Primary and Secondary Prevention of Overweight/Obesity in Children and Youth

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Section I. Purpose and Background

Purpose

This review will be used by the Canadian Task Force on Preventive Health Care to provide guidance on the production of new clinical practice guidelines to address obesity in childhood in primary care settings. A previous guideline (1994) included screening for and treatment of obesity in children but did not consider primary prevention.[1] This review will examine the evidence to support intervention in normal weight and in overweight / obese children and youth in the primary care setting in Canada. The lack of updated Canadian guidelines on this topic and the growing burden of obesity were key reasons for which this topic was chosen. Other Canadian and international groups have provided guidance on obesity screening, management, and prevention, including the Canadian Clinical Practice Guidelines for the Prevention and Treatment of Obesity in Adults and Children (2007),[2] the Scottish Intercollegiate Guidelines Network (2010)[3] and the United States Preventive Services Task Force (2010).[4]

Condition Background

Condition Definition

Obesity is a condition characterized by the accumulation of excess body fat or adipose tissue, resulting in disturbances in health. Though an imperfect measure, excess adiposity is most often approximated by calculation of the body mass index (BMI), utilizing measured height (m) and weight (kg) (weight / height^2). As BMI changes with growth in childhood and adolescence, classification of obesity in youth relies on the use of standardized curves and age and sex specific cut-off points.[5] In the absence of standardized Canadian growth curves, Canadian clinicians have previously utilized the US Centre for Disease Control (CDC) curves published in 2000 [6], while epidemiological studies including the recent Canadian Health Measures Survey (CHMS) utilized a set of cut-offs established by the International Obesity Task Force (IOTF).[7] Recently, prompted by the availability of improved growth charts developed by the World Health Organization (WHO), the Canadian Paediatric Society[8], the College of Family Physicians of Canada, Dieticians of Canada and the Community Health Nurses of Canada have published a collaborative statement urging use of these new charts. From birth to five years, the WHO chart represents a growth standard based on the growth of healthy, breastfed infants living in conditions of good hygiene and included participants from diverse geographical regions. Thus, this new standard reflects normal human growth in an ethnically diverse sample appropriate for use in multiethnic communities such as Canada. (web-link is www.who.int/childgrowth/en or www.dietitians.ca/Secondary-Pages/Public/Who-Growth-Charts.aspx) For children 5 – 19 years of age, the WHO Growth Reference 2007, constructed from historical, cross-sectional data, is now recommended. The Canadian collaborative statement encourages growth monitoring in all children and recommends tracking of BMI rather than weight alone after 2 years of age. While trajectory in BMI is most important, cut-off points for overweight and obesity were assigned to alert the practitioner to the need for "further assessment, referral or intervention". The recommended cut-offs for 5 – 19 years are greater than the 85th centile for overweight and greater than the 97th centile for obese. At 19 years of age, these coincide with adult cut-offs of 25 and 30 kg/m^2 for overweight and obesity respectively. In the pre-school years, a more conservative approach was applied with recommended cut-offs for children 2 – 5 years of greater than the 97th centile for overweight and greater than the 99.9th centile for obese.

BMI continues to be most widely used because of its relatively easy application and ability to predict presence of adverse health outcomes in adulthood.[9] It is however an indirect measure of adiposity and has some limitations as it does not specifically measure the amount or location of body fat. Among adults, waist circumference is more closely related to obesity-related health consequences than BMI

prompting the recommendation for classification in adults based on waist circumference cut-offs. There are preliminary data suggesting increased waist circumference is associated with cardiovascular risk factors (CVRF) but some data also suggests that waist circumference percentiles or waist / height add little to BMI Z score in the identification of CVRF in children. [10,11] While different risk cut-offs for BMI in adults are suggested in some ethnic groups, it is recommended that the same cut-offs be applied across the pediatric population.

Prevalence and burden of disease

Childhood obesity has increased rapidly in Canadian children over the last 3 decades. In the recent CHMS 2007-2009 survey, obesity prevalence among 6 – 17 year old Canadian children, based on measured height and weight, was 8.6% and an additional 17% were classified as overweight.[12] The rise in obesity prevalence was particularly notable from 1978/79 to 2004 when obesity prevalence increased 2.5 fold [13] with somewhat greater increases in the 12 – 17 year age group (increase from 3.0 to 9.4%). Both of these studies used the IOTF BMI cut-offs to assign classification as overweight or obese.[14]

Prevalence amongst Canadian Aboriginal children and youth living off reserve is likely higher as 32% of 6 – 8 year old and 13.1% of 9 – 14 year olds were classified as obese, based on self-reported height and weight, collected in the 2006 Aboriginal Peoples Survey.[15] In First Nation children and youth living on reserve, obesity prevalence was estimated at 14.1% amongst youth age 12 – 17 years, 26.4% amongst children age 9 – 11 years and 48.7% amongst those 3 – 5 years of age.[16]

Obesity in childhood usually persists into adulthood[17] and is associated with adverse metabolic and psychosocial outcomes by adolescence.[18-21] Recent longitudinal studies highlight the increased risk of atherosclerotic coronary artery disease associated with increased BMI during adolescence, particularly if left untreated.[20,21] Metabolic disturbances identified in children with obesity include dyslipidemia, hypertension, impaired glucose tolerance (IGT) and type 2 diabetes and hepatosteatosis. Multiple cardiovascular disease risk factors are identified in up to 50% of obese children and youth[22] attending weight management programs and the number of cardiovascular risk factors is related to extent of atherosclerosis in autopsy studies by the second decade of life.[23] The presence of multiple cardiovascular risk factors in adolescence is associated with a 14-fold increased risk of a cardiac event by 50 years of age.[24]

