reviewed &amp; quality rating</b>	<b>Population group/ applicability</b>	<b>Effectiveness</b>	<b>Equity or unintended effects</b>	<b>Other considerations (feasibility, cost, or acceptability)</b>	<b>Conclusion</b>
Three SRs (1 high quality, 2 medium quality)	General population, including individuals with lower SES.	<p>Evidence found regulatory policies that limit TFA content in foods or provide information on TFA content on product labels reduced TFA intake in the population.</p> <p>Evidence found mandatory limits or bans were more effective compared to voluntary targets.</p>	<p>Providing information on TFA content on product labels was less likely to shift the behaviour of individuals of lower SES; they were less likely to understand and apply the information or be able to afford a higher price for low TFA substitutes.</p> <p>Labelling may encourage manufacturers to reformulate their products, though this effect has not been evaluated.</p> <p>Impact of regulations to limit TFA may vary based on what food manufacturers uses as a substitute product.</p>	<p>Regulations for manufacturers need to be legislated at a federal level; however, local jurisdictions can create procurement policies which specify the allowable TFA contents on food purchased by their facilities.</p> <p>Ongoing resources required for implementation and compliance monitoring.</p>	<p>Recommend mandatory regulations to limit TFA content in foods to decrease consumers’ intake of TFA. A regulation to ban partially hydrogenated oils, a major dietary source of TFA, was passed in Canada and will be implemented September 2018.</p> <p>Suggest mandatory regulations to provide information about TFA content on product labels to decrease consumers’ intake of TFA, acknowledging this is less effective for individuals of lower SES but may encourage manufacturers to reformulate their products. This regulation has been implemented in Canada.</p>

<b>Intervention: Taxation or subsidies of food and drinks (fiscal policy)</b> Description: Taxation or subsidies on the price of food and drinks to shift the purchase and consumption of targeted foods.					
# SRs reviewed & quality rating	Population group/ applicability	Effectiveness	Equity or unintended effects	Other considerations (feasibility, cost, or acceptability)	Conclusion
Sixteen SRs (3 high quality, 12 medium quality, 1 low quality)  Many SRs included modelling studies.	General population, including individuals with lower SES.	<p>Evidence found taxation and subsidies of food or drink changed consumers' purchasing behaviours towards the desired direction.</p> <p>Lack of empirical evidence available in the SRs reviewed on the effects of taxation and subsidies on BMI or energy intake. Consumers may choose a different product as a substitute for a taxed item. What consumers choose differ between population groups. The food or drink chosen will affect their overall nutritional and caloric intake.</p>	<p>Individuals of lower SES spent a higher percentage of their grocery budget on taxes compared to individuals of higher SES; however they may also yield greater health benefits as they are more likely to reduce intake in response to higher prices.</p> <p>Complementing taxes on unhealthy foods with subsidies on healthy foods is recommended to increase healthy food intake. However, there has not been many studies that have explored this.</p> <p>Nutrient-based taxes are more likely to cause unintended effects compared to taxes on a certain type of food or nutrition profile.</p>	Acceptability to consumers and the cost of implementation can vary based on how taxes or subsidies are administered and how revenue from taxes are used.	<p>Recommend using taxation or subsidies above a threshold of 10-20% to change consumer purchase and consumption. Complementing taxes on unhealthy food with subsidies on healthy foods should be considered to increase healthy food intake.</p> <p>More natural experiments are needed to validate the effects of fiscal policy on overall diet quality, BMI and energy intake in a real world setting.</p> <p>The type and level of fiscal instrument chosen will influence its effectiveness, unintended consequences, acceptability, cost and feasibility. A full policy analysis is required prior to implementation.</p>

**Create supportive environments-** “The inextricable links between people and their environment constitutes the basis for a socioecological approach to health. The overall guiding principle for the world, nations, regions and communities alike, is the need to encourage reciprocal maintenance - to take care of each other, our communities and our natural environment – WHO, 1986”.<sup>7</sup>