Adverse health outcomes linked to obesity extend far beyond metabolic health and include disturbances in musculoskeletal, neurological, gastrointestinal, respiratory and psychosocial health. Perhaps most prevalent are the adverse psychosocial disturbances linked to childhood obesity including low self-esteem, increased risk of depression, and decreased health related quality of life.[25,26] Psychosocial disturbances and reduced quality of life are more prevalent in clinic-based studies than in population studies and are a common reason for referral.[27]

Etiology, natural history and consequences if left untreated

Although ultimately obesity develops from a positive energy balance, the underlying causes include a complex web of interactions between genetic, biological, environmental, social and economic factors. Further, as these factors interact at the individual, family, community and national levels, solutions must also address obesity at multiple levels. Changes in the social and physical environment, together with behavior change have culminated in the markedly increased prevalence of obesity in childhood. Obesity prevalence in children is also linked to family history of obesity related to both genetic predisposition (heritability approximately 50%) and shared environment.[28] Parental obesity also predicts increased persistence of childhood obesity into adulthood.[17] Individual / family characteristics that increase the risk

for obesity development include lifestyle behaviours of parents and child (nutrition, physical activity and sedentary time), low socioeconomic status and early life determinants including maternal cigarette smoking in pregnancy, maternal diabetes and obesity, low birth weight, formula feeding and poor sleep habits in the preschool years.[29,30]

The natural history of obesity appears to vary with age of onset, but deciphering the natural history in light of rapidly rising prevalence has been somewhat difficult. In a study which began prior to our current obesity epidemic, the likelihood that obese children remain obese in adulthood (i.e. tracking of obesity) increased with increasing age of the child, increasing extent of obesity and with the parental history of obesity. Tracking refers to periodic monitoring of BMI percentiles – with particular attention to be paid to those children whose BMI percentile is increasing over time – even if it has not yet reached the threshold for classification of obesity.[31] Obese children from age 3 years to adolescence who had at least one obese parent had an approximately 80% chance of being obese as adults.[17] With no parental obesity, 33% of 3 – 5 year olds and 66% of 10 – 17 year olds with obesity continued to be obese as young adults.

Risk Factors

The most predominant risk factor for the development of obesity is parental history of obesity. Age influences the probability of persistence of obesity into adulthood and also influences the development of obesity related health consequences. The prevalence of dysglycemia, dyslipidemia and hypertension increase in the second decade of life, and evidence of tracking of lipid values and blood pressure from childhood into adulthood underscore the calls for early detection.[32] Low socioeconomic status is an additional determinant thought to increase risk of developing obesity.

Rationale for screening and screening strategies

The increasing prevalence of obesity amongst children and recognition of the related health consequences has prompted multiple organizations to recommend growth monitoring or serial measurements of height and weight to identify disturbed growth early.[5,8,33] In relation to overweight and obesity, the calculation and plotting of body mass index is recommended from 2 years of age onwards. Should the trajectory of BMI centile for an individual be increasing with time, discussion of lifestyle behaviours and other prevention strategies are recommended. Should the BMI be within the overweight or obese range, further evaluation of obesity related health measures is recommended and development and implementation of a treatment plan is encouraged.[2,34] Given that growth monitoring is accepted as a critical component of well child visits for many reasons, it is expected that the additional step of calculating and plotting BMI should be relatively easily incorporated (reference collaborative statement referred to in definition).

Monitoring of BMI in children and youth is recommended within primary care practices and is also practiced in the community at public health clinics. Linkage to well child visits, immunizations and, for children that do not attend well child visits, at presentation for acute illness is encouraged.

Prevention Interventions in Children and Youth

Primary prevention interventions to prevent obesity would be applicable to all children and youth, and must be differentiated from secondary prevention interventions designed to detect obesity at an early stage so that the progress of obesity can be arrested and, if possible, reversed. Given the complexity of the underlying causes contributing to the development of obesity, population based interventions that do not focus on single changes but change at multiple levels are encouraged.[35] Multiple population- based approaches have been recommended including the implementation of school based programs and changes to the built environment (structures and resources constructed by humans with the purpose of supporting human activity) to

promote physical activity, alter the nutrition environment and reduce child focused advertising of food. The role of prevention interventions at the individual and family level through interventions that can be conducted or referred by primary care physicians' offices is recommended in some clinical practice guidelines, and the evidence to support this practice will be the subject of this review.

At the individual and family level, monitoring of BMI in primary care practices for the purpose of screening for the development of overweight or obesity has been recommended (collaborative statement). Referral for the treatment of childhood obesity to specialized treatment centres utilizing a family-based, comprehensive, behavioural modification approach has been supported based on recent reviews suggesting short-term efficacy of such programs. Programs defined as having moderate to high intensity (> 30 hours of individual or group intervention),[4,36,37] are efficacious in achieving moderate reductions in BMI, at least over the short term (up to 12 months). While encouraging, many questions remain including the impact of treatment programs on health measures beyond BMI (eg blood pressure, lipids, and quality of life) and the sustainability of these short term changes. Whitlock et al[4] identified only 7 papers that examined the influence of weight management on lipids, blood pressure, glucose or adiposity, and noted their lack of confidence in the conclusions given small sample sizes and methodological concerns. In the largest study, improvements in insulin resistance, glycemia, blood pressure, HDL-cholesterol and triglyceride levels were identified in children and youth participating in a weight management program over the short term and after 1 year of follow-up, [38] but only in the children who demonstrated persistent weight loss. Pharmacotherapy[39] and surgical interventions have been identified more recently as being efficacious. These are recommended in restricted populations only after other attempts at weight loss have occurred and are not without consequences.[40]

Current clinical practice

While CDC growth curves were previously recommended for clinical use in Canadian children, it is now recommended that health professionals utilize the 2007 World Health Organization's (WHO) Child Growth Reference and Growth Standard as described above. The BMI growth curves generated by this research are described in detail on the WHO website (http://www.who.int/childgrowth/en/).

While screening for BMI is widely recommended throughout the world, implementation at the clinical practice level has been moderate at best.[41-43] Barriers to implement monitoring of BMI percentiles in children have been identified and include lack of familiarity with recommendations, disagreement with recommendation[43] and physician attitudes and beliefs relating to outcome.[44] While expressing a willingness to engage in discussions with their patients around lifestyle behaviors, primary care physicians have expressed concern over available resources for treatment and knowledge gaps have been identified [45]

The availability of specialized weight management programs for children in Canada has historically been quite limited, although this has changed in the last 5 years and 18 programs have been identified in a recent environmental scan.[46] These programs incorporate a multi-disciplinary approach to family based behavioural interventions designed to change nutrition and activity behaviours utilizing group and individual based counseling. Most have developed over the last 5 years and few have been formally evaluated to date. Given the national geography, proximity to treatment centres continues to influence referral patterns however.[47] The fact that 72% of the programs identified are affiliated with academic institutions highlights the paucity of available programs at the primary care level in Canada.

Previous Review and Recommendations

1994 Canadian Periodic Health Examination[48]

Recommendations

1. Detection: Physicians should continue to plot the height and weight of infants and children during a periodic health examination, primarily to identify children who are failing to thrive. There is insufficient evidence to support screening children for obesity; however, there is no evidence that screening for obesity is harmful **(C category recommendation)**.[48]

2. Intervention: There is insufficient evidence to include counseling about nutrition and exercise in or exclude it from the routine treatment of severely obese children **(C category recommendation**). There is fair evidence to exclude very-low-kilojoule diets from the routine treatment of preadolescent obese children **(D category recommendation).**There is conflicting evidence concerning the inclusion or exclusion of exercise in the routine treatment of obese children **(C category recommendation).**

Other Guidelines

The Obesity Canada Clinical Guidelines Expert Panel (2006),[2] recommend screening for overweight and obesity children and adolescents aged 2 years and older with BMI using the growth charts of the US Centers for Disease Control and Prevention for BMI to screen children and adolescents for overweight (≥85th to < 95th percentile) and obesity (≥95th percentile). In managing overweight or obesity these guidelines recommend a multi-disciplinary team, including a registered dietician, utilizing behavior modification strategies to assist families in changing eating patterns and in increasing physical activity and reducing sedentary activities such as screen time. The NICE (2010) group recommend (with caution) using BMI to measure overweight and obesity. NICE recommend lifestyle change, including decreasing sedentary behaviour, and dietary change.[49] The USPSTF in 2010 recommend screening children aged 6 and older for obesity using BMI and referring overweight and obese children to behavioural or intensive counseling.[50]

Section II. Review Approach

Working Group Approach to the Key Questions

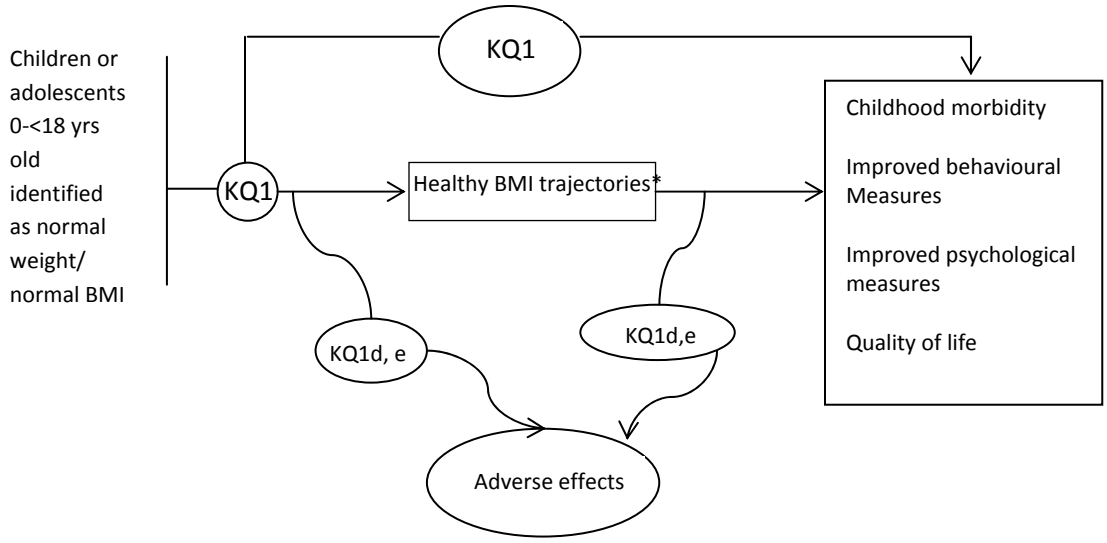
The Working Group first worked through an "ideal approach", considering the analytic framework and key questions for both screening and prevention of obesity in children that they considered to be the most important for clinicians. An evidence based analysis on screening and prevention of obesity was planned to address key questions about the effectiveness of screening and preventive efforts for normal weight, overweight or obese children in primary care on mortality, morbidity, various anthropometric measures of weight reduction or stabilization, costs, and harms. However, our preliminary search revealed recent reviews by the United States Preventive Services Task Force (USPSTF)[50] and Scottish Intercollegiate Guidelines Network (SIGN)[3] that asked similar questions and identified no evidence that screening improved patient important outcomes. In order to avoid engaging in a full review when no evidence had previously been identified we have removed these as key questions and have instead added a series of supplemental questions on screening. These will be examined in a condensed review process that will search for any studies published after the USPSTF review, This will allow us to capture any new evidence that may become available on screening for obesity since the last review.
The USPSTF also examined the effectiveness of weight management on children[51]. . As a result, the Working Group decided to adopt a more pragmatic approach to selecting the questions that it wanted to have answered, based on those for which preliminary review had indicated that there would be sufficient evidence upon which to formulate a recommendation. In addition, in order to avoid duplication in the work that had already been completed by the USPSTF, the Working Group decided to update the 2006 USPSTF review that examined interventions for those who were already overweight and obese (key questions 2 below). The USPSTF review was chosen as it is the last time a guideline group asked the specific question on the effectiveness of screening for obesity.