<p><b>Intervention: Restaurant settings*</b>                  Description: Educational, environmental, pricing or multi-component interventions at restaurant settings. Examples include table tents advertising healthier options, promotional banners, menu labelling, healthy menu features, and lower prices on healthy items.</p> <p>*a variety of interventions in this setting were examined in the SRs reviewed, including menu labelling.</p>					
# SRs reviewed & quality rating	Population group/ applicability	Effectiveness	Equity or unintended effects	Other considerations (feasibility, cost, or acceptability)	Conclusion
Two SRs (both medium quality)	General population	Lack of direct (conclusive/ sufficient) evidence available in SRs reviewed on the effects of promotional signage, menu labelling and increased number of healthier items on sales in a restaurant setting.	None noted in SRs reviewed.	Consumers’ food choices are affected by their motivation for dining.  For example, consumers may tend to choose more ‘indulgent’ foods if they are going to restaurants for a special occasion.	More research is needed to determine the effects of interventions to affect consumers’ food choice in a restaurant setting.

<b>Intervention: Menu labelling (at fast food restaurant, cafeteria, coffee shop, sit down restaurants)</b> Description: Providing the energy content (i.e. calories) of foods on restaurant menus or menu boards. The information may be presented numerically or interpretively and with or without contextual statements.					
# SRs reviewed & quality rating	Population group/ applicability	Effectiveness	Equity or unintended effects	Other considerations (feasibility, cost, or acceptability)	Conclusion
Seven SRs (2 high quality, 5 medium quality)	General population	<p>Evidence found menu labelling increased consumers' awareness of the availability of nutrition information; however, there was a lack of direct evidence on whether consumers comprehended the information.</p> <p>Evidence did not find menu labelling substantially decreased the amount of calories ordered or consumed by the general population in a real world setting.</p>	<p>Nutrition information tend to be applied by individuals of higher SES, women and health conscious individuals.</p> <p>Educational interventions were less effective for individuals of lower SES due to lower health literacy.</p> <p>Labelling may encourage operators to reformulate their recipe, though this effect has not been evaluated.</p>	<p>Surveys showed that the majority of customers want menu labelling</p> <p>Menu labels with contextual information (e.g. traffic symbol, physical activity equivalent, caloric intake for the day) are more likely to lead to changes to food ordered compared to labels with only numeric information.</p>	<p>Suggest the use of menu labelling with contextual information as part of a multi-component strategy to encourage changes in consumer purchasing behaviour. This includes environmental and/or pricing interventions.</p> <p>Menu labelling alone can increase consumer awareness of the nutrition information, but may not lead to significant reductions of calories ordered or consumed.</p>

<b>Intervention: Vending machines as a setting</b>					
<b>Description:</b> Educational, environmental, pricing or multi-component interventions in vending machines. Examples include increasing the proportion of healthier products, pricing interventions and point of purchase signage and labelling to identify healthier options in the machines.					
<b># SRs reviewed &amp; quality rating</b>	<b>Population group/ applicability</b>	<b>Effectiveness</b>	<b>Equity or unintended effects</b>	<b>Other considerations (feasibility, cost, or acceptability)</b>	<b>Conclusion</b>
Two SRs (1 high quality, 1 medium quality)	Changes were made to vending machines located in teacher lounges in school, post-secondary or workplace settings.	<p>Evidence found the use of price incentives (i.e. lower prices) increased the sales of healthier products.</p> <p>SRs were unable to determine if purchases were made by existing customers, indicating changes in behaviour, or new customers as outcome reported was based on total sales. Evidence found an increase to the proportion of healthy items (&gt;50% of machine) increased the sales of healthy product.</p> <p>Lack of direct (conclusive/sufficient) evidence on the effects of point of purchase signage or labelling on sales.</p>	Price interventions are most likely to reduce health inequity.	No information found on these dimensions in the SRs.	<p>Recommend the use of price incentives and/or an increased proportion of healthy items (&gt;50%) in a machine to increase the sales of healthier products, acknowledging sales data was used as a proxy of consumption.</p> <p>Do not suggest the use of point of purchase signage and labelling as a sole intervention to increase the sales of healthy products due to insufficient evidence on their effects on purchases. Educational interventions, such as labelling, need to be complemented by changes to the proportion of healthy items or pricing interventions to affect customer behaviour.</p>

<b>Intervention: Food/grocery store setting</b> Description: Educational, environmental, pricing or multi-component interventions in food stores and grocery stores. Examples include increased availability of healthy options, price incentives (making prices of healthier foods more affordable), advertisements of healthier choices, and point of purchase nutrition or health information (e.g. posters, brochures, and shelf tags).					
# SRs reviewed & quality rating	Population group/ applicability	Effectiveness	Equity or unintended effects	Other considerations (feasibility, cost, or acceptability)	Conclusion
Four SRs (2 medium quality, 2 low quality)	Small food stores and grocery store consumers	Evidence found pricing interventions shifted consumers' purchases toward healthy foods.  Multi-component interventions appeared to be more effective than sole interventions.  Lack of direct (conclusive/ sufficient) evidence on the effects of point of purchase nutrition information on sales.	Price interventions are most likely to reduce health inequity.  Setting-based interventions are unlikely to widen health inequities.	No information found on these dimensions in the SRs.	Recommend using pricing interventions within retail settings to increase the sale of healthy food products or to decrease the sale of unhealthy foods.  Suggest using multi-component interventions to increase the sale of healthy foods or decrease the sale of unhealthy foods.  Do not suggest providing educational information as a sole intervention to shift purchasing behaviour for the general population. These interventions need to be complemented by other changes such as increased availability of healthy options or price incentives.

<b>Intervention: Workplace setting</b> <b>Description:</b> Educational, environmental or multi-component interventions in workplaces. Educational interventions include providing information and resources on healthy eating. Environmental interventions include increasing availability of healthy foods and drinks sold or offered, space and equipment, and product positioning. Multi-component includes a combination of educational and environmental interventions discussed above.					
# SRs reviewed & quality rating	Population group/ applicability	Effectiveness	Equity or unintended effects	Other considerations (feasibility, cost, or acceptability)	Conclusion
Nine SRs (2 high quality, 6 medium quality, 1 low quality)	Workplace settings, various public and private workplaces. Most participants did not have a known CD, though some may have known clinical risk factors.	<p>Evidence found multi-component, environmental and educational interventions have a positive but small impact on nutrition intake in the short term.</p> <p>There is no evidence available in SRs reviewed on their effectiveness in the long term (&gt;12 months).</p> <p>Evidence did not find multi-component or educational interventions affected participants' clinical indicators.</p> <p>Lack of direct evidence on the effects of environmental interventions on clinical indicators.</p> <p>Lack of direct evidence on the effects of nutrition interventions on participants' knowledge or attitude towards nutrition.</p>	<p>Environmental interventions in workplace settings are unlikely to widen health inequities.</p> <p>Educational interventions are likely to widen health inequalities due to differences in effects between individuals of different SES.</p>	No other considerations found in the SRs.	<p>Recommend the use of multi-component (education and environmental) or environmental interventions to improve the nutrition intake of the general population in the short term.</p> <p>Educational information is not suggested as a sole intervention for the general population due to its differential effects on individuals of different SES. Educational interventions need to be complemented with environmental changes such as increased availability of healthy foods and drinks sold. More research is required to determine the effects of multi-component and environmental interventions in the long term. Research is also needed to provide guidance on effective combinations of activities to implement as part of an intervention.</p>

<b>Intervention: Post-secondary setting</b> Description: Educational or environmental interventions. Educational interventions include providing information or resources. Environmental changes include changes to food and drinks availability or accessibility to make healthy eating easier.					
# SRs reviewed & quality rating	Population group/ applicability	Effectiveness	Equity or unintended effects	Other considerations (feasibility, cost, or acceptability)	Conclusion
4 SRs (3 medium quality, 1 low quality)	Post-secondary students	<p>Evidence found multi-component (environmental + educational), educational and environmental intervention improved food choices in the short term, However, more research is required to determine if results were sustained in the long-term.</p> <p>Evidence found environmental interventions have a positive but modest effect on nutrition intake.</p> <p>More research is needed on educational interventions due to the lack of high quality studies or mixed results amongst existing studies.</p> <p>Lack of direct evidence on the effects of environmental interventions on knowledge, attitude and clinical indicators.</p>	<p>Environmental interventions in settings are unlikely to widen health inequities. Educational intervention are likely to widen inequities due to the differential effects on individuals with different SES.</p> <p>Post-secondary as a setting may only be able to reach individuals who are able to afford it and of higher SES.</p>	<p>Post-secondary is a transitional life stage where individuals are susceptible to changing their behaviour as new social and physical environments may require changes to habits.</p>	<p>Suggest using multi-component (environmental + educational) or environmental interventions in post-secondary institutions to improve nutrition intake. Educational intervention as a sole intervention is not recommended.</p> <p>Intervention design may be guided by the results of other interventions examined in this literature review.</p>