The Working Group was also interested in primary preventions to prevent overweight and obesity children who are currently of normal weight. A preliminary review of the literature indicated that the Cochrane Collaboration had conducted a review that examined prevention interventions in this group of children. As such the Working Group decided to update the Cochrane review to address the effectiveness of prevention interventions for those who are currently of normal weight (key question 1 below).

There are some changes that will be made to the USPSTF search strategy when the search for the CTFPHC Is conducted. The USPSTF limited their review to behavioural and pharmacological interventions. The CTFPHC also identified surgical interventions for consideration in this review, and considered this to be an intervention to which primary care might refer. As such, restrictions on setting to which primary care might refer were removed. In addition, the update would also consider articles identified through EMBASE, and include French language reports.

Analytic Framework and Key Questions

Figure 1: Analytic framework: interventions for normal weight children/normal BMI



*Healthy BMI trajectories refer to a child's BMI growth pattern that would be considered normal by *WHO's Child Growth Standards* http://www.who.int/childgrowth/en/index.html.

Normal weight Children (See Figure 1)

KQ1: Do primary care-relevant prevention interventions (behaviorally-based) in normal weight children lead to improved health outcomes or sustained/short-term healthy BMI trajectories?

a. How well are healthy BMI trajectories or health outcomes maintained after an intervention is completed?
b. What are common elements of effective interventions for healthy BMI trajectories?
c. Does the effectiveness of interventions vary between child subgroups (e.g., infants versus children or adolescents, sex, race-ethnicity, baseline cardiovascular risk status, low socio-economic status, parental history of obesity, maternal cigarette smoking in pregnancy, maternal diabetes, low birth weight, formula feeding, etc)?
d. What are the adverse effects of primary care-relevant prevention in normal weight children (e.g., disordered eating, psychological distress such as anxiety, micronutrient deficits, abnormal growth trajectory, or growth restriction)?
e. Are there differences in adverse effects between child subgroups (e.g. infants versus children and adolescents, sex, race-ethnicity. baseline cardiovascular risk status, lower socio-economic status, parental history of obesity, maternal cigarette smoking in pregnancy, maternal diabetes, low birth weight, formula feeding, etc)?

Inclusion/Exclusion Criteria for KQ1

Language

KQ1	We are updating the Cochrane Collaboration, however, the search will include studies published in English and French.

Study Design

KQ 1a-c	Study designs that are permissible: RCTS or CCTs evaluating the effectiveness of prevention interventions in children, Observational designs, case reports, case series and chart reviews will be excluded.
KQ 1d- e	All study designs are permissible, including non-controlled observational designs.

Population and Setting

KQ1	Studies will be limited to: • Human studies • Children aged 0-18 years (or their families) with any weight (or BMI) measurement including children who are already obese. Although the focus of the question is on the normal weight population, many studies include mixed weight populations so we need to include all populations to be able to answer the question for the normal weight group. • Excluded populations are those children who are *being treated* for obesity; those children with serious illness or severe co-morbidities; studies designed to prevent obesity in pregnant adolescents. Studies that only recruited already obese children at baseline will be considered to be focused on the treatment of obesity and will therefore excluded. •

Intervention

KQ1	• We will include interventions that are diet and nutrition, exercise and physical activity and lifestyle and social support. We will include educational, psychological/family/behavioural therapy/counselling/management strategies/ . • The location of the interventions can be community, clinics, primary care, schools, after school, home, childcare/nursey/preschool. • The term “behavioural” will be broadly used in the search strategy and limited only by the selected exclusion criteria • Pharmacological interventions are excluded for normal weight populations. •

Outcome

KQ1a-c	Primary Outcome: weight and height; percent of fat content; BMI; skin-fold thickness; ponderal index; skin-fold thickness; prevalence of overweight and obesity Secondary outcomes: childhood morbidity improved psychological measures; improved behavioural measures and quality of life.
KQ1d-e	Adverse effects will include: disordered eating, psychological distress (e.g. anxiety,

	stress), micronutrient deficiency, abnormal growth trajectory (underweight, BMI), and growth retardation (stunting).

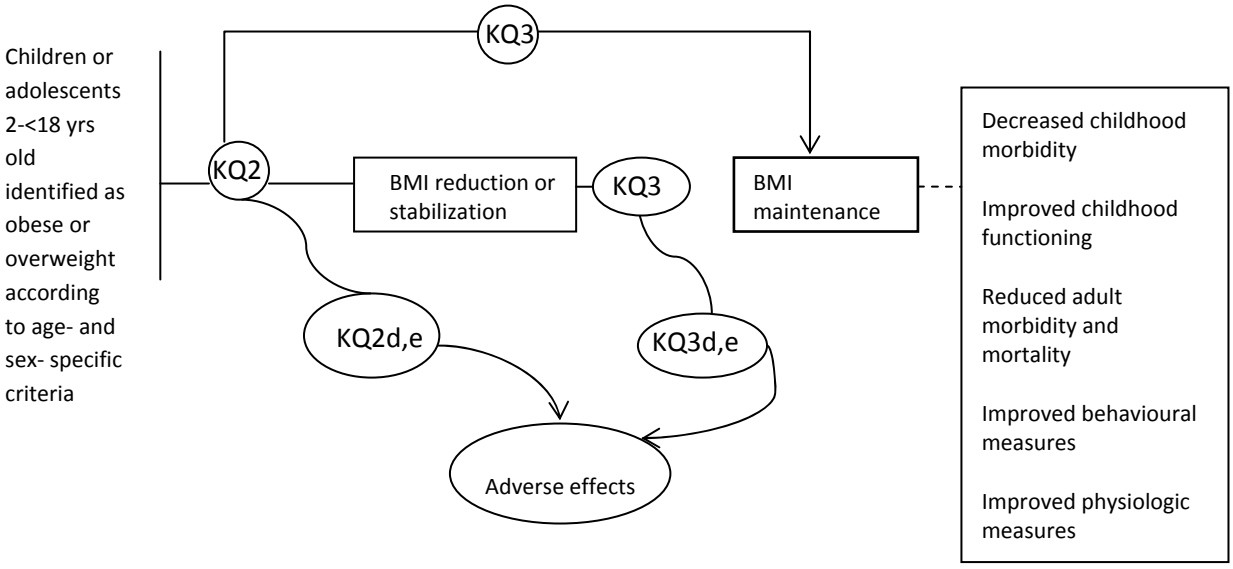
Time

KQ1	Duration of treatment and time of follow-up or outcome assessment ≥12 weeks. No duration for harms (adverse events).

Search Strategy

KQ1	We will conduct a new search for prevention for those who are normal weight search will include Embase, Medline, Cochrane, CINAHL, PsychINFO, back to 1985.

Figure 2: Analytic framework: interventions for obese or overweight children



KQ2 refers to interventions that result in an initial reduction or stabilization of BMI.

KQ3 refers to a subsequent step, where those who achieved an initial BMI reduction or stabilization, move on to maintain it over time Note: the inclusion exclusion criteria stipulates a minimum of 6 months for the initial and the subsequent step.

We do not include children 0-2 years in KQ2 and KQ3 as we are updating a review that excluded them.

Overweight/obese children population (See Figure 2)

KQ2: Do weight management programs (behavioural, combined behavioural, pharmacological and surgical interventions) lead to BMI, weight, or adiposity stabilization or reduction in children and adolescents who are obese or overweight?

a. Do these weight management programs lead to other positive outcomes (e.g. improved behavioural or physiological measures, decreased childhood morbidity, improved childhood functioning, or reduced adult morbidity and mortality)?
b. Do specific components of the weight management programs influence the effectiveness of the programs?
c. Are there population (e.g. age, sex, race-ethnicity, low socio-economic status, parental history of obesity, maternal cigarette smoking in pregnancy, maternal diabetes, low birth weight, formula feeding, etc) or environmental factors that influence the effectiveness of the weight management programs?
d. What are the adverse effects of weight management programs (behavioural, combined behavioural and pharmacological) attempting to stabilize or reduce BMI?
e. Are these differences in adverse effects between child subgroups (e.g. age, sex, race-ethnicity, low socio-economic status, severity of obesity, parental history of obesity, maternal cigarette smoking in pregnancy, maternal diabetes, low birth weight, formula feeding, etc)?

KQ3: Do weight management programs (behavioural, combined behavioural and pharmacological or surgical) help children and adolescents who are initially obese or overweight maintain BMI, weight, or adiposity improvements after the completion of an active intervention?

a. Do these weight management programs lead to other positive outcomes (e.g. improved behavioural or physiological measures, decreased childhood morbidity, improved childhood functioning, or reduced adult morbidity and mortality)?
b. Do specific components of the weight management programs influence the effectiveness of the programs?
c. Are there population (e.g. age, sex, race-ethnicity (e.g. Canadian Aboriginal youth), lower socio-economic status, parental history of obesity, maternal cigarette smoking in pregnancy, maternal diabetes, low birth weight, formula feeding, etc) or environmental factors that influence the effectiveness of the weight management programs?
d. What are the adverse effects of weight management programs (behavioural, combined behavioural, surgical and pharmacological) attempting to stabilize or maintain BMI?
e. Are these differences in adverse effects between child subgroups (e.g. age, sex, race-ethnicity, low socio-economic status, parental history of obesity, maternal cigarette smoking in pregnancy, maternal diabetes, low birth weight, formula feeding, etc)?

Inclusion/Exclusion Criteria for KQ2 and KQ3

Language

KQ2 and KQ3	Will include the intervention inclusion and exclusion criteria in the USPSTF review as we are updating their work, they restricted language to English but we are going to search for both English and French language reports.

Study Design

KQ2 and KQ3 Study design	Study design will be restricted to the study designs of the USPSTF.
KQ2a-e	For behavioural interventions, the study design will be restricted to RCTs or CCTs with

and KQ3a-e Study design	minimal intervention or placebo control, and for pharmacological interventions restricted to placebo (pill) controlled RCTs. All trials must have a minimum of 10 subjects per treatment arm. Minimum duration of follow up required for assessment of outcomes is 6 months. No minimum duration of assessment is required for adverse events.

Population and Setting

KQ2 and KQ3	Are based on the study populations in the USPSTF review as we are updating their work. These include: • human studies • children aged 2-18 years who were obese or overweight. • Note: For the update portion the search will be extended to include unselected populations, or selected for increased risk for specified conditions (cardiovascular disease, hypertension, dyslipidemia, or type 2 diabetes), or other risk factors such as parental obesity, ethnic background (Canadian Aboriginal youth) low socio-economic status, maternal cigarette smoking in pregnancy, maternal diabetes, low birth weight, formula feeding, etc. • Primary care population or comparable. • For behavioural interventions, all KQ except serious adverse effects: limit to countries listed as "high" human development on the Human Development Index (over 0.90). • Exclude trials in settings not feasible for implementation in primary care or health care systems to which primary care providers could refer. • Exclude trials in which the sample is limited to children and youth with: (1) eating disorders, (2) pregnant/post-partum, (3) overweight/obesity secondary to genetic or medical condition including Polycystic ovarian syndrome, hypothyroid, Cushings, GH deficiency, insulinoma, hypothalamic disorders (e.g. Froelich's syndrome), Laurence-Moon-Biedi syndrome, Prader-Willi syndrome, weight gain secondary to medications (e.g. antipsychotics), or (4) other idiosynchratic weight loss issues.