<b>Intervention: Community Garden (CG)</b>					
Description: A shared space in the community where people gather to grow vegetables or fruits for personal and group or community consumption.					
<b># SRs reviewed &amp; quality rating</b>	<b>Population group/ applicability</b>	<b>Effectiveness</b>	<b>Equity or unintended effects</b>	<b>Other considerations (feasibility, cost, or acceptability)</b>	<b>Conclusion</b>
<p>Four SRs (3 medium quality, 1 low quality).</p> <p>SRs included low quality studies.</p>	<p>Individuals who participated in CG as a gardener.</p>	<p>Lack of direct evidence available in SRs reviewed that CGs increased participants' nutrition knowledge, improve attitudes towards vegetable and fruit (VF) intake, or increase VF consumption.</p> <p>Evidence did not find it reduced participants' HFI status.</p>	<p>There is no relationship between participating in a CG and experiencing HFI.</p> <p>Social benefits were reported by participants in many SRs, though these benefits were anecdotally reported and not evaluated.</p> <p>Evidence does not show that CG address or reduce the prevalence of HFI.</p>	<p>Participants reported valuing the social aspects of CGs (i.e. increase their social engagement and build social networks), though these effects were not measured or evaluated.</p>	<p>Suggest using CG as a means to potentially strengthen participants' social support network and foster community engagement. Having a strong social support network is associated with better overall health outcomes.</p> <p>Do not suggest using CGs to improve participants' knowledge of, attitude towards, or intake of VF due to lack of direct evidence in SRs reviewed.</p> <p>Do not recommend using CGs to address or reduce the prevalence of HFI.</p>

<b>Intervention: Financial incentive programs</b>					
Description: The provision of a monetary or nonmonetary financial incentive to participants when they achieved a health goal.					
<b># SRs reviewed &amp; quality rating</b>	<b>Population group/ applicability</b>	<b>Effectiveness</b>	<b>Equity or unintended effects</b>	<b>Other considerations (feasibility, cost, or acceptability)</b>	<b>Conclusion</b>
Two SRs (1 high quality, 1 medium quality).  SRs Included low quality studies.	General population. However, most studies were directed towards people above a healthy weight to promote weight loss.	Evidence that participants experienced greater weight loss* compared to no incentives in the short-term.  The effects were not sustained after incentives are removed/ in the long-term.  *Weight loss was used as an indicator of changes in nutrition behaviour for both SRs.	May lead to unhealthy short term weight loss.  Appears to be more effective for individuals of lower income compared to higher income.	No information found on these parameters in SRs.	Do not recommend using personal financial incentive programs for sustainable weight loss.

**Develop personal skills** - “Health promotion supports personal and social development through providing information, education for health, and enhancing life skills...This has to be facilitated in school, home, work and community settings – WHO, 1986”.<sup>7</sup>