Intervention

KQ2 and KQ3 Study design	Intervention inclusion and exclusion criteria as in the USPSTF review as we are updating their work: • Include behavioral, pharmacological (such as but not limited to orlistat and sibutramine), complimentary/alternative, or health care system interventions, singly or combined, designed to promote weight control/loss or weight maintenance, or an important component of weight loss (e.g. physical activity).The term "behavioural" and "pharmacological" interventions will be broadly used in the search strategy and limited only by the selected exclusion criteria. • Intervention must either be conducted in primary care, feasible for conduct in

	primary care, or comparable to programs widely available for referral from primary care. Also accept programs that would be feasible for implementation in a health care system and therefore be available for referral from primary care, if available. • Exclude trials in which intervention focuses on primary prevention, changes in built environment, mazindol • We will also exclude weight loss drugs not approved by Health Canada • Surgical interventions will also be included in KQ2 and KQ3 and searches. Given that this information is not considered in the US review, the search will include an update for bariatric surgery literature from 2008 onwards (the date of the US review).

Outcome

KQ2 and KQ3 Outcome	Based on outcomes as in the USPSTF review as we are updating their work: • Must provide acceptable adiposity outcome (2-C, 3-C, or 4-C models, except 2-C models not using Lohman's age and sex-specific equation[52] or using the measurement of total body fat K+) or weight outcome (e.g., baseline and post-intervention weight, weight change, net weight change over control group, or related measures (such as BMI, BMI SDS, etc.). • Include multiple health outcomes: decreased morbidity from conditions including but not limited to type 2 diabetes, hypertension, dyslipidemia, fatty liver disease, slipped capital femoral epiphysis, and sleep apnea; improved depression; improved emotional function (scores on emotional subscales of quality of life instruments); physical fitness capacity or performance (not behavioral), physical functioning (scores on physical subscales of quality of life measures), disability (global measures of disability, such as activities of daily living). • Intermediate outcomes include a reduction or stabilization in BMI, weight, or adiposity; also weight maintenance after an intervention has ended. • Other intermediate outcomes include physiologic measures such as glucose tolerance, fasting insulin and insulin resistance, blood pressure, lipid testing, and physical fitness. • Adult outcomes (morbidity, mortality) will be searched but only included as part of background to inform decisions. • Adverse outcomes include serious treatment-related harms at any time point after an intervention began (i.e., death, need for medical or psychiatric treatment, growth retardation) or other treatment-related harms reported in trials (including but not exclusive to risk of injury, pharmacological side effects). • Outcomes reported ≥ 6 months after the start of the intervention were included. Trials of treatment-related harms have no minimum follow-up requirement.

Time

KQ2 and KQ3	Are restricted to time of outcome assessment as in the USPSTF review. This includes restricting outcomes reported at 6 months or longer with the exception of KQ2/3d-e

Time	which have no time restriction

Search Strategy

KQ2 and KQ3 Search strategy	We will update the USPSTF review for those who are overweight and obese. We will include all studies that they included except for pharmacological studies that examined drugs not approved by Health Canada, plus any additional studies that have been published since their last search. Embase will be included among the databases searched, and French language publications will be considered in the update. Surgical interventions will also be included in these Key Questions and searches.

Contextual Questions

CQ1. Is there evidence that the burden of disease, the risk/benefit ratio of prevention, the optimal prevention method, access, and implementation differ in any ethnic subgroups (e.g. Canadian Aboriginal youth) or by age (e.g.. infant, child, adolescent), rural and remote populations, or lower SES populations?

CQ2. What are the resource implications and cost effectiveness of overweight and obesity prevention in Canada?

CQ3. What are parents' and children's values and preferences regarding overweight and obesity prevention?

CQ4. What process and outcome performance measures (indicators) have been identified in the literature to measure and monitor the impact of prevention for overweight and obesity?

CQ5. What are the most effective (accurate and reliable) risk assessment tools* identified in the literature to identify those at higher risk of obesity?

CQ6. What are the most effective (accurate and reliable) risk assessment tools* identified in the literature to assess future health risk as a result of obesity?

*Risk assessment tools are defined as those tools that combine known risk factors to identify risk of future obesity or of future health risk (e.g., diseases) associated with being obese now.

Expedited searches are conducted to answer contextual questions. In these expedited searches, the ERSC searches selected databases to identify evidence (from any study type) published in the past five years. This search is supplemented by a search of key journals and websites for additional primary studies disseminated in the past two years (i.e., potentially too recent to have been included in published reviews). For these expedited reviews, the ERSC uses Canadian data sources wherever possible. The list of journals and databases to be searched is determined by the working group, with input from the ERSC and clinical and content experts.

Evidence used to address contextual questions does not require quality assessment and may be examined by only one reviewer. Qualitative analyses for all contextual questions will be performed. Study results addressing the above questions will be analysed descriptively.

Inclusion/Exclusion Criteria for Contextual Questions

Contextual questions	Searches for contextual questions are limited to Medline and Embase for systematic reviews and primary studies published from 2009-2013. Any study design is eligible. A systematic search will not be done for contextual questions. Study results addressing the above questions will be analysed descriptively.

Supplemental Question:

Does screening for overweight and obesity in children and youth in primary care practice reduce the risk of morbidity, and mortality and/or improve health outcomes (impaired glucose tolerance, type 2 diabetes, hypertension, dyslipidemia, non-alcoholic fatty liver disease, sleep apnea, slipped capital femoral epiphysis and psychosocial disorders)?

a. Does screening for overweight/obesity in children and youth result in reduction or stabilization of adiposity?
b. What is the most effective method of screening for overweight and obesity in children in primary care?
c. What is the optimal interval/frequency for screening for overweight and obesity in children in primary care?
d. What is the most effective type of screening (opportunistic vs. organized/systematic) for overweight and obesity in children in primary care?
e. What are the harms associated with screening for overweight and obesity in children in primary care?
f. Do screening interventions decrease mortality and incidence of health outcomes in high risk groups such as but not limited to those with a family history of obesity, psychological issues or co-morbid conditions?

Inclusion/Exclusion Criteria for Supplemental Questions

Language, Population and Setting, Intervention, Outcome, Time

Supplemental Questions	The inclusion/exclusion criteria will be as per the USPSTF review 2006 (the last review in which the question of the effectiveness of screening for obesity was directly asked by that guideline group)

Study Design

Supplemental Questions	All study designs will be eligible for inclusion. It will include systematic reviews and meta-analyses, randomized control trials, and non-randomized studies.

Search Strategy

Supplemental Questions	The search for the literature to answer the supplemental questions will be included in the main literature search for the key questions.

Definitions of Terms

Primary Care: Primary care is the provision of integrated, accessible health care services by clinicians who are accountable for addressing a large majority of personal health care needs, developing a sustained partnership with patients, and practicing in the context of family and community. (Primary Care: America's Health in a New Era. Institute of Medicine (IOM): National Academy Press, 1996.)

Primary Care Interventions Addressed by the CTFPHC: The CTFPHC considers primary care interventions to be those that are delivered in primary care settings or are judged to be feasible for delivery in primary care. To be feasible in primary care, an intervention could be applicable for patients seeking care in primary care settings, and the skills to deliver the intervention are typically present in clinicians and/or related staff or interdisciplinary primary care teams in the primary care setting, or the intervention can generally be ordered/initiated by a primary care clinician.

Child Obesity Primary Prevention (KQ1)
Proposed Search Strategy

OVID-Medline

1. Obesity/pc [Prevention & Control]
2. weight-gain/
3. weight-loss/
4. weight change*.mp.
5. ((bmi or body mass index) adj2 (gain or loss or change)).mp.
6. weight maintenance.mp.
7. (obesity or obese).ti.
8. (weight gain or weight loss).ti.
9. body mass index/
10. ((normal or average or healthy) adj2 weight).tw.
11. non-obese.tw.
12. or/10-11
13. or/2-9
14. 1 or 12 or 13
15. exp behavior-therapy/
16. family-therapy/
17. exp psychotherapy-group/
18. ((psychological or behavio?r*) adj (therapy or modif* or strateg* or intervention*)).mp.
19. (group therapy or cognitive therapy or family therapy).mp.
20. ((lifestyle or life style) adj (chang* or intervention*)).mp.
21. counsel?ing.mp.
22. (peer adj2 support).mp.
23. ((child* adj3 parent*) and therapy).mp.
24. or/15-23
25. 14 and 24
26. exp OBESITY/dh [Diet Therapy]
27. "Diet-Fat-Restricted"/
28. "Diet-Therapy"/
29. (diet$ adj (modif$ or therapy or intervention$ or strateg$)).mp.
30. (low calorie or calorie control$ or healthy eating).mp.
31. exp "Dietary-Fats"/
32. (fruit or vegetable$).mp.
33. (high fat$ or low fat$ or fatty food$).mp.
34. breast feeding/
35. or/26-34
36. 14 and 35
37. "Exercise"/
38. "Exercise-Therapy"/
39. (aerobics or physical therapy or physical activity or physical inactivity).mp.
40. (fitness adj (class$ or regime$ or program$)).mp.
41. (physical training or physical education).mp.
42. dance therapy.mp.
43. sedentary lifestyle/
44. motor activity/
45. video games/
46. television/
47. computers/
48. screen time.tw.
49. (active adj3 play).tw.
50. or/37-49
51. 14 and 50
52. sleep/

53. sleep deprivation/
54. sleep.ti.
55. or/52-54
56. 14 and 55
57. primary prevention/ or preventive health services/
58. Prevent*.ti.
59. or/57-58
60. 14 and 59
61. *Obesity/pc [Prevention & Control]
62. 25 or 36 or 51 or 56 or 60 or 61
63. animals/ not humans/
64. 62 not 63
65. limit 64 to (addresses or autobiography or bibliography or biography or comment or editorial or in vitro or interview or letter or news or newspaper article or video-audio media or webcasts)
66. 64 not 65
67. limit 66 to yr="1985 -Current"
68. (child* or adolescen*).mp.
69. (teenage* or young people or young person or young adult*).mp.
70. (schoolchildren or school children).mp.
71. (boys or girls or youth or youths).mp.
72. (child* or adolescen*).jn.
73. (pediatr* or paediatr*).ti,ab,jn.
74. or/68-73
75. 67 and 74
76. limit 67 to ("all child (0 to 18 years)" or "preschool child 2 to 5 years)" or "child (6 to 12 years)" or "adolescent (13 to 18 years)")
77. 75 or 76

Search Strategy per the USPSTF review (KQ2 and KQ3)

MERSC Childhood Obesity Prevention Detailed Search Strategy
OVID-Medline
June 2008-present
1. exp obesity/
2. weight-gain/
3. weight-loss/
4. (obesity or obese).mp.
5. (weight gain or weight loss).mp.
6. (overweight or over weight or overeat* or over eat*).mp.
7. weight change*.mp.
8. ((bmi or body mass index) adj2 (gain or loss or change)).mp.
9. weight maintenance.mp.
10. or/1-9
11. limit 10 to "child (6 to 12 years)"
12. limit 10 to "adolescent (13 to 18 years)"
13. limit 10 to "preschool child (2 to 5 years)"
14. (child* or adolescen*).mp.
15. (teenage* or young people or young person or young adult*).mp.
16. (schoolchildren or school children).mp.
17. (pediatr* or paediatr*).ti,ab.
18. (boys or girls or youth or youths).mp.
19. or/11-18
20. exp behavior-therapy/
21. social support/
22. family-therapy/
23. exp psychotherapy-group/