<b>Intervention: Education interventions</b>					
Description: Interventions that builds knowledge or skills for healthy eating include: group or individual workshop or counselling					
<b># SRs reviewed &amp; quality rating</b>	<b>Population group/ applicability</b>	<b>Effectiveness</b>	<b>Equity or unintended effects</b>	<b>Other considerations (feasibility, cost, or acceptability)</b>	<b>Conclusion</b>
32 SRs (11 high quality, 18 medium quality, 3 low quality)	The majority of studies reviewed in SRs included individuals who are healthy and those with clinical risk factors for CD.	<p>Evidence found in-person education programs (group or individuals) improved knowledge, behaviour and clinical outcome in the short term. Evidence did not find these changes were sustained in the long-term.</p> <p>Evidence did not find computer programs, text messages, or email interventions changed participant behaviour or clinical outcomes.</p> <p>Lack of strong direct evidence on the effects of telephone counselling and printed material on nutrition outcome.</p>	Effects on behaviour and clinical outcomes are greater for individuals with known clinical risk factors for CD and those of higher SES compared to population without risk factors.	Drop-out rates for in-person education programs varied, ranging from 1% to about 30%.	<p>Recommend the use of multi-component strategies (environmental + policy + educational interventions) to promote changes in nutrition behaviour for the general population. Education sessions are not suggested as a sole intervention to promote sustained changes to nutrition behaviour.</p> <p><i>For individuals with known clinical risk factors for CD, in-person education sessions are recommended to promote positive changes to nutrition behaviour and clinical indicators in the short term, acknowledging that it will need to be complemented by environmental and policy interventions to sustain changes in the long term.</i></p>

<b>Intervention: Collective kitchen (CK)</b> Description: A group of people getting together to cook. The program may be peer or facilitator led and may or may not have an associated cost or educational component.					
# SRs reviewed & quality rating	Population group/ applicability	Effectiveness	Equity or unintended effects	Other considerations (feasibility, cost, or acceptability)	Conclusion
Two SRs (both medium quality).  SRs included low quality studies.	Studies reviewed in SRs targeted participants with low income.  This is not considered as a universal intervention, but included in this review due to use of CK in many communities in Alberta.	Lack of direct evidence available from SRs reviewed that participants increased knowledge (e.g. food skills) or improved nutrition intake; where these benefits were reported, they were not measured or evaluated.  Lack of long term studies available.	Most studies targeted participants with low income, though did not assess whether they experienced household food insecurity (HFI) or CK's impact on HFI.  Evidence did not find individuals with HFI have lower food skills compared to household who are food secure.	Participants reported valuing the social aspects of CK (e.g interaction with and learning from others), where these benefits were reported, they were not measured or evaluated.  How CK were implemented varied substantially in the SRs. May be led by paid facilitators, volunteers, or by peers. This affect cost, time requirements feasibility, and participant acceptance of CK.	Suggest using CK as a means to potentially strengthen participants' social support network. Having a strong social support network is associated with better overall health outcomes.  Do not suggest using CK to improve the nutrition knowledge or behaviour of participants with low income due to lack of direct evidence in SRs reviewed.  Do not recommend using CK to address or reduce the prevalence of HFI.

<b>Intervention: Mass Media Campaigns (MMC)</b>					
Description: Providing nutrition information through mass communication channels to influence behaviours peer groups and individuals. Changes in a group of individuals can lead to shifts in social norms about healthy eating.					
<b># SRs reviewed &amp; quality rating</b>	<b>Population group/ applicability</b>	<b>Effectiveness</b>	<b>Equity or unintended effects</b>	<b>Other considerations (feasibility, cost, or acceptability)</b>	<b>Conclusion</b>
<p>Three SRs (2 medium quality, 1 low quality)</p> <p>SRs included studies of variable quality.</p>	<p>General population 18+</p>	<p>Evidence of increased nutrition knowledge and nutrition intake when used as part of a multi-component strategy. Modest changes in nutrition intake (~ + 0.25 serving of vegetables and fruit) can be expected.</p> <p>Evidence did not find MMC promoted changes in self-efficacy.</p>	<p>One SR suggested no differences in terms of awareness and behaviour change on individuals of different SES.</p>	<p>Providing focused messages on a specific food or behaviour was more effective than messages that touch on multiple risk factors.</p> <p>Conducting target audience research is critical to a successful campaign.</p>	<p>Recommend the use of MMC to increase nutrition knowledge and improve nutrition intake as part of a sustained and targeted multi-component strategy, which ideally include changes to the accessibility and availability of foods in the environment.</p>