24. ((psychological or behavio?r*) adj (therapy or modif* or strateg* or intervention*)).mp.
25. (group therapy or cognitive therapy or family therapy).mp.
26. ((lifestyle or life style) adj (chang* or intervention*)).mp.
27. counsel?ing.mp.
28. (peer adj2 support).mp.
29. ((child* adj3 parent*) and therapy).mp.
30. social support.mp.
31. or/20-30
32. exp obesity/dt
33. exp anti-obesity agents/
34. lipase inhibitor*.mp.
35. (orlistat or xenical or tetrahydrolipstatin).mp.
36. (appetiteadj (suppressant* or depressant*)).mp.
37. sibutramine.mp. or meridia.ti,ab.
38. (dexfenfluramine or fenfluramine or phentermine).mp.
39. bulking agent$.mp.
40. (methylcellulose or celevac).mp.
41. ((antiobesity or anti obesity) adj (drug$ or agent$)).mp.
42. guar gum.mp.
43. (metformin or glucophage).mp.
44. (fluoxetine or prozac).mp.
45. (Sertraline or zoloft).mp.
46. Diethylpropion.mp.
47. zonisamide.mp.
48. topiramate.mp.
49. (Octreotide or somatostatin or sandostatin).mp.
50. (Amantadine or symmetrel).mp.
51. (Glucagon-Like Peptide 1 or glp-1).mp.
52. (rimonabant or acomplia).mp.
53. (SLV 319 or SLV319).mp.
54. exenatide.mp.
55. liraglutide.mp.
56. vildagliptin.mp.
57. sitagliptin.mp.
58. (qnexa or contrave or excalia).mp.
59. exp OBESITY/dh [Diet Therapy]
60. "Diet-Fat-Restricted"/
61. "Diet-Reducing"/
62. "Diet-Therapy"/
63. "Fasting"/
64. (diet or diets or dieting).mp.
65. (diet$ adj (modif$ or therapy or intervention$ or strateg$)).mp.
66. (low calorie or calorie control$ or healthy eating).mp.
67. (fasting or modified fast$).mp.
68. exp "Dietary-Fats"/
69. (fruit or vegetable$).mp.
70. (high fat$ or low fat$ or fatty food$).mp.
71. formula diet$.mp.
72. or/59-71
73. "Exercise"/
74. "Exercise-Therapy"/
75. exercis$.mp.
76. (aerobics or physical therapy or physical activity or physical inactivity).mp.
77. (fitness adj (class$ or regime$ or program$)).mp.
78. (physical training or physical education).mp.
79. dance therapy.mp.

80. sedentary behavio?r reduction.mp.
81. or/73-80
82. exp OBESITY/su [Surgery]
83. "Surgical-Staplers"/
84. "Surgical-Stapling"/
85. "Lipectomy"/
86. "Gastric-Bypass"/
87. "Gastroplasty"/
88. (dental splinting or jaw wiring).mp.
89. (gastroplasty or gastric band$ or gastric bypass).mp.
90. (intragastric balloon$ or vertical band$).mp.
91. (stomach adj (stapl$ or band$ or bypass)).mp.
92. biliopancreatic diversion$.mp.
93. liposuction.mp.
94. or/82-93
95. exp "Alternative-Medicine"/
96. (alternative medicine or complementary therap$ or complementary medicine).mp.
97. (hypnotism or hypnosis or hypnotherapy).mp.
98. (acupuncture or homeopathy).mp.
99. (chinese medicine or indian medicine or herbal medicine or ayurvedic).mp.
100. or/95-99
101. ((diet or dieting or slim$) adj (club$ or organi?ation$)).mp.
102. (weightwatcher$ or weight watcher$).mp.
103. (correspondence adj (course$ or program$)).mp.
104. (fat camp$ or diet$ camp$).mp.
105. or/101-104
106. (family intervention$ or parent$ intervention$).mp.
107. (parent$ adj2 (behavio?r or involve$ or control$ or attitude$ or educat$)).mp.
108. or/106-107
109. (systematic$ review$ or systematic$ overview$).mp.
110. (quantitative$ review$ or quantitative$ overview$).mp.
111. Evidence-Based Medicine/
112. evidence based review$.mp.
113. exp clinical trial/
114. exp "Research-Design"/
115. ((singl$ or doubl$ or trebl$ or tripl$) adj5 (blind$ or mask$)).mp.
116. (CONTROLLED-CLINICAL-TRIAL or RANDOMIZED CONTROLLED TRIAL or META-ANALYSIS).pt.
117. (control$ and (trial$ or stud$ or evaluation$ or experiment$)).ti,ab.
118. (comparison group$ or control group$).mp.
119. random$.ti,ab.
120. matched pairs.mp.
121. (outcome study or outcome studies).mp.
122. (quasiexperimental or quasi experimental or pseudo experimental).mp.
123. (nonrandomi?ed or non randomi?ed or pseudo randomi?ed).mp.
124. cohort studies/
125. (cohort adj (study or studies)).ti,ab.
126. cohort analys$.ti,ab.
127. case series.ti,ab.
128. longitudinal studies/
129. longitudinal$.ti,ab.
130. follow-up studies/
131. (follow up adj (study or studies)).ti,ab.
132. prospective studies/
133. prospective$.ti,ab.
134. or/109-133

135. 10 and 19
136. or/32-58
137. 134 and 135 and 136
138. limit 137 to ed=20080610-20111018
139. 31 or 35 or 37 or 72 or 81 or 94 or 100 or 105 or 108
140. 134 and 135 and 139
141. limit 140 to ed=20080610-20111018
142. 138 or 141
143. animals/ not humans/
144. 142 not 143
145. limit 144 to (english or french)

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