The table below 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
<p><b>Recommended</b></p> <p>(Consistent evidence; benefits outweigh harm)</p>	<p><i>Leads to behaviour change</i></p> <ul style="list-style-type: none"> <li>• Fiscal policy (taxes or subsidies on food &amp; drink)</li> <li>• Pricing interventions in vending machines and food/grocery stores</li> <li>• High proportion of healthy foods in vending machines (&gt;50%)</li> <li>• Multi-component or environmental interventions in workplaces</li> <li>• Mass media campaigns as part of a multi-component strategy</li> <li>• Mandatory regulations to limit industrially produced TFA content in foods (will be implemented in Canada in 2018)</li> <li>• Education interventions for individuals with risk factors only, but not for the general population</li> </ul>
<p><b>Suggested</b></p> <p>(Promising evidence; benefits outweigh harm)</p>	<p><i>Leads to behaviour change</i></p> <ul style="list-style-type: none"> <li>• Menu labelling as part of a multicomponent strategy</li> <li>• Multi-component interventions in food/grocery stores</li> <li>• Multi-component interventions in post-secondary settings</li> </ul>
<p><b>Not suggested</b></p> <p>(Lack of evidence to support – mixed evidence or no direct evidence available)</p>	<ul style="list-style-type: none"> <li>• Point of purchase information at vending machines and food/grocery stores to shift purchases as a sole intervention</li> <li>• Education interventions for sustained behaviour changes for general population (without risk factors)</li> <li>• Community gardens for nutrition related outcomes</li> <li>• Collective kitchens for nutrition related outcomes</li> </ul>
<p><b>Not recommended</b></p> <p>(Consistent evidence on ineffectiveness; risks outweigh benefits)</p>	<ul style="list-style-type: none"> <li>• Financial incentive programs for sustainable weight loss</li> <li>• Community gardens to reduce the prevalence of household food insecurity</li> <li>• Collective kitchens to reduce the prevalence of household food insecurity</li> </ul>

## 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.<sup>8</sup>

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.<sup>9,10</sup>

**Midstream interventions** promote healthy eating through influencing food norms.<sup>9</sup>

**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).<sup>9,10</sup>

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.<sup>8</sup> 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.

### 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<sup>11</sup>. The

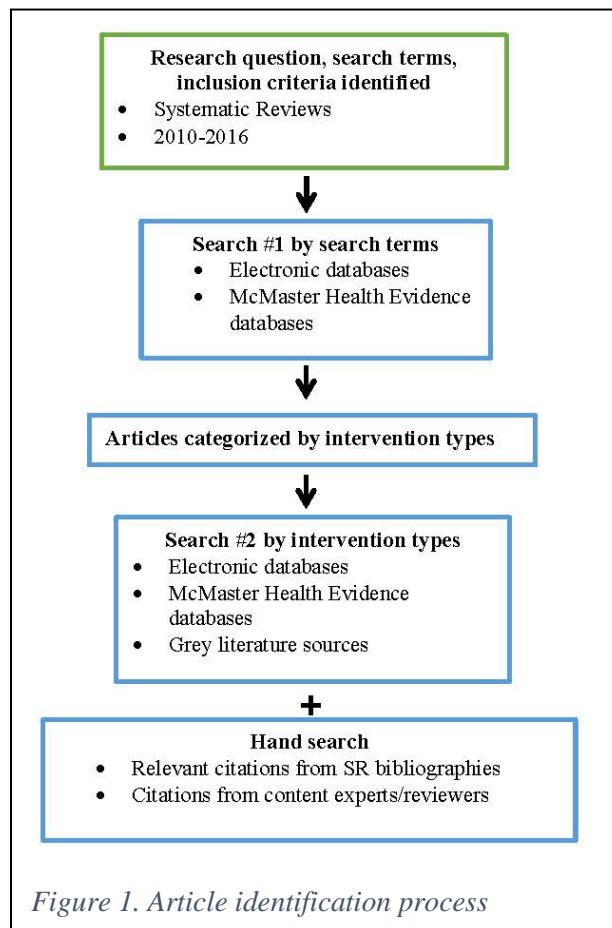


Figure 1. Article identification process

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*<sup>6</sup> 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

<b>Abbreviation</b>	<b>Term</b>
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

